CONTRACT JW14463
HALFWAY HOUSE WATER UPGRADE

TENDER COVER PAGE **MBD 1**

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF JOHANNESBURG WATER

BID NUMBER: JW14463 **CLOSING DATE: 30 APRIL 2025** **CLOSING TIME: 10:30 AM**

DESCRIPTION: IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

CIDB REQUIREMENTS: TENDERERS SHOULD HAVE A CONTRACTOR CIDB GRADING OF 9CE

BRIEFING SESSION	**COMPULSORY**
BRIEFING DETAILS	**DATE AND TIME: 01 APRIL 2025 AT 10:00 AM** **ADDRESS: MIDRAND JW DEPOT, 621-6TH ROAD, CORNER NEW ROAD, ERAND, MIDRAND: https://maps.app.goo.gl/3awz471hg5tZTZ1w5** **VENUE: WORKSHOP** **TENDERS RECEIVED FROM NON-ATTENDED BIDDERS OF A COMPULSORY BRIEFING SESSION WILL NOT BE ACCEPTED**
TENDER SUBMISSION DETAILS	**BID DOCUMENTS MUST BE DEPOSITED IN THE TENDER BOX SITUATED AT GROUND FLOOR IN JOHANNESBURG WATER** **ADDRESS: TURBINE HALL, 65 NTEMI PILISO STREET, NEWTOWN, JOHANNESBURG, 2001** **PLEASE ALLOW SUFFICIENT TIME TO ACCESS JOHANNESBURG WATER OFFICES IN TURBINE HALL AND DEPOSIT YOUR TENDER DOCUMENT IN THE JOHANNESBURG WATER TENDER BOX SITUATED AT RECEPTION BEFORE TENDER CLOSING TIME.** **TIMES: THE BUILDING WILL OPEN 7 DAYS A WEEK FROM 06:00 UNTIL 18:00**

BIDDER INFORMATION				
NAME OF BIDDER				
POSTAL ADDRESS				
PHYSICAL ADDRESS				
TELEPHONE NUMBER				
CELLPHONE NUMBER				
E-MAIL ADDRESS				
VAT REGISTRATION NUMBER				
TAX COMPLIANCE STATUS	**TCS PIN**		**MAAA No**	
OTHER STATUS	**COIDA Registration No**		**CIDB No**	

EMPLOYER INFORMATION			
DEPARTMENT	**CAPEX**	**DEPARTMENT**	**SCM**
CONTACT PERSON	**TLHOKOMELO MOGOTSI**	**CONTACT PERSON**	**NTHABISENG MORE**
TELEPHONE NUMBER	**011 688 1877**	**TELEPHONE NUMBER**	**011 688 1512**
E-MAIL ADDRESS	**TLHOKOMELO.MOGOTSI@JWATER.CO.ZA**	**E-MAIL ADDRESS**	**NTHABISENG.MORE@JWATER.CO.ZA**

DOCUMENTS DOWNLOADED FROM THE ETENDER PORTAL IS AT NO COST BUT MUST COMPLY WITH SUBMISSION REQUIREMENTS.

WITHOUT LIMITATION, JOHANNESBURG WATER TAKES NO RESPONSIBILITY FOR ANY DELAYS IN ANY COURIER OR POSTAL SYSTEM OR ANY LOGISTICAL DELAYS WITHIN THE PREMISES OF JOHANNESBURG WATER. JOHANNESBURG WATER LIKEWISE TAKES NO RESPONSIBILITY FOR OFFERS DELIVERED TO A LOCATION OTHER THAN THE TENDER BOX AS PER THE TENDER SUBMISSION DETAILS STATED IN THE TENDER. PROOF OF POSTING OR OF COURIER DELIVERY WILL NOT BE TAKEN BY JOHANNESBURG WATER AS PROOF OF DELIVERY. TENDER SUBMISSION DOCUMENTS MUST BE IN THE BOX BEFORE TENDER CLOSURE.

The Johannesburg Water Supply Chain Policy, Version 16, is applicable which is available on the JW website www.johannesburgwater.co.za

THE TENDERER IS ENCOURAGED TO SIGN THE TENDER SUBMISSION REGISTER WHEN SUBMITTING THEIR TENDERS.

PLEASE ENSURE YOU SUBMIT 1 x ORIGINAL TENDER HARD DOCUMENT
(IF PRACTICAL, ALSO PROVIDE AN ELECTRONIC COPY IN A MEMORY STICK/USB TO ENSURE INFORMATION IS NOT MISSED WHEN TENDERS ARE BEING EVALUATED BY THE BID EVALUATION COMMITTEE – NON-SUBMISSION OF ELECTRONIC COPY AND MEMORAY STICK/USB WILL NOT LEAD TO DISQUALIFICATION).

Any documents required that are not submitted in the tender box at the deadline will be considered late.

The tenderer accepts that Johannesburg Water will not take responsibility for the misplacement or premature opening of the tender if the outer package is not sealed and marked as stated.

NB: NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.

NAME OF CONTACT PERSON: ……..

SIGNATURE OF BIDDER: ……

CAPACITY UNDER WHICH THIS BID IS SIGNED: ……..

DATE: ……...

PART B
TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:

1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.

1.2. **ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE**

1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.

2. TAX COMPLIANCE REQUIREMENTS

2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.

2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS.

2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA.

2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.

2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.

2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.

2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)? ☐ YES ☐ NO

3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA? ☐ YES ☐ NO

3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA? ☐ YES ☐ NO

3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA? ☐ YES ☐ NO

3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION? ☐ YES ☐ NO

IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.

NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.

1. TENDER NOTICE AND INVITATION TO TENDER

Johannesburg Water (SOC) Ltd invites the tenderer for the following:

CONTRACT NO. JW14463: IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

The tender document will be available in the form of a download from the Johannesburg Water website (https://www.johannesburgwater.co.za/scm/supply-chain/tenders/all-open-tenders/) starting from 20 March 2025.

All tenders and supporting documents must be submitted in a sealed envelope and be placed in the Tender box on the ground floor of the Johannesburg Water by no later than 10:30 am on 30 APRIL 2025.

Address is as follows:

TURBINE HALL, 65 NTEMI PILISO STREET, NEWTOWN, JOHANNESBURG, 2001

Johannesburg Water (SOC) Ltd is not obliged to accept the lowest or any tender and Johannesburg Water reserves to appoint:

a) in whole or in part.
b) to more than one tenderer.
c) to the highest points scoring bidder.
d) to the lowest acceptable tender or highest acceptable tender in terms of the point scoring system.
e) to a bidder not scoring the highest points (based on objective grounds in terms of section 2 (1) (f) of the PPPFA) (where applicable).
f) not to consider any bid with justifiable reasons.

A valid and binding contract with the successful tender/s will be concluded once Johannesburg Water has awarded the contract. Johannesburg Water (SOC) Ltd and the successful tenderer/s will sign the contract agreement forms.

Johannesburg Water SOC Ltd

CONTRACT NO: JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 1

TENDER AND CONTRACT

Prepared by
PMU
PO Box 61542
Marshalltown
2107

V2.0
August 2023

The Tenderer is to indicate in the "Submitted (Yes/No)" column in the below table that they have completed the required section of the tender document. Completion of this checklist will assist the Tenderer in ensuring that they have attended to all the required items for submission with this tender. Additionally, it is an absolute requirement that tenderers comply with National Treasury's CSD registration as well as SARS tax compliance requirements for contract award – refer T2.2.4. The below will form part of the tender document, the tenderers are therefore encouraged to submit the returnable and or documentation with their tender offer to avoid elimination especially with regards to what is stated in the Required for Tender Evaluation column or not obtaining points for Specific Goals. Tenderers are encouraged to ensure that their Tax status remains Tax Compliant on CSD throughout the process to avoid delaying the process or being eliminated at award stage. For infrastructure related projects. Tenderer must have a CIDB Active Status at the requested CIDB requirement at evaluation stage to avoid disqualification.

All documentation listed in the Checklist below shall form part of the Contract.

Table 1

No	Description of Returnable/s or Documentation that will form Part of Contract and must therefore to be Completed and / or Submitted by the Tenderer	Required for Tender Evaluation	Required for Tender Award	Required After Tender Award	Submitted (Yes/No)
1.	**Tender Cover:**				
	Name of Tender	•			
	Contact Person	•			
	Telephone Number	•			
	Central Supplier Database Registration	•			
	CIDB Registration Number, minimum required CIDB grading for the tender and Active Status – if applicable	•			
	COIDA Registration Number			•	
	Tax SARS PIN No.		•		
	MAAA No. for Tax Compliant Status		•		
	Bank Details Form		•		
2.	**Mandatory Documents at Particular Stage:**				
	CIDB – Grading 9CE	•			
	Mandatory Briefing Meeting	•			
	Form of Offer Completed and Signed.	•			
3.	**Administrative Documentation:**				
	Signed Certificate of Authority to Sign	•			
	Signed Acknowledgement of Tender Conditions	•			
	MBD 1 - Invitation to Bid - Completed and signed		•		
	MBD 4 - Declaration of interest -		•		

No	Description of Returnable/s or Documentation that will form Part of Contract and must therefore to be Completed and / or Submitted by the Tenderer	Required for Tender Evaluation	Required for Tender Award	Required After Tender Award	Submitted (Yes/No)
	Completed and signed				
	MBD 5 - Declaration for procurement above R10 Million (all applicable taxes included) Completed and signed.		•		
	MBD 6.1 - Preference Points Schedule – Specific Goals and Price Points - Completed and signed.	•	•		
	MBD 8 - Bidder's past supply chain management practices – Completed and signed.		•		
	MBD 9 - Certificate of Independent Bid Determination – Completed and signed.		•		
	Municipal Rates and Taxes for the **Tenderer** - Current municipal rates for the entity not older than 90 days (if leasing/renting, submitted proof such as lease agreement where premises are rented), OR Confirmation that suitable arrangements are in place for arrear municipal obligations with your local municipality.		•		
	Municipal Rates and Taxes - Current municipal rates for the **directors** of the entity not older than 90 days (if leasing/renting, submitted proof such of lease agreement where premises are rented), OR Confirmation that suitable arrangements are in place for arrear municipal obligations with your local municipality.		•		
	JW 6.5 Returnable Annexure B: Acknowledgement of Tender Drawings	•	•		
	JW 6.4 Returnable Annexure A: Acknowledgement of SHE Specification & Annexures	•	•		
	3-year financial statements (audited where applicable)		•		
	Joint Venture Consortium or equivalent Agreement signed by all parties if applicable	•			
	Any qualifications. If “Yes”, reference to such qualification/s must be indicated on a cover letter. Please be aware that alterations on the tender document may result in your tender being **eliminated as**	•			

No	Description of Returnable/s or Documentation that will form Part of Contract and must therefore to be Completed and / or Submitted by the Tenderer	Required for Tender Evaluation	Required for Tender Award	Required After Tender Award	Submitted (Yes/No)
	the qualification may impede on the ability to evaluate like with like.				
	Occupational Health and Safety Declaration form	•			
4.	**Functionality Documentation:**				
	Documentary Evidence Required for Criteria 1 – **Reference Letters and completion certificates**	•			
	Documentary Evidence Required for Criteria 2 - **Reference Letters and completion certificates**	•			
	Documentary Evidence Required for Criteria 3 - **curriculum vitae and qualifications**	•			
	Documentary Evidence Required for Criteria 4 - **curriculum vitae and qualifications**	•			
	Documentary Evidence Required for Criteria 5 - **curriculum vitae and qualifications**	•			
	Documentary Evidence Required for Criteria 6 - **curriculum vitae and qualifications**	•			
	Documentary Evidence Required for Criteria 7 - **curriculum vitae and qualifications**	•			
	Documentary Evidence Required for Criteria 8- **Method Statement**	•			
5.	**Specific Goals:**				
	Documentary Evidence Required for Criteria 2 - **Proof of municipal account / valid lease agreement, letter from the Ward Council confirming the business address. Businesses that operate from personal properties are required to submit an affidavit**	•			
	Documentary Evidence Required for Criteria 1 - **Valid Construction Sector BBBEE Certificate issued by SANAS accredited verification agency**	•			
6.	**Scope of Work**				
	Scope of Work and or Specifications	•			
7.	**Pricing Schedule:**				
	Bill of quantities completed	•			
	Alterations authenticated – Refer to	•			

No	Description of Returnable/s or Documentation that will form Part of Contract and must therefore to be Completed and / or Submitted by the Tenderer	Required for Tender Evaluation	Required for Tender Award	Required After Tender Award	Submitted (Yes/No)
	Acknowledgment of Tender Conditions				
8.	**Terms and Conditions:**				
	General Conditions of Contract	•			
	Special Conditions of Contract	•			
9.	**Other Documents**				
	Letter of Award			•	
	Public Liability Insurance			•	
	Valid Registration with Compensation for Occupation Injuries and Diseases Act			•	
	Performance Security – where applicable for industrial related services			•	
	Resolution Letter for the Subcontractor (a letter authorizing the person completing the tender to sign on behalf of the company) – if applicable		•		
	Comprehensive Health and Safety Plan (compliance with OHSE Specification - if applicable			•	

Tenderers will be notified of such missing and incomplete documents and will be offered a period of 3 days to complete or submit those pages i.e., Municipal Bidding Documents (MBD), authority to sign and other documents that require completion and signatures that do not have a bearing on functionality, price and preference points for specific goals.

Tenders that are received contrary to the above requirements will be disqualified after three (3) days period has lapsed.

If locality is a specific goal in MBD6.1 – the requested documentation may not be used to allocate points for specific goals.

Signature: _____Date_____

Johannesburg Water (SOC) Ltd

CONTRACT NO: JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 1

PART 1: TENDERING PROCEDURES

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T1.1 TENDER DATA

T1.1.1 Conditions of Tender

The conditions of tender are the Standard Conditions of Tender as contained in Annex C of the CIDB Standard for Uniformity in Construction Procurement (August 2019). (See www.cidb.org.za).

The Standard Conditions of Tender make several references to the Tender Data for details that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender.

Each item of data given below is cross-referenced to the clause in the Standard Conditions of Tender to which it mainly applies.

T1.1.2 Tender Data

The clause numbers in the Tender Data refer to the corresponding clause numbers in the Conditions of Tender.

The additional Conditions of Tender are:

Clause number	Tender Data
C.1.1	The Employer is, Johannesburg Water (SOC) Limited
C.1.2	The tender document issued by the Employer comprise: **Volume 1** **Tender Part 1: Tendering Procedures** T1.1 Tender Notice and Invitation to Tender T1.2 Tender Data **Tender Part 2: Returnable Documents** T2.1 List of Returnable Documents T2.2 Returnable Schedules, including the Enterprise Declaration Affidavit which may be bound in a separate volume **Contract Part 1: Agreement and Contract Data** C1.1 Form of Offer and Acceptance C1.2 Contract Data C1.3 Forms of Securities **Contract Part 2: Pricing Data** C2.1 Pricing Instructions C2.2 Bill of Quantities **Volume 2** **Contract Part 3: Scope of Work** C3.1 Scope of Work C3.2 Particular Specifications **Contract Part 4: Site Information** C4 Site Information **Volume 3** Occupational Health, Safety and Environmental Specification Environmental Management Plan **Volume 4** Tender Drawings

Clause number	Tender Data
C.1.4	The Employer's representative is: Contact Person: Tlhokomelo Mogotsi Telephone: 011 688 1877 E-mail address: Tlhokomelo.mogotsi@jwater.co.za The SCM representative is: Contact Person: Nthabiseng More Telephone: 011 688 1512 E-mail address: Nthabiseng.more@jwater.co.za
C.2.1	**Eligibility criteria and requirements** **CIDB registration and grading:** 1) Only tenderers who are registered with the CIDB and were capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a **9 CE** class of construction work, are eligible to submit tenders. Tenders must have an Active status at the required CIDB grading at time of tender evaluation for the bidder to meet the eligibility criteria and requirement. 2) Joint ventures are eligible to submit tenders provided that: i) every member of the joint venture is registered with the CIDB; and ii) the combined contractor grading designation calculated in accordance with the CIDB Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for an **9 CE** class of construction work. **Failure to meet to Eligibility criteria and requirements will result in disqualification.**
C.2.8	Replace the contents of the clause with the following: "Request clarification of the tender documents, if necessary, by notifying the Employer's Officials indicated on the Tender Notice and Invitation to Tender in writing at least seven (7) working days before the closing time stated in the foregoing notice and clause C.2.15.1"
C.2.10.5	Add the following to the clause: A price or rate is to be entered against each item in the Bill of Quantities, whether the quantities are stated or not. An item against which no price is entered will be considered to be covered by the other prices in the Schedule. The above excludes items of the Bill of Quantities that have rates and amounts scratched out by the Employer.
C.2.11	The evaluation on price alteration will be conducted as follows: Where the tender award strategy is to evaluate and award per item or category, the following must apply: a) If there is an alteration on the rate but no alteration on the total for the item or category, the bidder will not be disqualified b) If there is an alteration on the total for the item/s without authentication, bidders will only be disqualified for alteration per item or category. Where the tender award strategy is to evaluate and award total bid offer, the following must apply: a) If there is an alteration on the rate, total for the line item, sub-total/ sum brought/carried forward for the section but no alteration on the total bid offer, the bidder will not be disqualified. b) If there is an alteration on the total bid offer on form of offer, then the amount in words must

Clause number	Tender Data
	be considered or vice-versa. c) If there is an unauthenticated alteration on the total bid offer and the amount in words is not authenticated, the bidders will be disqualified for the entire tender. Where the tender pricing schedule or bill of quantities is requesting rates/price from bidder/s without providing a total, the following will apply: a) (i) If there is an unauthenticated alteration on the unit rate/price the bidder must be disqualified. **Corrections may not be made using correction fluid, correction tape or the like, bid received contrary to this will be disqualified.**
C.2.12.1	Replace Contents Alternative offers will **not** be permitted.
C.2.12.2	Failure to complete bid amount on the form of offer and sign full will result in the elimination of the tenderer.
C.2.13.3	Each tender offer shall be submitted as an original. Tenderers are also requested to submit a soft copy in a USB (Tenderers who do not submit a soft copy will not be disqualified)
C.2.13.5	The Employer's address for delivery of tender offers and identification details to be shown on the Tenderer's offer package are: **Location of tender box:** Ground Floor Entrance **Physical address:** Johannesburg Water (SOC) Ltd Turbine Hall 65 Ntemi Piliso Street Newtown Johannesburg 2001 **Identification details:** Tender reference number, Title of Tender and the closing date and time of the tender, *as well as the Tenderer's name, their Authorised Representative's name, postal address and telephonic contact numbers*.
C.2.13.6 & C.3.5	A two-envelope procedure will **not** be followed.
C.2.15.1	The closing time for submission of tender offers is as stated in the Tender Notice and Invitation to Tender.
C.2.16	The tender offer validity period is 150 days.
C.2.16.1	Add the following to the clause: "If the tender validity expires on a Saturday, Sunday or public holiday, the Tender Offer shall remain valid and open for acceptance until the closure of business on the following working day."
C.2.23	The Tenderer is required to submit with his tender: 1) Valid SARS Compliance status Pin for Tenders issued by the South African Revenue Services. 2) Proof of CSD registration i.e. MA number 3) A Certificate of Contractor Registration issued by the CIDB. 4) where the tendered amount inclusive of VAT exceeds R 10 million:

Clause number	Tender Data
	i. audited annual financial statement for 3 years, or for the period since establishment if established during the last 3 years, if required by law to prepare annual financial statements for auditing; ii. if the bidder is not required by law to prepare financial statements, then the bidder is required to submit their unaudited financial statements prepared by an independent accounting professional. 5) Proof that the tenderer and directors of the tenderer are not in arrears for more than 90 days with municipal rates and taxes and municipal service charges, The latest municipal account is to be attached, or a signed copy of the valid lease agreement if the tenderer or director of the tenderer is currently leasing premises and not responsible for paying municipal accounts. i. Should the municipal statement that was submitted with the tender document before tender closing date and time be in arrears for more than 90 days at time of award, the tenderer will be requested to submit the latest municipal statement which shows that the tenderer is not in arrears for more than 90 days. If the statement at that time is in arrears for more than 90 days, the tenderer must submit before the stipulated deadline, the written proof of an approved arrangement with the municipality. ii. The proof may be a copy of the agreement or an updated municipal statement which reflects the arrangement. iii. Should this tender be considered for award of the contract, based on proof of submission and should proof of such submission be found to be invalid, erroneous or inaccurate, the tenderer will no longer be considered for the award of the contract. iv. Statement must not be older than 90 days from the closing date of this tender. Attach latest municipal account statement behind this page. v. In cases where the director of the tenderer resides with their spouse, parent, partner or sibling the owner of the property that confirm where the director of the tenderer resides must submit an affidavit stating such and explaining the relationship. This would happen in the case where the submitted municipal statement or lease agreement is not in the name of the director of the tenderer. Point (i) will be applicable. vi. In cases where the business address of the tenderer is also the official residence of the director of the tenderer, the director of the tenderer must submit an affidavit stating such. Proof that the municipal statement is not in arrears for more than 90 days or a valid lease agreement must be submitted. Point (i) will be applicable. Where a tenderer satisfies CIDB contractor grading designation requirements through joint venture formation, such tenderers must submit the Certificates of Contractor Registration in respect of each partner.
C.2.24	Add the following new clause: **Canvassing and obtaining of additional information by tenderers** Accept that: i) No Tenderer shall make any attempt either directly or indirectly to canvass any of the Employers officials or the Employer's agent in respect of his tender, after the opening of the tenders but prior to the Employer arriving at a decision thereon. i) No Tenderer shall make any attempt to obtain particulars of any relevant information, other than that disclosed at the opening of tenders

Clause number	Tender Data
C.2.25	Add the following new clause: **Prohibitions on awards to persons in service of the state** Accept that the Employer is prohibited to award a tender to a person - a) who is in the service of the state; or b) if that person is not a natural person, of which any director, manager, principal shareholder or stakeholder is a person in the service of the state; or c) a person who is an advisor or consultant contracted with the municipality or municipal entity. "In the service of the state" means to be - i) a member of: - • any municipal council. • any provincial legislature; or • the National Assembly or the National Council of Provinces. ii) a member of the board of directors of any municipal entity. iii) an official of any municipality or municipal entity. iv) an employee of any national or provincial department. v) provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999). vi) a member of the accounting authority of any national or provincial public entity; or vii) an employee of Parliament or a provincial legislature." In order to give effect to the above, the questionnaire for the declaration of interests in the tender of persons in service of state in Section T2.1 must be completed.
C.2.26	Add the following new clause: **Awards to close family members of persons in the service of the state** Accept that the notes to the Employer's annual financial statements must disclose particulars of any award of more than R 2 000 to a person who is a spouse, child or parent of a person in the service of the state (defined in clause C.2.25), or has been in the service of the state in the previous twelve months, including a) the name of that person; b) the capacity in which that person is in the service of the state; and c) the amount of the award. To give effect to the above, the questionnaire for the declaration of interests in the tender of persons in service of state in part T2 – Returnable Documents must be completed in full and signed.
C.2.27	Add the following new clause: **Tax Compliance** In the case of a Joint Venture/Consortium the tax Compliance status Pin must be submitted for each member of the Joint Venture/Consortium.

Clause number	Tender Data
C.2.28	Add the following new clause: i) Tenderers will be notified of any omitted, outstanding, missing and or incomplete administrative documents and will be offered a period of 3 days to complete or submit those pages i.e., Municipal Bidding Documents (MBD), authority to sign and other administrative documents that require completion and signatures. These exclude documentation on technical evaluation, price and preference points for specific goals. ii) Tenders that are received contrary to the above requirements will be disqualified after three (3) days period has lapsed. iii) In cases where locality is a specific goal and the bidder did not submit the required documentation, the tenderer upon submitting the municipal statement, lease agreement or letter from ward councilor confirming business address as per above, may not be eligible for points under specific goals if such documentation was not submitted with the tender document.
C.3.2	Replace the contents of the clause with the following: If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until seven (7) calendar days before the tender closing time stated in the Tender Data. If, as a result, a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who collected tender documents.
C.3.4.2	Tenders will be opened in public soon after closing time and recording of received documents but not later than 11:00 at the tender office located at Turbine Hall, 65 Ntemi Piliso, Newtown, 2001, Ground Floor. Tenderers' names and total prices, where practical will be, read out
C.3.9	Replace Existing Clause Arithmetic Errors **Construction related tenders** JW undertakes to check the highest scoring bid for arithmetical errors and correcting them as follows: JW shall check for arithmetic errors using the following sequence: (i) Check the amount in words against the amount in figures on the *Form of Offer*, (ii) Check the Form of Offer against the Summary Schedule Total, (iii) Check the Section Sub-Totals per section against the Summary Total for summation errors, (iv) Check the Section Sub-Totals in the Summary Schedule against Section Sub-Totals in the Bill of Quantities. (v) Check the Section Sub-Totals against the Item Totals for summation errors. (vi) Check the Item Totals against the product of the Item Rate and the Quantity Provided. If a bill of quantities or price schedule applies JW will request the bidder to correct the arithmetic errors as follows: (i) In respect of the Form of Offer, where there is a discrepancy between the amounts in figures and the amount in words, the amount in words shall govern. The bidder must be requested to adjust the amount in figures to correspond with the amount in words.

Clause number	Tender Data
	JW will notify the tenderer of all errors or omissions that are identified in the tender offer and either request the tenderer to confirm the offer as tendered or JW will accept the corrected total of prices. Where the tenderer elects to confirm the tender offer as tendered, correct the errors as follows: (i) If bills of quantities or pricing schedules apply and there is an error in the line-item total resulting from the product of the unit rate and the quantity, the line-item total shall govern, and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line-item total as quoted shall govern, and the unit rate shall be corrected. (ii) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern, and the tenderer will be requested to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices. Clarification session(s) shall be held with Tenderer where there is pricing discrepancies, errors are highlighted and identified corrections are explained. Tenderer is afforded an opportunity to provide clarification, accept or reject identified corrections in writing. (i) In the event that the Tenderer accepts identified corrections, JW will proceed with evaluation. (ii) In the event that the Tenderer rejects the identified correction(s), JW must review the Tenderer's motivation and risks associated with the proposed change. (iii) This is not an opportunity for Tenderers to change the bid offer. A bidder that does not agree to the above will be disqualified. Risk related to the Arithmetic Corrections shall be assessed. Where risks are identified, tenderers shall provide JW with any other material or information that has a bearing on the tender offer, the tenderer's commercial position (including joint venture agreements), quotations preferencing arrangements or samples of materials considered necessary by JW for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the JW request or fails to attend any meeting in which it has been formally invited to clarify any issue, the tender offer will be regarded as non-responsive.
C.3.11	Tenderer to complete, sign and return MBD6.1 with the tender submission. Tenderer to claim the points in the space provided and submit documentary evidence to support the points claimed for specific goals. **STAGE** / **DESCRIPTION** **Stage 1** – Mandatory Evaluation **Stage 2** – Administrative Evaluation **Stage 3** – Technical Evaluation **Stage 4** – Preferential Procurement Goals and Pricing Evaluation

Clause number	Tender Data

Stage 1: Mandatory Evaluation

Description		Complied	
No	**Description**	**Yes**	**No**
1	CIDB grading 9CE. Active Status at the required CIDB grading at the time of Evaluation		
2	Attendance of Mandatory Tender Briefing Meeting		
3	Form of Offer Completed and Signed		

Tenderers who FAIL to meet the mandatory criteria or requirements of tender will be disqualified.

Clause number	Tender Data

Stage 2: Administrative Evaluation

Description			Complied	
Reference	**Description**	**Requirement**	**Yes**	**No**
Certificate of Authority	Signed Certificate of Authority to Sign or signed board resolution	Completed and signed certificate of authority to sign or signed board resolution		
MBD 1	Invitation to Bid	Complete and submit complete and signed MBD 1 Form		
CSD	Central Supplier Database Registration	Provide proof of CSD registration		
MBD 4	Declaration of interest	Complete and submit signed MBD 4 Form		
MBD 5	Declaration for procurement above 10 million (all applicable taxes included)	Complete and submit signed MBD 5 Form		
MBD 6.1	Preference Points Claim in Terms of The Preferential Procurement Regulations 2022	Complete and submit signed MBD 6.1 Form		
MBD 8	Declaration of bidder's past supply chain management practices	Complete and submit signed MBD 8 Form		

Clause number	Tender Data

Description			Complied	
Reference	**Description**	**Requirement**	**Yes**	**No**
MBD 9	Certificate of Independent Bid Determination	Complete and submit signed MBD 9 Form		
T2.3.2	Acknowledgement of Tender Drawings	Complete and submit signed T2.3.2 Form		
T2.3.1	Returnable Annexure A: Acknowledgement of SHE Specification & Annexures	Complete and submit signed T2.3.21 Form		
Annexure – Proof of Specific Goals	Valid BBBEE Certificate issued by SANAS accredited verification agency showing percentage of ownership and share certificate where applicable	Submit applicable documentation with the tender submission		
Annexure – Proof of Specific Goals	Proof of municipal account / valid lease agreement, letter from the Ward Council confirming the business address	Submit applicable documentation with the tender submission		
Annexure T2.2.4	Municipal statement of account for tendering entity (not older than three (03) months from the closing date of tender or a valid lease agreement at time of tender closure)	Submit applicable documentation with the tender submission		

Clause number	Tender Data

Description			Complied	
Reference	**Description**	**Requirement**	**Yes**	**No**
Annexure T2.2.4	Municipal statement of account for Director/s (not older than three (03) months from the closing date of tender or a valid lease agreement at time of tender closure)	Submit applicable documentation with the tender submission		
Annexure	3-year financial statements (audited where applicable)	Submit applicable documentation with the tender submission		
Annexure	Joint Venture Consortium or equivalent Agreement signed by all parties if applicable	Submit applicable documentation with the tender submission		

Tenderers will be notified of any omitted, outstanding, missing and or incomplete administrative documents and will be offered a period of 3 days to complete or submit those pages i.e., Municipal Bidding Documents (MBD), authority to sign and other administrative documents that require completion and signatures. These exclude documentation on functionality, price and preference points for specific goals.

Tenders that are received contrary to the above requirements will be disqualified after three (3) days period has lapsed.

Any document or form submitted or completed upon request (was not included in the initial tender submission before the closing date) will not be used to claim points for specific goals.

Clause number	Tender Data

Stage 3: Technical Evaluation

The following aspects will be considered during the Technical Evaluation:

CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
1	Tenderer's Experience with Respect to experience in welded water steel pipeline projects with valves, chambers and a minimum diameter of 700mm.	Supporting Documents Required include Reference Letters as per T2.1.7 (Or on Client Letter Head with all required Information) and Completion / Final Approval Certificates. T2.1.7 must be completed by the client and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the technical criteria requirements as stated on this template. A separate form must be completed for each reference as required in the evaluation criteria.	**NUMBER OF COMPLETED WATER STEEL WELDED PIPELINE PROJECTS WITH VALVES, CHAMBERS AND A MINIMUM PIPE DIAMETER OF 700MM**	0 Completed Projects	**30**	**0**
				1 or 2 Completed Projects		**15**
				3 Completed Projects		**22.50**
				More than 3 Completed Projects		**30**

Clause number	Tender Data

CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
2	Tenderer's Experience with Respect to culvert jacking beneath a national or provincial road	Supporting Documents Required include Reference Letters as per T2.1.7 (Or on Client Letter Head with all required Information) and Completion / Final Approval Certificates. T2.1.7 must be completed by the client and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the technical criteria requirements as stated on this template. A separate form must be completed for each reference as required in the evaluation criteria.	**NUMBER OF PROJECTS INVOLVING CULVERT JACKING BENEATH A NATIONAL OR PROVINCIAL ROAD WITH MINIMUM DIMENSIONS OF 3M X 2.5M AND 50M IN LENGTH**	0 Completed Projects	**15**	**0**
				1 Completed Projects		**11.25**
				More than 1 Completed Project		**15**

Clause number	Tender Data

NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
3	**Post Qualification Experience of Contract Manager** Only **Contract Managers** with qualifications of Bachelors' Degree or Bachelor of Technology (Civil Engineering) or higher **AND** ECSA Professional Registration (Pr. Eng. / Pr. Tech Eng) **or** SACPCMP Professional Registration (PrCPM / PrCM) will obtain a score for experience of a **Contract Manager**. The date of registration of **Contract Manager** will not impact post qualification number of projects. **NOTA BENE: Tenderers who do not meet the minimum qualifications and registration will not be scored for these criteria.**	Tenderer must provide a Curriculum Vitae of the **Contract Manager** in the format given on T2.1.9 Note: *Tenderers may provide their own* Curriculum Vitae's *but information provided should contain all information in T2.1.9* *Note: Certified Copies of qualifications and valid registration certificates to accompany the CVs. The information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting in participating in any future government tenders.*	**NUMBER OF YEARS EXPERIENCE AS A CONTRACT MANAGER AFTER OBTAINING MINIMUM QUALIFICATION.**	Less than 3 Years or did not meet the minimum qualifications/ registration	15	**0**
			3 - 5 years			**7.50**
			More than 5 years - 7 Years			**11.25**
			More than 7 Years			**15**

Clause number	Tender Data

NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
4	**Post Qualification Experience of Construction Manager** Only **Construction Managers** with a minimum qualification of National Diploma in Civil Engineering or higher. **AND** Registered as a Candidate or Professional Registration with ECSA **OR** Registered as a Candidate or Professional Registration with SACPCMP will be considered. The date of registration of **Construction Manager** will not impact post qualification number of projects. **NOTA BENE: Tenderers who do not meet the minimum qualifications and registration will not be scored for these criteria.**	Tenderer must provide a Curriculum Vitae of the **Construction Manager** in the format given on T2.1.9 Note: *Tenderers may provide their own* Curriculum Vitae's *but information provided should contain all information in T2.1.9* *Note: Certified Copies of qualifications and valid registration certificates to accompany the CVs. The information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting in participating in any future government tenders.*	**NUMBER OF COMPLETED WATER STEEL WELDED PIPELINE PROJECTS WITH VALVES, CHAMBERS AND A MINIMUM PIPE DIAMETER OF 700MM AS A CONSTRUCTION MANAGER**	0 Completed Project or did not meet the minimum qualifications/ registration	**10**	**0**
				1 or 2 Completed Projects		**5**
				3 Completed Projects		**7.50**
				More than 3 Completed Projects		**10**

Clause number	Tender Data

NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
5	**Post Qualification Experience of Construction Manager** Only **Construction Managers** with a minimum qualification of National Diploma in Civil Engineering or higher. **AND** Registered as a Candidate or Professional Registration with ECSA **OR** Registered as a Candidate or Professional Registration with SACPCMP will be considered. The date of registration of **Construction Manager** will not impact post qualification number of projects. **NOTA BENE: Tenderers who do not meet the minimum qualifications and registration will not be scored for these criteria.** **NOTA BENE:** One Construction Manager meeting Criteria 4 and 5 is required	Tenderer must provide a Curriculum Vitae of the **Construction Manager** in the format given on T2.1.9 Note: *Tenderers may provide their own* Curriculum Vitae's *but information provided should contain all information in T2.1.9 Note: Certified Copies of qualifications and valid registration certificates to accompany the CVs. The information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting in participating in any future government tenders.*	**NUMBER OF COMPLETED PROJECTS WITH CULVERT JACKING BENEATH A NATIONAL OR PROVINCIAL ROAD WITH MINIMUM DIMENSIONS OF 3M X 2.5M AND 50M IN LENGTH**	0 Completed Projects or did not meet the minimum qualifications/ registration	10	**0**
				1 Completed Project		**7.50**
				More than 1 Completed Project		**10**

Clause number	Tender Data

NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
6	Post Qualification Experience of **Safety Officer** Only Safety Officers registered with SACPCMP in the "Construction Health and Safety" Sector will be considered. However, the time of registration of Safety Officer will not impact post qualification number of projects **AND** Minimum Qualification: National Diploma Safety Management (NQF 6) **OR**	Tender must Provide CV of Safety Officer in the format given on T2.1.9 *Note: Certified Copied of qualifications and a valid registration certificate to accompany the CVs. The information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting in participating in any future government tenders.*	**NUMBER OF YEARS EXPERIENCE AS SAFETY OFFICER AFTER OBTAINING MINIMUM QUALIFICATION**	Less than 2 years or did not meet the minimum qualifications/ registration	**5**	**0**
			2 - 3 Years		**3.75**
			More than 3 Years.		**5**

Clause number	Tender Data			
	Minimum Qualification: Safety Officers Course (NQF 5) **OR**	Less than 3 Years or did not meet the minimum qualifications/ registration	**5**	**0**
		3 - 4 Years		**3.75**
		More than 4 Years		**5**
	Minimum Qualification: SAMTRAC / SHEOMTRAC/ SHEMTRAC / MESHTRAC /NEBOSH will be considered. **NOTA BENE: Tenderers who do not meet the minimum qualifications and registration will not be scored for these criteria.**	Less than 4 years or did not meet the minimum qualifications/ registration	**5**	**0**
		4 - 5 Years		**3.75**
		More than 5 Years		**5**

Clause number	Tender Data

NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
7	Post Qualification Experience of **Environmental Officer** **Only Environmental Officers with** Minimum Qualification: National Diploma in Environmental Management (NQF 6) **OR**	Tender must Provide CV of Safety Officer in the format given on T2.1.9 *Note: Certified Copied of qualifications and a valid registration certificate to accompany the CVs. The information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting in participating in any future government tenders.*	**NUMBER OF YEARS EXPERIENCE AS ENVIRONMENTAL OFFICER**	Less than 3 years or did not meet the minimum qualifications/ registration	**5**	**0**
				3 - 4 Years		**3.75**
				More than 4 Years		**5**
	Minimum Qualification: BA/BSc Environmental Management (NQF 7) will be considered. **NOTA BENE: Tenderers who do not meet the minimum qualifications will not be scored for these criteria.**			Less than 2 year or did not meet the minimum qualifications/ registration	**5**	**0**
				2 - 3 Years		**3.75**
				More than 3 Years		**5**

Clause number	Tender Data

NO #		CRITERIA	EVIDENCE	MAX SCORE	SCORE
8	Method Statement	Tenderer must provide **Site Specific** Method Statement Which Addresses the following sections: **Section 1: Approach statement and Introduction** which illustrates understanding of the scope **(Maximum 1 page)** • **Section 2: Quality Control Plan** including all necessary **standards** to be used, resources available and procedures to ensure quality **(Maximum 5 pages)** **Section 3: Project Programme / schedule** outlining critical path, aligned to the scope of works, aligned to the contractual timelines, and including all contractual dates. **(On MS Projects as Annexure)**	Method Statement not submitted.	**10**	**0**
			Tenderer has partially covered major components of two or less method statement sections		**5**
			Tenderer has partially covered major components of all three method statement sections		**7.50**
			Tenderer has covered all major components of all three method statement sections		**10**
Minimum Acceptable Score					**75**
Maximum Possible Score					**100**

Tenderers who **FAIL** to meet the technical criteria or requirements (75 minimum Score) of tender will be disqualified.

Clause number	Tender Data
	Note: The following outline will be used in assessing the method statement for scoring: **Method Statement Section 1 – Approach Statement** (Maximum 2 Pages) including all necessary standards to be used, resources available and procedures to ensure quality. This is inclusive of the following **major components** of section 1: o Laying of the steel pipeline, including pipe jacking o Construction of air valve chambers o Construction of scour valve chamber o Construction of a pressure reducing valve building o Construction of a metering chamber **Method Statement Section 2 – Quality Control Plan** **Major components** of section 2: (Maximum 5 Pages) including all necessary standards to be used, resources available and procedures to ensure safety. This is inclusive of the following **major components**: o Quality control and standards for on-site pipes and fittings welding. o Quality control and standards for offsite pipe fitting manufacture. o Quality control and standards for offsite pipe manufacture. o Quality control and standards for valve manufacture. o Quality control and standards for internal pipe lining. o Quality control and standards for external pipe coating. o Indicate how quality control and standards will be managed and the procedures used to manage the quality control. o Indicate the resources available for quality control. o Safety plan in trenchless and open-trench steel pipeline installation. o High level outline of traffic management plan during construction. • To include traffic management plan and indicate that drawing will be provided. • Traffic management plan to include vehicles and pedestrians • To include barricading of all work areas. • To include appointment of qualified traffic safety officer. o Safety communication channels and emergency management strategy o Risk management matrix o Tie-in procedure • Shutdown planning procedure • Customer engagements pre and post shutdown • Actual tie-in procedure • Pipe disinfection.

Clause number	Tender Data
	Method Statement Section 3 - Project Programme/ Schedule **Major components** of section 3: (On MS Projects or any other Gantt chart) outlining critical path, aligned to the scope of works, aligned to the contractual timelines, and including all contractual dates. This is inclusive of the following **major components**: o Laying of the steel pipeline, including pipe jacking o Construction of air valve chambers o Construction of scour valve chamber o Construction of a pressure reducing valve building o Construction of a metering chamber **Acronyms** SACPCMP: South African Council for the Project and Construction Management Professions. SAMTRAC: Safety Management Training Course. NEBOSH: National Examination Board in Occupational Safety and Health. SHEOMTRAC: Safety Health Environmental Occupational Management Training Course. SHEMTRAC: Safety Health Environmental Management Training Course. MESHTRAC: Management Environmental Safety Health Training Course FIDIC: International Federation of Consulting Engineers GCC: General Conditions of Contract NEC: New Engineering Contract
C.3.11.2 & C.3.11.3	The procedure for the evaluation of responsive tenders is Method 2 (Financial Offer and Specific Goals): **1. APPLICATION OF THE PREFERRENCE POINTS SCORING SYSTEM** <u>The following preference point systems are applicable to all bids:</u> - the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included). - The Specific Goals for the tender will be stated in MBD 6.1. In MBD 6.1, the tenderer must indicate how many points they are claiming for each Specific Goal and must submit all the required supporting documentation for the points to be verified and awarded by JW. The BEC will evaluate the submitted supporting documentation and confirm Specific Goal points claimed by the tenderer. Specific goals to be allocated by the Bid Evaluation Committee will depend on verification documentation submitted. - Only tenderers that have completed and signed MBD 6.1 and submitted applicable verification documents will be allocated Specific Goal points for preferencing. (a) The value of this bid is estimated to exceed R50 000 000 (all applicable taxes

Clause number	Tender Data

included) and therefore the 90/10 preference point system shall be applicable.

(b) Preference points for this bid shall be awarded for:

Price; and

Specific Goals.

(c) The maximum points for this bid are allocated as follows:

DESCRIPTION	POINTS
PRICE	90
SPECIFIC GOALS	10
Total points for Price and Specific Goals must not exceed	**100**

(d) Failure on the part of a bidder to submit proof of specific goals points claimed in MBD 6.1 will not result in disqualification but will result in points not being awarded for Specific Goals.

Specific Goals

In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations 2022, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1 below as must be supported by proof/ documentation stated in the conditions of this tender.
Specific goals may include contracting with persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of race, gender or disability.

Race:

I. Ownership by black people

II. Black Designated Group:

Ownership by black people that are unemployed
Ownership by black people who are youth
Ownership by black people living in rural or underdeveloped areas or townships
Ownership by black people with disabilities
Ownership by black people who are military veterans
Cooperative owned by black people

Gender:

Clause number	Tender Data
	I. Persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of gender are women. Ownership by persons that are classified as female or women according to the Department of Home Affairs of South African. **Disability:** I. Persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of disability are disabled persons. Reconstruction and Development Programme (RDP) objectives as published in Government Gazette No. 16085 dated 23 November 1994 i.e., **Local Manufacture:** I. Promotion of procurement of locally manufactured goods in South Africa to promote job creation in light of the high unemployment rate in South Africa which has a greater impact previously disadvantaged individuals and black youth. **Locality:** I. Promotion of procurement from local business in the geographical areas that JW operate in. This is also directed at creating employment in the areas JW operate in. The BSC may allocate points as follows: • Promotion of enterprises located in the Gauteng Province • Promotion of enterprises located in a specific region within COJ (the 7 regions. A to G) • Promotion of enterprises located in the City of Johannesburg municipality • Promotion of enterprises located rural or underdeveloped areas or townships. **Qualifying Small Enterprises (QSE)** I. Promotion of procurement from QSE's that are black owned. **Exempted Micro Enterprises (EME):** I. Promotion of procurement from EME's that are black own. **SUB-CONTRACTING:** Promotion of sub-contracting a Historically Disadvantaged Individuals (HDI) company. Consider sub-contract only in cases where there are no company which can meet any of the specific goals. Check if the portion of the work cannot be subcontracted in terms of specific goals. One goal may be chosen, or a combination of goals may be decided upon including a sub-goal i.e., owned by black people that are disabled etc.,

Clause number	Tender Data

JOINT VENTURE, CONSORTIUM OR EQUIVALENT:

For Joint Venture Agreements, Consortiums or equivalent, the agreement must show percentages of ownership and work to be completed by each party. This agreement must form part of the tender submission.
To determine the Joint Venture, Consortium or equivalent score for specific goals, JW will look at the consolidated BBBEE certificate to determine the points for specific goals that will be awarded to the tenderer. If a consolidated BBBEE certificate is not submitted, the parties to the joint venture, consortium or equivalent must submit their individual BBBEE certificates issued by a SANAS accredited verification agency or the documents listed below on 4.6 and the joint venture, consortium or equivalent agreement in order for JW to determine the proportional points for specific goals.

Documentation to be provided:

- JV, Consortium, or equivalent agreement
- Consolidated BBBEE certificate issued by an SANAS accredited verification agency. Certificate must be valid

Table 1:

The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system)
Business owned by 51% or more – Black Youth	6
Businesses located within the boundaries of Gauteng province	4
Total	**10**

The following verification documents must be submitted with the tender document:

SPECIFIC GOALS – ANY ONE OR A COMBINATION OF ANY	MEANS OF VERIFICATION THAT MAY BE SELECTED OR A COMBINATION THEREOF
Business owned by 51% or more – Black Youth	Valid Construction Sector BBBEE Certificate issued by SANAS accredited verification agency
Businesses located within the boundaries of Gauteng	Proof of municipal account / valid lease agreement, letter from the Ward Council confirming the business address. Businesses that operate from personal properties are required to submit an affidavit

Clause number	Tender Data

Note: The joint venture, consortium, or equivalent agreement in order for JW to determine the proportional points for specific goals.

Example, If there are two parties in a Joint Venture with a 50:50 ownership of the Joint Venture and one party is located within the boundaries of COJ and one is located in Tshwane, if one of the goals is locality and has total points of 4, the JV will only be entitled the proportional points of 2.

The following are the requirements for a valid Sworn Affidavit in terms of the BBBEE Sector Codes of Good Practise:

Affidavit Prescribed Formats	Category	Financial Threshold
Generic Enterprises		
	BO QSE	Between R10m and R50m
	BO EME	Less than R10m
Sector Specific Enterprises		
	BO QSE	Between R10m and R50m
	BO EME	Less than R10m
Construction Sector Code		
	EME Contractor	Less than R3m
	BO EME BEP	Less than R1.8m
Financial Sector Code		
	BO QSE	Between R10m and R50m
	BO EME	Less than R10m
Information Communication Technology Sector Code (ICT)		
	BO QSE	Between R10m and R50m
	BO EME	Less than R10m
Marketing, Advertising & Communication Sector Code (MAC)		
> Public Relations	BO QSE	Between R5m and R10m
> Marketing, Advertising & Communications	BO EME	Less than R5m
Property Sector Code		
> Service-based	BO QSE	Between R5m and R10m
	EME	Less than R5m
> Agency-based	BO QSE	Between R2.5m and R35m
> Asset-based	EME	Less than R2.5m
	BO QSE	Between R80m and R400m
Tourism Sector Code		
	BO QSE	Between R5m and R45m
	BO EME	Less than R5m
Specialised Enterprises		
	BO QSE	Between R10m and R50m
	BO EME	Less than R10m

Note: A sworn affidavit received from a tenderer that does not meet the above requirement will not be considered for the allocation of points for specific goals.

Clause number	Tender Data
	Requirements for a valid BBBEE Certificate are as follows: a) Copy of a certified valid BBBEE certificate (Only Valid BBBEE accredited by SANAS), or a valid Sworn Affidavit issued by the DTIC or the CIPC or in a similar format complying with commissioner of oath Act. b) Bidders who do NOT qualify as EME's and QSE's as outlined above must submit B-BBEE verification certificates that are issued by an Agency accredited by SANAS. c) Bidders who fail to submit a certified copy of their valid B-BBEE certificate or valid sworn affidavit or valid DTI / CIPC B-BBEE certificate will score zero points for specific goals. Valid Sworn Affidavits or certified copies of B-BBEE Certificate must comply with the requirements outlined in the Justices of the Peace and Commissioners of Oaths Act, no 16 of 1963 and its Regulations promulgated in Government Notice GNR 1258 of 21 July 1972 Justices of the Peace and Commissioners of Oaths Act, No. 16 of 1963. i.e. (i) The deponent shall sign the declaration in the presence of the commissioner of oaths (COA). (ii) Below the deponent's signature the COA shall certify that the deponent has acknowledged that he knows and understands the contents of the declaration and the COA shall state the manner, place, and date of taking the declaration. (iii) The COA shall sign the declaration and print his full name and business address below his signature; and state his designation and the area for which he holds his appointment, or the office held by him if he holds his appointment ex officio. (iv) Copy of certified copies will not be accepted. **Note**: A tenderer failing to submit proof of specific goals claimed as per indicated above will not be disqualified but will be allocated zero points for specific goals and will be allocated points for pricing. 2. **ADJUDICATION USING A POINT SYSTEM** (a) The bidder obtaining the highest number of total points will be awarded the contract. (b) Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts;. (c) Points scored must be rounded off to the nearest 2 decimal places. (d) In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the highest number of points for specific goals. (e) However, when technical evaluation is part of the evaluation process and two or

Clause number	Tender Data
	more bids have scored equal points including equal preference points for specific goals, the successful bid must be the one scoring the highest score for technical evaluation. (f) Should two or more bids be equal in all respects, the award shall be decided by the drawing of lots. **3. POINTS AWARDED FOR PRICE THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS** A maximum of 90 points is allocated for price on the following basis: **90/10** $Ps = 90\left(1 - \frac{Pt - P\min}{P\min}\right)$ Where Ps = Points scored for comparative price of bid under consideration Pt = Comparative price of bid under consideration Pmin = Comparative price of lowest acceptable bid
C.3.12	Replace the contents of the clause with the following: "Insurance will not be provided by the Employer. See Contract data."
C.3.13.1	Add to the existing clause: Tender offers will only be accepted if: a) the tenderer submits a valid SARS tax Compliance status Pin for tenders issued by the South African Revenue Services or has made arrangements to meet outstanding tax obligations; b) Proof of CSD registration ie MA xxxxx number; c) the tenderer submits a letter of intent from an approved insurer undertaking to provide the Performance Guarantee to the format included in Part T2.2.22 of this procurement document d) the tenderer is registered with the Construction Industry Development Board in an appropriate contractor grading designation; e) the tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector; f) the tenderer has not: i) abused the Employer's Supply Chain Management System; or ii) failed to perform on any previous contract and has been given a written notice to this effect;

Clause number	Tender Data
	g) the tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the Employer or potentially compromise the tender process and persons in the employ of the state are permitted to submit tenders or participate in the contract; h) the tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer; i) the Employer is reasonably satisfied that the tenderer has in terms of the Construction Regulations, 2014, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely; and j) the tenderer has met the minimum score for technical evaluation required to carry out the works
C.3.17	The number of paper copies of the signed contract to be provided by the Employer is one.
	There are no additional conditions of tender.

-- END OF PART ---

Johannesburg Water SOC Ltd

CONTRACT NO: JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 1

RETURNABLE DOCUMENTS AND SCHEDULES

T2.1 LIST OF RETURNABLE DOCUMENTS

The tenderer must complete the following returnable documents:

Document		Page
1. Returnable Schedules required for tender evaluation purposes		
T2.1.1	Record of addenda to tender documents	RD.5
T2.1.2	Certificate of Authority	RD.6
T2.1.3	Compulsory Enterprise Questionnaire	RD.11
T2.1.4	Preferential Procurement	RD.13
MBD 6.1	Preference points claim form in terms of the preferential procurement regulations	RD.14
MBD 4	Declaration of any potential conflict of interest	RD.21
MBD 8	Declaration of bidder's past Supply Chain management practices	RD.24
MBD 5	Declaration for Procurement above R10 Million (VAT Included)	RD.26
MBD 9	Certificate of independent bid determination	RD.29
T2.1.5	Proposed qualifications	RD.32
T2.1.6	Schedule of the Tenderer's experience	RD.33
T2.1.7	Contactable reference template	RD.34
T2.1.8	Schedule of key personnel	RD.35
T2.1.9	Curriculum vitae of key personnel	RD.40

T2.2 LIST OF RETURNABLE DOCUMENTS

Document		Page
2. Other documents required only for tender evaluation purposes		
T2.2.1	Certificate of Contractor Registration issued by the Construction Industry Development Board	RD.57
T2.2.2	SARS Tax Compliance Status Pin and Proof of CSD registration i.e. MA number	RD.58

T2.3 LIST OF RETURNABLE SCHEDULES

Document		Page
3. Other documents that will be incorporated into the contract		
T2.3.1	Returnable Annexure A – SHE Acknowledgment Form	RD.43
T2.3.2	Returnable Annexure B: Acknowledgement of Tender Drawings	RD.44
T2.3.3	Minutes of the Mandatory Tender Briefing Meeting	RD.46

NOTE: The Tenderer is required to complete each and every schedule listed above to the best of his ability as the evaluation of tenders and the eventual contract will be based on the information provided by the tenderer.

T2.1 LIST OF RETURNABLE DOCUMENTS

Document		Page
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T2.1.7	Contactable reference template	RD.34
T2.1.8	Schedule of key personnel	RD.35
T2.1.9	Curriculum vitae of key personnel	RD.40

T2.1.1 RECORD OF ADDENDA TO TENDER DOCUMENTS

We confirm that the following communications received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:

	Date	Title or Details
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Attach additional pages if more space is required.

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

T2.1.2 CERTIFICATE OF AUTHORITY

Indicate the status of the Tenderer by ticking the appropriate box hereunder. The Tenderer must complete the certificate set out below for the relevant category.

(I) COMPANY	(II) CLOSE CORPORATION	(III) PARTNERSHIP	(IV) JOINT VENTURE	(V) SOLE PROPRIETOR

(I) Certificate For Company

I, ……, chairperson of the Board of Directors of ....., hereby confirm that by resolution of the Board (copy attached) taken on ....., Mr/Ms ....., acting in the capacity of ....., was authorized to sign all documents in connection with the tender for Contract No. JW14463 and any contract resulting from it on behalf of the company.

Chairman: .....

As Witnesses: 1.....

2.....

Date: .....

(II) Certificate For Close Corporation

We, the undersigned, being the key members in the business trading as .....

..... hereby authorize Mr/Ms …….... , acting in the capacity of

....., to sign all documents in connection with the tender and any contract resulting from it on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

Note : This certificate is to be completed and signed by all of the key members upon whom rests the direction of the affairs of the Close Corporation as a whole.

(III) Certificate For Partnership

We, the undersigned, being the key partners in the business trading as,

....., hereby authorize Mr/Ms .....,

acting in the capacity of ....., to sign all documents in connection.

with the tender and any contract resulting from it on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

Note : This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.

(IV) Certificate For Joint Venture

This Returnable Schedule is to be completed by joint ventures.

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms . . . . . , authorised signatory of the company . . . . . , acting in the capacity of lead partner, to sign all documents in connection with the tender offer and any contract resulting from it on our behalf.

NAME OF FIRM	ADDRESS	DULY AUTHORISED SIGNATORY
Lead partner		Signature. . . . . . Name …… Designation
		Signature. . . . . . Name …… Designation
		Signature. . . . . . Name …… Designation
		Signature. . . . . . Name …… Designation

Note : This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Joint Venture as a whole.

(V) Certificate For Sole Proprietor

I, ..., hereby confirm that I am the sole owner of the Business trading as …….....

Signature of Sole owner: .....

As Witnesses:

1.....

2. .....

Date: .....

T2.1.3 COMPULSORY ENTERPRISE QUESTIONNAIRE

The following particulars must be furnished. In the case of a joint venture, **separate** enterprise questionnaires in respect of each partner must be completed and submitted.

Section 1: Name of enterprise: . . . . . .

Section 2: VAT registration number, if any: . . . . . .

Section 3: CIDB registration number, if any: . . . . . .

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	Identity number*	Personal income tax number*

***** Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

Section 5: Particulars of companies and close corporations

Company registration number . . . . . .

Close corporation number . . . . . .

Proof of CSD registration ie MA xxxxxxxxx number. . . . . .

SARS Tax Compliance status Pin number . . . . . .

Section 6: Record in the service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National Council of Province
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

If any of the above boxes are marked, disclose the following:

Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*insert separate page if necessary

Section 7: Record of spouses, children and parents in the service of the state

Indicate by marking the relevant boxes with a cross, if any spouse, child or parent of a sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months been in the service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National Council of Province
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

Name of spouse, child or parent	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*insert separate page if necessary

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise:

i) authorizes the Employer to verify the tax compliance status from the South African Revenue Services that my / our tax matters are in order;

ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;

iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;

iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and

iv) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed _____ Date _____

Name _____ Position _____

Enterprise name _____

T2.1.4 PREFERENTIAL PROCUREMENT

Forms for Completion by the Tenderer included in this section are:

Form No.	Form Title	Description	Page
MBD 6.1	Empowerment and Preferential Procurement	Procedures and adjudication criteria for the information of the Tenderer	RD.14
MBD 4	Declaration of any potential Conflict of Interest	Form to be completed by the Tenderer	RD.21
MBD 8	Declaration of bidder's past supply chain management practices	Form to be completed by the Tenderer	RD.24
MBD 5	Declaration for Procurement above R10 Million (VAT Included)	Form to be completed by the Tenderer	RD.26
MBD 9	Certificate of Independent Bid Determination	Form to be completed by the Tenderer	RD.29

Note:

All information supplied must be current and valid. Proposed or imminent changes to a Tenderer's status may be mentioned but the declarations must reflect current circumstances.

MBD 6.1 PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 2022

---

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:

- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2 **To be completed by the organ of state**

a) The applicable preference point system for this tender is the 90/10 preference point system.

1.3 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:

a) Price; and
b) Specific Goals.

1.4 **To be completed by the organ of state:**

The maximum points for this tender are allocated as follows:

	POINTS
PRICE	90
SPECIFIC GOALS	10
Total points for Price and SPECIFIC GOALS	**100**

1.5 Failure on the part of a tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals with the tender, will be interpreted to mean that preference points for specific goals are not claimed.

1.6 The organ of state reserves the right to require of a tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

2. DEFINITIONS

a) **"tender"** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation;

b) **"price"** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;

c) **"rand value"** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;

d) **"tender for income-generating contracts"** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and

e) **"the Act"** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1 POINTS AWARDED FOR PRICE

3.1.1 THE 90/10 PREFERENCE POINT SYSTEMS

A maximum of 90 points is allocated for price on the following basis:

90/10

$$Ps = 90\left(1 - \frac{Pt - P\,min}{P\,min}\right)$$

Where

Ps = Points scored for price of tender under consideration
Pt = Price of tender under consideration
Pmin = Price of lowest acceptable tender

4. FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT

4.1 POINTS AWARDED FOR PRICE

A maximum of 90 points is allocated for price on the following basis:

90/10

$$Ps = 90\left(1 + \frac{Pt - P\,max}{Pmax}\right)$$

Where

Ps = Points scored for price of tender under consideration
Pt = Price of tender under consideration
Pmax = Price of highest acceptable tender

5. POINTS AWARDED FOR SPECIFIC GOALS

5.1 In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in Table 1 below as may be supported by proof/ documentation stated in the conditions of this tender:

5.2 In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—

(a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or

(b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,

then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

***Note to tenderers: The tenderer must indicate how they claim points for each preference point system.*)**

The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system)	Number of points claimed (90/10 system) (To be completed by the tenderer)
Business owned by 51% or more black people who are youth	6	
Businesses located within the boundaries of Gauteng province	4	
Total	**10**	

6. DECLARATION WITH REGARD TO COMPANY/FIRM

6.1 Name of company/firm…….

6.2 Company registration number: ……...

6.3 TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One-person business/sole propriety
- ☐ Close corporation
- ☐ Public Company
- ☐ Personal Liability Company
- ☐ (Pty) Limited
- ☐ Non-Profit Company
- ☐ State Owned Company

[TICK APPLICABLE BOX]

6.4 I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I acknowledge that:

i) The information furnished is true and correct;

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;

iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –

(a) disqualify the person from the tendering process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution, if deemed necessary.

.....
SIGNATURE(S) OF TENDERER(S)

SURNAME AND NAME: .....
DATE: .....

ADDRESS: .....

.....

.....

.....

6.5 SUB-CONTRACTING

6.5.1 Will any portion of the contract be sub-contracted?

(***Tick applicable box***)

YES		NO	

6.5.2 If yes, indicate:

i) What percentage of the contract will be subcontracted_____

ii) The name of the sub-contractor(s):

_____

_____

_____

_____

_____

iii) The black sharehold of the sub-contractor(s):

_____

_____

_____

_____

_____

iv) Whether the sub-contractor(s) is an EME or QSE
(Tick applicable box)

YES		NO	

v) Specify, by ticking the appropriate box, if subcontracting with an enterprise in terms of Preferential Procurement Regulations,2022:

Designated Group: An EME or QSE which is at last 51% owned by:	EME √	QSE √
Black people		
Black people who are youth		
People who are women		
Black people with disabilities		
Black people living in rural or underdeveloped areas or townships		
Cooperative owned by black people		
Black people who are military veterans		
OR		
Any EME		
Any QSE		

6.6 DECLARATION WITH REGARD TO COMPANY/FIRM

6.6.1 Name of company/firm: ……

6.6.2 VAT number registration number: ……

6.6.3 Company registration number: ……

6.7 TYPE OF COMPANY/ FIRM

- □ Partnership/Joint Venture / Consortium
- □ One person business/sole propriety
- □ Close corporation
- □ Company
- □ (Pty) Limited

[TICK APPLICABLE BOX]

6.8 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

……

……

……

……

6.9 COMPANY CLASSIFICATION

- □ Manufacturer
- □ Supplier
- □ Professional Service Provider
- □ Other service providers, e.g transporter, etc.

[*TICK APPLICABLE BOX*]

6.10 MUNICIPAL INFORMATION

Municipality where business is situated: .....

Registered Account Number: .....

Stand Number: .....

6.11 Total number of years the company/firm has been in business: .....

6.12 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the Specific Goals in MBD 6.1 qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

i) The information furnished is true and correct;

ii) In the event of a contract being awarded as a result of points claimed as shown in MBD 6.1, the contractor is required to furnish documentary proof as requested in the Tender Data to the satisfaction of the purchaser that the claims are correct;

iii) If the specific goals points have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –

(a) disqualify the person from the bidding process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution.

WITNESSES 1. ..... 2.	..... SIGNATURE(S) OF BIDDERS(S) DATE: ..... ADDRESS ....

MBD 4

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state[1].

2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority.

3 In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

3.1 Full Name of bidder or his or her representative:……..

3.2 Identity Number…….

3.3 Position occupied in the Company (director, trustee, hareholder[2]):……..

3.4 Company Registration Number: …….

3.5 Tax Reference Number:……

3.6 VAT Registration Number: ……

3.7 The names of all directors / trustees / shareholders members, their individual identity numbers and state employee numbers must be indicated in paragraph 4 below.

3.8 Are you presently in the service of the state? **YES / NO**

3.8.1 If yes, furnish particulars. ….……

……..

[1]MSCM Regulations: "in the service of the state" means to be –

(a) a member of –
  (i) any municipal council;
  (ii) any provincial legislature; or
  (iii) the national Assembly or the national Council of provinces;

(b) a member of the board of directors of any municipal entity;
(c) an official of any municipality or municipal entity;
(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);
(e) a member of the accounting authority of any national or provincial public entity; or
(f) an employee of Parliament or a provincial legislature.

[2] Shareholder" means a person who owns shares in the company and is actively involved in the management of the company or business and exercises control over the company.

3.9 Have you been in the service of the state for the past twelve months? ……**YES / NO**

3.9.1 If yes, furnish particulars……..……..
……

3.10 Do you have any relationship (family, friend, other) with persons in the service of the state and who may be involved with the evaluation and or adjudication of this bid? …… **YES / NO**

3.10.1 If yes, furnish particulars……
……..

3.11 Are you, aware of any relationship (family, friend, other) between any other bidder and any persons in the service of the state who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

3.11.1 If yes, furnish particulars
……
……

3.12 Are any of the company's directors, trustees, managers, principle shareholders or stakeholders in service of the state? **YES / NO**

3.12.1 If yes, furnish particulars…….
……

3.13 Are any spouse, child or parent of the company's directors trustees, managers, principle shareholders or stakeholders in service of the state? **YES / NO**

3.13.1 If yes, furnish particulars…….
……

3.14 Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders of this company have any interest in any other related companies or business whether or not they are bidding for this contract. **YES / NO**

3.14.1 If yes, furnish particulars:……..
……..

4.Full details of directors / trustees / members / shareholders.

Full Name	Identity Number	State Employee Number

…….. ……..

Signature **Date**

…… ……

Capacity **Name of Bidder**

MBD 8

DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

1 The bid of any bidder may be disregarded if that bidder, or any of its directors have-

a. abused the institution's supply chain management system;
b. committed fraud or any other improper conduct in relation to such system; or
c. failed to perform on any previous contract.

2 In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

Item	Question	Yes	No
4.1	Is the bidder or any of its directors listed on the National Treasury's database as companies or persons prohibited from doing business with the public sector? (Companies or persons who are listed on this database were informed in writing of this restriction by the National Treasury after the *audi alteram partem* rule was applied).	Yes □	No □
4.1.1	If so, furnish particulars:		
4.2	Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)? **To access this Register, enter the National Treasury's website, www.treasury.gov.za, click on the icon "Register for Tender Defaulters" or submit your written request for a hard copy of the Register to facsimile number (012) 3265445.**	Yes □	No □
4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court outside of the Republic of South Africa) for fraud or corruption during the past five years?	Yes □	No □
4.3.1	If so, furnish particulars:		
4.4	Was any contract between the bidder and any organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes □	No □
4.4.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME)…… CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS TRUE AND CORRECT.

I ACCEPT THAT, IN addition TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

……...	**……..**
Signature	**Date**
…….	**……..**
Position	**Name of Bidder**

MBD 5

DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (VAT INCLUDED)

For all procurement expected to exceed R10 million (VAT included), bidders must complete the following questionnaire:

1 Are you by law required to prepare annual financial statements for auditing? **YES / NO**

1.1 If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.

……

……

2. If the bidder is not required by law to prepare annual financial statements for auditing, they shall be required to furnish their Annual Financial Statements -

i.for the past three years , or
ii. since their establishment if established during the past three years

Do you have any outstanding undisputed commitments for municipal services towards a municipality or any other service provider in respect of which payment is overdue for more than 30 days? **YES / NO**

2.1 If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards a municipality or other service provider in respect of which payment is overdue for more than 30 days.

2.2 If yes, provide particulars.

……

……

3 Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract? **YES / NO**

3.1 If yes, furnish particulars

…….

…….

4 Will any portion of goods or services be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality / municipal entity is expected to be transferred out of the Republic? **YES / NO**

4.1 If yes, furnish particulars

……..…….

……..…….

CERTIFICATION

I, THE UNDERSIGNED (NAME)
……

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE

FALSE.

…….. ……..
Signature Date

…… …….
Position Name of Bidder

MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Municipal Bidding Document (MBD) must form part of all bids[1] invited.

2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging)[2].Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.

3. Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:

   a. take all reasonable steps to prevent such abuse;

   b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and

   c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.

4. This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.

5 In order to give effect to the above, the attached Certificate of Bid Determination (MBD9) must be completed and submitted with the bid:

[1] **Includes price quotations, advertised competitive bids, limited bids and proposals.**

[2] **Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.**

MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description) in response to the invitation for the bid made by:

_____

(Name of Municipality / Municipal Entity) do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of _____that:
(Name of Bidder)

1. I have read, and I understand the contents of this Certificate;

2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;

3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;

4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;

5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:

   (a) has been requested to submit a bid in response to this bid invitation;
   (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
   (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder

6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium[3] will not be construed as collusive bidding.

7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

   (a) prices;
   (b) geographical area where product or service will be rendered (market allocation)
   (c) methods, factors or formulas used to calculate prices;
   (d) the intention or decision to submit or not to submit, a bid;

[3] **Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.**

(e) the submission of a bid which does not meet the specifications and conditions of the bid; or
(f) bidding with the intention not to win the bid.

8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.

9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No. 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No. 12 of 2004 or any other applicable legislation.

…… …… ……
Signature Date

…… …… ……
Position Name of Bidder

T2.1.5 PROPOSED AMENDMENTS AND QUALIFICATIONS

The Tenderer should record any deviations or qualifications he may wish to make to the tender documents in this Returnable Schedule. Alternatively, a tenderer may state such qualifications in a covering letter to his tender and reference such letter in this schedule.

The Tenderer's attention is drawn to clause C.3.8 of the Standard Conditions of Tender referenced in the Tender Data regarding the employer's handling of material qualifications.

Page	Clause or item	Proposal

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

T2.1.6 SCHEDULE OF THE TENDERER'S EXPERIENCE

EMPLOYER: CONTACT PERSON AND TELEPHONE NUMBER	EMPLOYER'S AGENT OR REPRESENTATIVE: CONTACT PERSON AND TELEPHONE NUMBER	NATURE OF WORK	VALUE OF WORK (inclusive of VAT)	DATE COMPLETED OR EXPECTED TO BE COMPLETED

T2.1.7 CONTACTABLE REFERENCE TEMPLATE (STEEL WATER PIPELINE)

Note : Please see NB at bottom of page.

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorized to do so, hereby furnish a reference to Johannesburg Water relative to tender **JW14463 Halfway House Water Upgrade Project**.

Name of tenderer_____

Description of Project_____

Pipe Diameter and Material_____

Pipe Joining Method_____

Value of Contract _____

Start Date (DD/MM/YYYY) _____

End Date (DD/MM/YYYY) _____

Was their performance satisfactory? Yes / No*

If No, please furnish details……
……
…..

Name of authorised person/referee: _____ **Signature:**_____

Telephone: _____ **e-mail:** _____ **Date:**_____

Completed on behalf (name of business)

_____

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.
IF BIDDER WAS A SUBCONTRACTOR ON THE PROJECT – PROOF OF SUBCONTRACTING AGREEMENT BETWEEN BIDDER AND MAIN CONTRACTOR PLUS MAIN CONTRACTOR COMPLETION CERTIFICATE AND REFERENCE LETTER TO BE SUBMITTED AS STATED ABOVE.

T2.1.7 CONTACTABLE REFERENCE TEMPLATE (STEEL WATER PIPELINE)

Note : Please see NB at bottom of page.

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorized to do so, hereby furnish a reference to Johannesburg Water relative to tender **JW14463 Halfway House Water Upgrade Project**.

Name of tenderer_____

Description of Project_____

Pipe Diameter and Material_____

Pipe Joining Method_____

Value of Contract _____

Start Date (DD/MM/YYYY) _____

End Date (DD/MM/YYYY) _____

Was their performance satisfactory? Yes / No*

If No, please furnish details……
……
…..

Name of authorised person/referee: _____ **Signature:**_____

Telephone: _____ **e-mail:** _____ **Date:**_____

Completed on behalf (name of business)

_____

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.
IF BIDDER WAS A SUBCONTRACTOR ON THE PROJECT – PROOF OF SUBCONTRACTING AGREEMENT BETWEEN BIDDER AND MAIN CONTRACTOR PLUS MAIN CONTRACTOR COMPLETION CERTIFICATE AND REFERENCE LETTER TO BE SUBMITTED AS STATED ABOVE.

T2.1.7 CONTACTABLE REFERENCE TEMPLATE (STEEL WATER PIPELINE)

Note : Please see NB at bottom of page.

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorized to do so, hereby furnish a reference to Johannesburg Water relative to tender **JW14463 Halfway House Water Upgrade Project**.

Name of tenderer_____

Description of Project_____

Pipe Diameter and Material_____

Pipe Joining Method_____

Value of Contract _____

Start Date (DD/MM/YYYY) _____

End Date (DD/MM/YYYY) _____

Was their performance satisfactory? Yes / No*

If No, please furnish details……
……
……

Name of authorised person/referee: _____ **Signature:**_____

Telephone: _____ **e-mail:** _____ **Date:**_____

Completed on behalf (name of business)

_____

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.
IF BIDDER WAS A SUBCONTRACTOR ON THE PROJECT – PROOF OF SUBCONTRACTING AGREEMENT BETWEEN BIDDER AND MAIN CONTRACTOR PLUS MAIN CONTRACTOR COMPLETION CERTIFICATE AND REFERENCE LETTER TO BE SUBMITTED AS STATED ABOVE.

T2.1.7 CONTACTABLE REFERENCE TEMPLATE (STEEL WATER PIPELINE)

Note : Please see NB at bottom of page.

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorized to do so, hereby furnish a reference to Johannesburg Water relative to tender **JW14463 Halfway House Water Upgrade Project**.

Name of tenderer_____

Description of Project_____

Pipe Diameter and Material_____

Pipe Joining Method_____

Value of Contract _____

Start Date (DD/MM/YYYY) _____

End Date (DD/MM/YYYY) _____

Was their performance satisfactory? Yes / No*

If No, please furnish details……
……
……

Name of authorised person/referee: _____ **Signature:**_____

Telephone: _____ **e-mail:** _____ **Date:**_____

Completed on behalf (name of business)

_____

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.
IF BIDDER WAS A SUBCONTRACTOR ON THE PROJECT – PROOF OF SUBCONTRACTING AGREEMENT BETWEEN BIDDER AND MAIN CONTRACTOR PLUS MAIN CONTRACTOR COMPLETION CERTIFICATE AND REFERENCE LETTER TO BE SUBMITTED AS STATED ABOVE.

T2.1.7 CONTACTABLE REFERENCE TEMPLATE (CONCRETE CULVERT JACKING)

Note : Please see NB at bottom of page.

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorised to do so, hereby furnish a reference to Johannesburg Water relative to tender Contract No**. JW14463** for **Halfway House Water Upgrade**

Name of Tenderer :

Description of Project :

Type of Road Jacked Beneath (e.g National, Provincial, Local municipality) :

Name of Road Jacked Beneath :

Road Owner (e.g SANRAL, RAL) :

Dimension of Culvert Jacking (Width (m) x Breadth (m) x Length (m))

Construction Start date (Year- Month -Day) :

Construction End date (Year- Month -Day) :

Completed on behalf of (Name of the Client) :

Name of authorised person/referee from Client :

Email :

Signature: Date:

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.

T2.1.8 SCHEDULE OF KEY PERSONNEL

In terms of the Project Specification and the Conditions of Tender, unskilled workers may only be brought in from outside the local community if such personnel are not available locally.

The Tenderer shall list below the personnel which they intend to utilize on the Works, including key personnel which may have to be brought in from outside if not available locally.

CATEGORY OF EMPLOYEE	NUMBER OF PERSONS					
	KEY PERSONNEL, PART OF THE CONTRACTOR'S ORGANISATION		KEY PERSONNEL TO BE IMPORTED IF NOT AVAILABLE LOCALLY		UNSKILLED PERSONNEL TO BE RECRUITED FROM LOCAL COMMUNITY	
	HDI	NON-HDI	HDI	NON-HDI	HDI	NON-HDI
Site Agent, Contracts Manager						
Foremen, Quality Control and Safety Personnel						
Technicians, Surveyors, etc.						
Artisans and other Skilled workers						
Plant Operators						
Unskilled Workers						
Others: ……..... .....…. …….						

SIGNATURE:.....…… DATE: …….....

(of person authorized to sign on behalf of the Tenderer)

T2.1.9 CURRICULUM VITAE OF KEY PERSONNEL

Provide separate forms for each position listed in Form: Key Personnel

Proposed role in the project	

1. **Surname**	
2. **First Name**	

3. **Education (Submit certified copies of qualifications)**

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained

4. **Registration/ Membership of Professional Bodies (Submit copies of registration certificates)**

Institution/ Professional Body	Category of Registration	Registration Number

5. **Post Qualification Experience**

Company/ Organisation	(Date from – Date to)	Years of Employment	Position

6. Project-based Experience

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Duplicate relevant section to add more information, if required.

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

..... …….....

Signature of person named in the schedule *Date*

T2.1.9 CURRICULUM VITAE OF KEY PERSONNEL

Provide separate forms for each position listed in Form: Key Personnel

Proposed role in the project	

1. **Surname**	
2. **First Name**	

3. **Education (Submit certified copies of qualifications)**

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained

4. **Registration/ Membership of Professional Bodies (Submit copies of registration certificates)**

Institution/ Professional Body	Category of Registration	Registration Number

5. **Post Qualification Experience**

Company/ Organisation	(Date from – Date to)	Years of Employment	Position

6. Project-based Experience

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
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Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
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Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Duplicate relevant section to add more information, if required.

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

....

Signature of person named in the schedule *Date*

T2.1.9 CURRICULUM VITAE OF KEY PERSONNEL

Provide separate forms for each position listed in Form: Key Personnel

Proposed role in the project	

1. **Surname**	
2. **First Name**	

3. **Education (Submit certified copies of qualifications)**

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained

4. **Registration/ Membership of Professional Bodies (Submit copies of registration certificates)**

Institution/ Professional Body	Category of Registration	Registration Number

5. **Post Qualification Experience**

Company/ Organisation	(Date from – Date to)	Years of Employment	Position

6. Project-based Experience

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Duplicate relevant section to add more information, if required.

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

....

Signature of person named in the schedule *Date*

T2.1.9 CURRICULUM VITAE OF KEY PERSONNEL

Provide separate forms for each position listed in Form: Key Personnel

Proposed role in the project	

1. **Surname**	
2. **First Name**	

3. **Education (Submit certified copies of qualifications)**

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained

4. **Registration/ Membership of Professional Bodies (Submit copies of registration certificates)**

Institution/ Professional Body	Category of Registration	Registration Number

5. **Post Qualification Experience**

Company/ Organisation	(Date from – Date to)	Years of Employment	Position

6. Project-based Experience

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Construction Manager, etc.)	
Description of Duties	
Description of Project Scope (including pipe diameter, material, joining mechanism and accessories, type of jacked road and dimensions of culvert jacking where applicable)	

Duplicate relevant section to add more information, if required.

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

....

Signature of person named in the schedule *Date*

T2.2 LIST OF RETURNABLE DOCUMENTS

Document **Page**

2. Other documents required only for tender evaluation purposes

T2.2.1 Certificate of Contractor Registration issued by the Construction Industry Development Board RD.57

T2.2.2 SARS Tax Compliance Status Pin and Proof of CSD registration i.e. MA xxxxxxxxxx number RD.58

T2.2.1 CONTRACTOR'S CERTIFICATE OF REGISTRATION WITH CIDB

NB: The Tenderer shall attach hereto the Contractor's Certificate of Registration with CIDB OR provide the CIDB registration number that JW can use to verify CIDB requirements for this tender.

SIGNATURE: .....…… DATE: …….....

(of person authorized to sign on behalf of the Tenderer)

T2.2.2 SARS TAX COMPLIANCE STATUS PIN AND PROOF OF CSD REGISTRATION

The Tenderer must attach hereto a copy SARS Tax Compliance Status Pin and Proof of CSD registration i.e. MA xxxxxxxxxx number.

SIGNATURE:.....…… DATE: …….....

(of person authorized to sign on behalf of the Tenderer)

T2.3 LIST OF RETURNABLE SCHEDULES

Document		Page
3. Other documents that will be incorporated into the contract		
T2.3.1	Returnable Annexure A – SHE Acknowledgment Form	RD.43
T2.3.2	Returnable Annexure B: Acknowledgement of Tender Drawings	RD.44
T2.3.3	Minutes of the Mandatory Tender Briefing Meeting	RD.46

T2.3.1 Returnable Annexure A: Acknowledgement of SHE Specification & Annexures

DECLARATION BY CONTRACTOR

I, the undersigned, and representing the tenderer as indicated hereby acknowledge that I have obtained copies of the following listed documentation and confirm that I fully understand the contents thereof and confirm compliance thereto in the event of being successful:

- OHS Specification
- Annexure 1: Baseline Risk Assessment
- Annexure 2: Medical Screening Policy
- Annexure 3: Sign off form
- Annexure 4: Environmental Management Plan

We furthermore commit to:

- Comply with all applicable SHE related legal and other requirements.
- Inform all staff of their role in managing environmental impacts and safety hazards on site.

Signed at …… on this …….. Day of …… 20……...

Name of tenderer	
Name of Authorized person	
Authorized Signature*	

*Signature must be as per form T2.1.2 as applicable

T2.3.2 Returnable Annexure B: Acknowledgement of Tender Drawings

DECLARATION BY CONTRACTOR

I, the undersigned, and representing the tenderer as indicated hereby acknowledge that I have obtained copies of the following listed documentation and confirm that I fully understand the contents thereof and confirm compliance thereto in the event of being successful:

The drawings that are issued for **TENDER PURPOSES** are those noted below:

DRAWING NUMBER	DESCRIPTION
111242-0000-REG-ZUT-001	DRAWING REGISTER
	WATER LAYOUTS
111242-0000-DRG-WW-0200	BULK WATER FEEDER AND SUPPLY PIPELINE SCHEMATIC LAYOUT
111242-0000-DRG-WW-0201	BULK WATER FEEDER AND SUPPLY PIPELINE KEY PLAN
111242-0000-DRG-WW-0202	BULK WATER FEEDER PIPELINE LAYOUT SHEET 1 OF 2
111242-0000-DRG-WW-0203	BULK WATER SUPPLY PIPELINE LAYOUT SHEET 2 OF 2
	WATER SECTIONS
111242-0000-DRG-WW-0301	PLAN AND LONGSECTION: SHEET 1 OF 10
111242-0000-DRG-WW-0302	PLAN AND LONGSECTION: SHEET 2 OF 10
111242-0000-DRG-WW-0303	PLAN AND LONGSECTION: SHEET 3 OF 10
111242-0000-DRG-WW-0304	PLAN AND LONGSECTION: SHEET 4 OF 10
111242-0000-DRG-WW-0305	PLAN AND LONGSECTION: SHEET 5 OF 10
111242-0000-DRG-WW-0306	PLAN AND LONGSECTION: SHEET 6 OF 10
111242-0000-DRG-WW-0307	PLAN AND LONGSECTION: SHEET 7 OF 10
111242-0000-DRG-WW-0308	PLAN AND LONGSECTION: SHEET 8 OF 10
111242-0000-DRG-WW-0309	PLAN AND LONGSECTION: SHEET 9 OF 10
111242-0000-DRG-WW-0310	PLAN AND LONGSECTION: SHEET 10 OF 10
	WATER DETAILS
111242-0000-DRG-WW-0500	TYPICAL DETAILS OF AIR VALVE CHAMBER
111242-0000-DRG-WW-0501	TYPICAL DETAILS OF ISOLATING VALVE CHAMBER
111242-0000-DRG-WW-0502	TYPICAL DETAILS OF SCOUR VALVES CHAMBER SHEET 1 OF 2
111242-0000-DRG-WW-0503	TYPICAL DETAILS OF SCOUR VALVES CHAMBER SHEET 2 OF 2
111242-0000-DRG-WW-0504	TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL
111242-0000-DRG-WW-0505	THRUST BLOCK DETAILS
111242-0000-DRG-WW-0506	TYPICAL PIPE JACKING DETAILS
111242-0000-DRG-WW-0507	TYPICAL DETAILS OF MARKER BLOCK
111242-0000-DRG-WW-0508	TYPICAL WATER METER CHAMBER DETAIL
111242-0000-DRG-WW-0509	DETAILS OF ACCESS CHAMBER 1
111242-0000-DRG-WW-0510	TYPICAL DETAIL – DN 700 SUPPORT BRACKET DETAILS
111242-0000-DRG-WW-0511	TYPICAL RIVER CROSSING DETAILS
111242-0000-DRG-WW-0512	TYPICAL DETAILS FOR N1 CROSSING
111242-0000-DRG-WW-0513	DETAILS OF ACCESS CHAMBER 2
111242-0000-DRG-WW-0514	FENCING AROUND ACCESS CHAMBERS
	MECHANICAL
111242-0000-DRG-WW-0516	ACCESS CHAMBERS VENTILATION SHEET 1 OF 3
111242-0000-DRG-WW-0517	ACCESS CHAMBERS VENTILATION SHEET 2 OF 3
111242-0000-DRG-WW-0518	ACCESS CHAMBERS VENTILATION SHEET 3 OF 3
111242-0000-DRG-WW-0519	ACCESS CHAMBER 2 PRV DETAILS SHEET 1 OF 2
111242-0000-DRG-WW-0520	ACCESS CHAMBER 2 PRV DETAILS SHEET 2 OF 2

DRAWING NUMBER	DESCRIPTION
111242-0000-DRG-WW-0521	STANDARD DETAIL ANCHOR PIPE SUPPORT GALVANISED STEEL
	ELECTRICAL
111242-0000-DRG-EL-2000	ELECTRICAL SERVICES LIGHTING LAYOUT
111242-0000-DRG-EL-2001	ELECTRICAL SERVICES POWER LAYOUT
111242-0000-DRG-EL-2002	ELECTRICAL SERVICES CONTAINMENT LAYOUT
111242-0000-DRG-EL-2003	ELECTRICAL SERVICES DISTRIBUTION BOARD SINGLE LINE DIAGRAM
	STRUCTURAL
111242-0000-DRG-SS-3000	CHAMBER & CULVERT LOCATION PLAN LAYOUT, SECTIONS, DETAILS & 3D VIEWS
111242-0000-DRG-SS-3001	CHAMBER 1 LAYOUT, SECTIONS, DETAILS & 3D VIEW
111242-0000-DRG-SS-3002	CHAMBER 2 LAYOUT, SECTIONS, DETAILS
111242-0000-DRG-SS-3003	CHAMBER 2 LAYOUT, DETAILS & 3D VIEWS

Signed at …… on this …….. Day of …… 20……...

Name of tenderer	
Name of Authorized person	
Authorized Signature*	

*Signature must be as per form T2.1.2 as applicable

T2.3.3 Minutes of the Mandatory Tender Briefing Meeting

Minutes of the Mandatory Tender Briefing Meeting

Johannesburg Water SOC Ltd

Johannesburg Water

CONTRACT NO: JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 1

PART 1: AGREEMENT AND CONTRACT DATA

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C1.1 FORM OF OFFER (ACCEPTANCE & AGREEMENT)

C1.1.1 FORM OF OFFER

The contractor is to complete and sign the form of offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract in respect of the following works:

JW14463: IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

The Contractor, identified in the Offer signature block below, has examined the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Contractor, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Contractor offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED RATES TO PROVIDE THE WORKS TOTAL OF THE PRICES INCLUSIVE OF VALUE ADDED TAX IS

.....

..... Rand (in words); R ..... (in figures),

This offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Contractor before the end of the period of validity stated in the Tender Data, whereupon the Contractor becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

Signature(s)

Name(s) _____ _____

_____ _____

Capacity _____ _____

For the Contractor _____

(Name and address of organisation)

Name and signature of witness _____ **Date** _____

C1.1.2 FORM OF ACCEPTANCE

THE EMPLOYER IS TO COMPLETE AND SIGN THE FORM OF ACCEPTANCE

By signing this part of the Form of Offer and Acceptance, the Employer identified below accepts the Contractor's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the Conditions of Contract identified in the Contract Data. Acceptance of the Contractor's Offer shall form an agreement between the Employer and the Contractor upon the terms and conditions contained in this Agreement and in the Contract that is the subject of this Agreement.

The terms of the contract are contained in:
Part 1 Agreement and Contract Data, (which includes this Agreement)
Part 2 Pricing Data
Part 3 Scope of Work
Part 4 Site Information
and drawings and documents or parts thereof, which may be incorporated by reference into Parts 1 to 4 above.
Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Contractor and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be duly signed by the authorised representative(s) of both parties.

The Contractor shall within twenty-eight (**28) days** after receiving a completed copy of this Agreement, including the Schedule of Deviations (if any), contact the employer's agent (whose details are given in the Contact Data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data at, or just after, the date of this Agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the Contractor receives one fully completed copy of this document, including the Schedule of Deviations (if any). Unless the Contractor (now the Contractor) within five days after the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute binding contract between the parties,

FOR EMPLOYER OFFICIAL USE ONLY

Name(s) _____ _____

Capacity _____ _____

For the Employer ***Johannesburg Water SOC Ltd, Turbine Hall,65 Ntemi Piliso, Newtown, Johannesburg***

(Name and address of organisation)

Name and signature of witness _____ **Date** _____

Employer:		Contractor:	
Witness:		Witness:	

C1.1.3 Schedule of Deviations

Notes:

1. The extent of deviations from the tender documents issued by the employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender;

2. A Contractor's covering letter shall not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid become the subject of agreements reached during the process of offer and acceptance, the outcome of such agreement shall be recorded here;

3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here; and

4. Any change or addition to the tender documents arising from the above arrangements and recorded here shall also be incorporated into the final draft of the Contract.

1 Subject

Details

2 Subject

Details

3 Subject

Details

4 Subject

Details

5 Subject

Details

6 Subject

Details

7 Subject

Details

8 Subject

Details

By the duly authorised representatives signing this Schedule of Deviations, the Employer and the Contractor agree to and accept the foregoing Schedule of deviations as the only deviations from and amendments to the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, as well as any confirmation, clarification or change to the terms of the offer agreed by the Contractor and the Employer during the process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the Contractor of a completed and signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this Agreement.

For the Contractor:
Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

_____
(Name and address of organisation)

Name and signature of witness _____ **Date** _____

For the Employer:
Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

Johannesburg Water SOC Ltd, Turbine Hall,65 Ntemi Piliso, Newtown, Johannesburg
(Name and address of organisation)

Name and signature of witness _____ **Date** _____

C1.2 CONTRACT DATA

C1.2.1 Part 1: Data provided by the Employer

CONDITIONS OF CONTRACT

The General Conditions of Contract for Construction Works (2015), published by the South African Institution of Civil Engineering, is applicable to this Contract.

C1.2.1.1 Contract Specific Data

The following contract specific data are applicable to this Contract:

GCC Clause	Information
1.1.1.13	The Defects Liability Period is 52 weeks from the date of the Certificate of Completion.
1.1.1.14	The Work shall be completed within 540 days.
1.1.1.15	The name of the Employer is Johannesburg Water (SOC) Limited. Contact person is: William Chitsa.
1.2.1.	The address of the Employer is: Physical / Postal / Tel: 011 688 1603/71 Turbine Hall / P.O. Box 61542 65 Ntemi Piliso Street Newtown / Marshalltown / Email:william.chitsa@jwater.co.za Johannesburg / 2107 2001
1.1.1.16	The name of the Employer's Agent is Zutari (Pty) Ltd represented by Chester Kan, who is Registered as a Pr. Eng with the Engineering Council of South Africa.
1.2.1.2	The address of the Employer's Agent is: Physical Address / Postal / Tel: 011 214 4500 Oxford Corner / P.O. Box 653763 32A Jellicoe Avenue / Benmore / Email: chester.kan@zutari.com Rosebank, 2196 / 2010
3.2.3	Specific Approval – The Employer's Agent is required to obtain the Employer's approval for the following: • Approval of Variation Orders • Approval to exceed the Contract Sum • Approval of Subcontracting and Labour Plan • Approval for stoppage / suspension of works
4.11.1	Add the following to this clause: Competent Employees shall include, amongst others, the following Key Personnel: • Contracts Manager • Construction Manager • Safety Officer • Environmental Officer The minimum requirements in terms of qualifications and experience of these Key Personnel are listed in **C1.2.1.2.15** (see below).
5.3.1	The documentation required before commencement with Works execution are: • Approved Health and Safety File (Clause 4.3) • Third Party Insurance for the Works. • Approval of the Environmental File

GCC Clause	Information
	• Initial programme (Clause 5.6) • Guarantee from Bank or Insurance Company (Clause 6.2) • Insurance of Construction Machinery Plant (Clause 8.6) • Insurance of Motor Vehicle Liability (Clause 8.6) • Commissioner of COID (Clause 8.6) • Signed Notification to the Department of Labour • Construction Work Permit where applicable. It is the Employer's responsibility to obtain this permit. • Subcontracting and Labour Plan.
5.3.2	The Contractor shall deliver the documentation as required in clause 5.3.1 within 28 days from the Commencement Date.
5.3.3	**Time to instruct commencement of the Works** Delete Clause 5.3.3 and replace with the following: The Contractor shall commence with carrying out the Works upon written instruction from the Employer's Agent to commence with the Works.
5.8	The special non-working days are All Public Holidays in terms of the Public Holidays Act as amended. Working days shall be Monday to Friday, between 07h00 to 17h00.
5.8.1	The year-end break ''builder's break'' commences on 16 December until the first working Monday of January of the succeeding year as defined by the SAFCEC on annual basis.
5.11.1.2	Delete 5.11.1.2
5.13.1	The penalty for failing to complete the Works is the greater of: An amount equal to daily Time Related P&G rate (as calculated from the Time Related P&G section in the Bill of Quantities) or R10 000.00 per day, whichever is greater.
5.14.1	The requirements for achieving Practical Completion are: • Construction, testing & commissioning of all pipework. • Installation, testing & commissioning of all valves. • Installation, testing & commissioning of all electrical infrastructure. • Reinstatements of man-made surfaces, including road surfaces. • Environmental rehabilitation of site.
5.16.3	The latent defects period is 10 years.
6.2	The time to deliver the Form of Guarantee is within 28 days from the Commencement Date.
6.2.1	The liability of the guarantee shall be 10% of the tendered sum
6.8.2	This contract is subject to Contract Price Adjustment. The Contract Price Adjustment Factor, rounded off to the fourth decimal place, is determined according to the formula: $$(1-x)[\frac{aL_t}{L_0}+\frac{bP_t}{P_0}+\frac{cM_t}{M_0}+\frac{dF_t}{F_0}-1]$$ The value of payment certificates will be adjusted by a Contract Price Adjustment Factor, the value of each payment certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule, with the following values: The value of "x" is 0,10 The values of the coefficients are: a = 0,32 Labour b = 0,25 Contractor's equipment c = 0,33 Material

GCC Clause	Information
	d = 0,10 Fuel The province where the Site is located is Gauteng. The base month is the month prior to the month in which the tender closes. (a) 'L' is the 'Labour Index' and shall be the price index for 'Consumer Price Index' for the Gauteng Province as published in the Statistical News Release, P0141, Table A "Consumer Price Index: Main indices" " of Statistics South Africa. (b) 'P' is the 'Construction Equipment' and shall be the Producer Price Index applicable to Plant and Equipment (Total) as published in the Statistical Release P0151.1, Table 4 of Statistics South Africa. (c) 'M' is the 'Materials Index' and shall be the Producer Price Index applicable to Civil Engineering Material (Total) as published in the Statistical Release P0151.1, Table 6 of Statistics South Africa. (d) 'F' is the 'Fuel Index' and shall be the Producer Price Index for Final manufactured goods - Coal and Petroleum Products - Diesel as published in the Statistical News Release P0142.1, Table 1 of Statistics South Africa." There will be no escalation within the first twelve months of the appointment.
6.8.3	Price adjustments for variations in the costs of special materials are **NOT** allowed.
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is 80%.
6.10.3	The percentage retention on the amounts due to the Contractor is 10%. The limit of retention money is 5% of the Contract Price.
6.10.4	**Delivery, dissatisfaction with and payment of payment certificates** Delete Clause 6.10.4 and replace with the following: Payment shall be made upon: • After the payment certificate has been approved by Employer's Agent, the Contractor must issue an Original Tax Invoice compliant with SARS requirements for Valid Tax Invoice. The date of the Original Tax Invoice must be the date the Employer's Agent approved the payment Certificate. The payment certificate will then be ready for handing in to the Employer latest by the 25th of every month. • No payment certificate will be processed if correct labour returns are not submitted. • Any failure to submit the required, Employer's Agent-approved payment certificate by the agreed date will result in the assessment by the Employer's Agent being held over until the assessment interval following the correct submission of the required information. These assessments and certificates shall not be regarded as late and interest shall not be applicable. Payment shall be subject to the Contractor submitting an Original Tax Invoice compliant with SARS requirements for a Valid Tax Invoice to the Employer for the amount due. Payment will be made on or before the last day of the month following the assessment date. Any dissatisfaction in respect of such payment certificate shall be dealt with in terms of Clause 10.2.
6.10.5	Payment of Retention Money

GCC Clause	Information
	Delete Clause 6.10.5 and replace with the following: When defects liability is specified, one half of the retention money shall be paid after the Employer's Agent has issued a Certificate of Completion in terms of Clause 5.14.4 as follows: • The Contractor will provide a statement for release of 5% retention to the Employer's Agent before or on the 20th of the month. • After the payment certificate has been approved by Employer's Agent, the Contractor must issue an Original Tax Invoice compliant with SARS requirements for Valid Tax Invoice. The date of the Original Tax Invoice must be the date the Employer's Agent approved the Payment Certificate. The certificate will then be ready for handing in to the Employer latest by the 25th of every month. • Payment will be on or before the last day of the month following the approval of the payment certificate by the Employer's Agent. The other half of the retention money shall be paid after the Employer's Agent has issued Final Approval Certificate at the end of the Defects Liability Period, which may be extended in term of Clauses 5.14.4 or 7.8.1, if necessary, as follows: • The Contractor will provide a statement for release of 5% retention to the Employer's • After the payment certificate has been approved by Employer's Agent, the Contractor must issue an Original Tax Invoice compliant with SARS requirements for Valid Tax Invoice. The date of the Original Tax Invoice must be the date the Employer's Agent approved the Payment Certificate. The certificate will then be ready for handing in to the Employer latest by the 25th of every month. Payment shall be subject to the contractor submitting an Original Tax Invoice compliant with SARS requirements for Valid Tax Invoice to the Employer for the amount due.
6.10.6	A Retention Money Guarantee is not permitted
6.11	Delete Clause 6.11.
8.4.1.1	Add to the end of Clause 8.4.1.1 the following text: "hereby indemnifies the Employer against any liability in respect of damage or physical loss of property of any person or injury or death of any person due to non-compliance with the Occupational Health and Safety Act (Act 85 of 1993).
8.6.1.1.2	The value of plant and materials supplied by the Employer to be included in the insurance sum is **R0.**
8.6.1.1.3	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum is **15 % (fifteen percent)** of the value of the damage and/or loss.
8.6.1.2	A Coupon Policy for Special Risks Insurance issued by the South African Special Risks Insurance Association is required.
8.6.1.3	The limit of indemnity for liability insurance is **R10 000 000 (Ten million Rand)** for any single claim – the number of claims to be unlimited during the construction and Defects Liability Periods.
8.6.1.4	Ground (lateral) support insurance to cover potential damage to protect critical existing municipal infrastructure to be affected by the Contractor prior to commencing work on site.
8.6.1.5	In addition to the insurances required in terms of General Conditions of Contract Clauses

GCC Clause	Information
	8.6.1.1 to 8.6.1.4 the following insurance is also required: Employer's own surrounding property insurance in an amount of **R10 000 000 (Ten million Rand).**
8.6.1.6	In addition to the insurances required in terms of General Conditions of Contract Clauses 8.6.1.1 to 8.6.1.4 the following insurance is also required: a. Insurance of Construction Plant and Equipment (including tools, offices and other temporary structures and contents) and other things (except those intended for incorporation into the Works) brought onto the site for a sum sufficient to provide for their replacement. b. Insurance in terms of the provisions of the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993. c. Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger Liability Indemnity. d. Where the contract involves manufacturing and/or fabrication of the works or part thereof at premises other than the Site, the Contractor shall satisfy the Employer that all materials and equipment for incorporation in the works are adequately insured during manufacture and/or fabrication. In the event of the Employer having an insurable interest in such works during manufacture or fabrication then such interest shall be noted by endorsement to the Contractor's Policies of Insurance. e. Lateral Support liability insurance
8.6.2	Liability of deductibles At the end of the sub-clause, add the following paragraph: "Except where otherwise provided in the Special Conditions of Contract, the insurance cover effected by the Contractor in terms of this clause shall not carry a first loss amount greater than those set out below: Contract Price First Loss Greater than R 10,000,000 R 30,000
10.3.2	Dispute resolution shall be by Amicable Settlement, failing which, any dispute shall be resolved by way of ad-hoc Adjudication.
10.5.3	The number of Adjudication Board Members to be appointed is one (1).
10.7.1	The determination of disputes shall be by arbitration.

C1.2.1.2 Additions

The additional Conditions of Contract are:

C1.2.1.2.1 Penalties

In addition to GCC clause 5.13, during the Contract Period should the Contractor:

a) Fail to report

- The Employer shall levy a penalty on Contractor, should the latter fail to provide reporting as required in the specification highlighted in the Scope of Work in PS 3.2, PS 6.7 and PS 6.9, with regard to content and frequency, whilst as per the Pricing Data section no payment for work completed shall be processed.
- The penalty value shall be R15,000.00 per report per occasion; and
- If the Contractor fails to complete the latter more than three incidents and should the Employer or his duly authorised representative find that the Contractor is hindering his (the Employer's) deliverables to senior management, he shall reserve the right to:

i. perform the Works internally or through another Contractor; and
ii. deduct additional costs incurred by the Employer from monies owed to the Contractor or from the Contractor's Guarantee. Additional costs incurred by the Employer shall include all claims from Contract affected parties, claims such as but not be limited to claims from customers, any costs associated with the loss of water, and all costs associated with the procurement of an alternative Contractor.
iii. terminate the Contract;

No liability in terms of this clause shall be attached to the Contractor if he can prove to the satisfaction of the Employer that the nature of the failure is due to fire, war, riot, strikes, act of God, lockout, accident or other unforeseen occurrences or circumstances beyond the Contractor's control, provided, however, that in all cases the Contractor has notified the Employer in writing within 24 hours of it first coming to his notice, that delivery shall be delayed or become impossible for the above-mentioned reasons.

b) Fail to pay any labour or SMME

- The Employer shall levy a penalty on Contractor, should the latter fail to provide payment to the any labourer or SMME as required in the specification highlighted in the Scope of Work and specified in the appointment agreements with the Contractor and the labourer or SMME.
- The penalty value shall be R 50,000.00 per report per occasion; and
- If the Contractor fails to complete the latter more than three incidents and should the Employer or his duly authorised representative find that the Contractor is hindering his (the Employer's) deliverables to senior management, he shall reserve the right to:

i) perform the Works internally or through another Contractor; and
ii) deduct additional costs incurred by the Employer from monies owed to the Contractor or from the Contractor's Guarantee. Additional costs incurred by the Employer shall include all claims from Contract affected parties, claims such as but

not be limited to claims from customers, any costs associated with the loss of water, and all costs associated with the procurement of an alternative Contractor.

iii) terminate the Contract;

No liability in terms of this clause shall be attached to the Contractor if he can prove to the satisfaction of the Employer that the nature of the failure is due to fire, war, riot, strikes, act of God, lockout, accident or other unforeseen occurrences or circumstances beyond the Contractor's control, provided, however, that in all cases the Contractor has notified the Employer in writing within 24 hours of it first coming to his notice, that delivery shall be delayed or become impossible for the above-mentioned reasons

c) Failure to meet target participation by local SMME

If the Contractor fails to achieve the monetary value of the target set by the Employer for contract participation by local SMME Contractors in terms of C1.2.1.2.14, the Contractor shall be liable to the Employer for a sum calculated in accordance with the Contract Data and the aforementioned Scope as a penalty for such underachievement.

The penalty for failing to achieve the monetary value of the target set by the Employer for contract participation by Targeted Enterprises and local SMME Contractors in terms of the Scope of Works is 50% of the monetary value by which the achieved monetary value falls short of the target monetary value.

d) Failure to meet the occupational health and safety compliance target

Monthly compliance rating will be calculated for each Contractor as per criteria indicated on the monthly audit form (Volume 3) focusing on or incorporating outcomes of assurance (e.g. monthly audit), operational (e.g. behavioural based safety inspection) assessments and other requirements, as necessary.

Each Contractor is required to maintain a minimum compliance rating of 93% (Ninety Three Percent).

The Employer may impose a penalty of value of R20 000 where the Contractor scores not more than 80% and, or scores more than 80% but less than 93% for two consecutive months.

e) Failure to meet the environmental compliance target

Monthly compliance rating will be calculated for each Contractor as per criteria indicated on the monthly audit form (Volume 3) focusing on or incorporating outcomes of assurance (e.g. monthly audit), operational assessments and other requirements, as necessary.

Each Contractor is required to maintain a minimum compliance rating of 93% (Ninety Three Percent).

The Employer may impose a penalty of value of R20 000 where the Contractor scores not more than 80% and, or scores more than 80% but less than 93% for two consecutive months.

f) Penalties irreversible

If the Contractor fails to achieve the monetary value of the target set by the Employer for contract participation by local SMME Contractors in terms of for Procurement and Particular Specifications in Scope of Works clause PS3.2.3, the Contractor shall be liable to the Employer for a sum calculated in accordance with the Contract Data and the aforementioned Scope of Works as a penalty for such underachievement."

g) Penalties irreversible

The Contractor shall note that all penalties once imposed shall be non-recoverable or reversible, even if the default is remedied.

C1.2.1.2.2 Source of instructions

The Contractor shall neither seek nor accept instructions from any authority external to the Employer's Agent in connection with the performance of his services under this Contract. The Contractor shall refrain from any action which may adversely affect the Employer and shall fulfill his commitments with fullest regard for the interest of the Employer. The Contractor may only take and comply with Employers Health and Safety representative or Environmental representative on matters regarding Health & Safety, as well as Environmental.

C1.2.1.2.3 Officials not to benefit

The Contractor warrants that no official of the Employer has been or shall be admitted by the Contractor to any direct or indirect benefit arising from this Contract or the award thereof. The Contractor agrees that breach of this provision is a breach of the Contract.

C1.2.1.2.4 Prevention of corruption

The Employer shall be entitled to cancel the Contract and to recover from the Contractor the amount of any loss resulting from such cancellation, if the Contractor has offered or given any person any gift or consideration of any kind as an inducement or reward for doing or intending to do any action in relation to the obtaining or the execution of the Contract or any other contract with the Employer or for showing or intending to show favor or disfavor to any person in relation to the Contract or any other contract with the Employer, if the like acts shall have been done by any persons employed by him or acting on his behalf whether with or without the knowledge of the Contractor in relation to this or any other Contract with the Employer.

C1.2.1.2.5 Confidential nature of documents

All maps, drawings, photographs, mosaics, plans, reports, recommendations, estimates, documents and all other data compiled by or received by the Contractor under the Contract shall be the property of the Employer, shall be treated as confidential and shall be delivered only to the Employer's Agent or his duly authorized representative on completion of the Works; their contents shall not be made known by the Contractor to any person other than the personnel of the Contractor performing services under this Contract without the prior written consent of the Employer.

C1.2.1.2.6 Returns of labour, SMME, plant, equipment and material

The Contractor shall provide a return in detail in the form and at such intervals as the Employer's Agent or his duly authorized representative may prescribe showing the supervisory staff and the numbers of the several classes of labour from time to time

employed by the Contractor on the Site and such information respecting constructional plant, equipment and material as the Employer's Agent or his duly authorized representative may require. The supporting documents required for SMMEs include but are not limited to the following:

- A completed and signed sub-contracting agreement between the Contractor and the SMME
- Valid CIPC registration (i.e. CK, COR)
- SA ID copies of owners
- Active CIDB membership: minimum grading 1CE
- Valid CSD compliance status
- Valid EME affidavit
- COIDA certificate
- Company Profile including similar experience and skilled personnel CVs
- Health and Safety Plan
- Proof of Payments

The supporting documents required for local labourers include but are not limited to the following:

- A completed and signed employment contract between the Contractor and labourer
- Certified Copies of IDs
- Monthly Individual proof of payment
- Monthly timesheets
- Training returns
- UIF forms (proof of registration from Labour)

C1.2.1.2.7 Materials and workmanship

All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Employer's Agent's instructions and shall be subjected from time to time to such tests as the Employer's Agent may direct at the place of manufacture or fabrication, or on the Site or at all or any of such places. The Contractor shall provide such assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any materials used and shall supply samples of materials before incorporation in the Works for testing as may be selected and required by the Employer's Agent. All testing equipment and instruments provided by the Contractor shall be used only by the Employer's Agent or by the Contractor in accordance with the instructions of the Employer's Agent.

a) No material not conforming with the Specifications in the Contract shall be used for the Works without prior written approval of the Employer and instruction of the Employer's Agent, provided always that if the use of such material results or may result in increasing the Contract Price, the procedure in GCC clause 6.3 (Variations) shall apply.

C1.2.1.2.8 Examination of the work before covering up

No work shall be covered up or put out of view without the approval of the Employer's Agent or his duly authorize representative and the Contractor shall afford full opportunity for the Employer's Agent or his duly authorize representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The Contractor shall give due notice to the Employer's

Agent whenever any such work or foundations is or are ready or about to be ready for examination.
The Employer's Agent or his duly authorized representative shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

C1.2.1.2.9 Employer's Agent's power to order removal of improper work and materials

The Employer's Agent or his duly authorized representative shall during the progress of the Works have power to order in writing from time to time, and the Contractor shall execute at his cost and expense, the following operations the:

a) removal from the Site within such time or times as may be specified in the order of any materials which in the opinion of the Employer's Agent are not in accordance with the Contract;
b) substitution of proper and suitable materials; and
c) removal and proper re-execution (notwithstanding any previous test thereof or interim payment therefore) of any work which in respect of materials or workmanship is not in the opinion of the Employer's Agent or his duly authorized representative in accordance with the Contract.

C1.2.1.2.10 Default of Contractor in carrying out Employer's Agent's or his duly authorized representative's Instructions

In case of default on the part of the Contractor in carrying out an instruction of the Employer's Agent or his duly authorized representative, the Employer shall be entitled to employ and pay other persons to carry out the same, and all expenses consequent thereon or incidental thereto shall be borne by the Contractor and shall be recoverable from him by the Employer and may be deducted by the Employer from any monies due or which may become due to the Contractor.

C1.2.1.2.11 Date falling on public holiday or weekend

Where under the terms of the Contract any act is to be done or any period is to expire upon a certain day and that day or that period fall on a day of rest or recognized holiday or weekend, the Contract shall have effect as if the act were to be done or the period to expire upon the working day following such day.

C1.2.1.2.12 Ambiguities and inconsistencies

The Employer or the Contractor shall notify the other as soon as either becomes aware of an ambiguity or inconsistency in or between the documents, which are part of this Contract. Governed by the spirit and intention of the Contract, the Employer shall give a binding instruction resolving the ambiguity or inconsistency.

C1.2.1.2.13 False claims by the Contractor

a) Failure, by the Contractor, to demonstrate or present any feature declared during the procurement stage shall constitute grounds for Contract termination or the market related equivalent price discount, if no market related value is available, the Employer shall give a final ruling on the amount. This shall be at the discretion of the Employer based on the implication of such omission. Should the Contractor refuse to accept the Employer's price, the Contract shall be terminated.

b) Any false claims by the Contractor or his staff (with or without his knowledge), based on Works to be performed or completed per site stage shall constitute grounds for Contract termination and result in blacklisting on the Employer's database.

The Contractor shall note that any of the above shall constitute non-performance on the part of the Contractor, further resulting in him forfeiting his full Contract Guarantee.

C1.2.1.2.14 Special Conditions

The successful Tenderer must subcontract a minimum of 19**%** of the value of this contract to an entity(s) described below. The subcontractor/s chosen for this purpose must be registered on National Treasury's Central Supplier Database (CSD), be based in the ward (or region where indicated by the Employer's Agent) and must be from one of the following designated groups.

- An EME or QSE which is at least 51% black owned by black people;
- An EME of QSE which is at least 51% owned by black people who are youth;
- An EME of QSE which is at least 51% owned by people who are women;
- an EME or QSE which is at least 51% owned by black people with disabilities;
- an EME or QSE which is 51% owned by black people living in rural or underdeveloped areas or townships;
- a cooperative which is at least 51% owned by black people;
- an EME or QSE which is at least 51% owned by black people who are military veteran;
- an EME or QSE.

1. Subcontractors must be chosen from National Treasury's Central Supplier Database which can be accessed on National Treasury's website.
2. A subcontracting agreement between main contractor and the subcontractor shall be submitted to JW upon appointment and must include minimum information below.
    - Name of sub-contractor and BBBEE status
    - Area and location of project
    - Scope of work issued to the sub-contractor
    - Value of the work issued including P&G's (auditable)
    - Assistance provided to the sub-contractor e.g. acquisition of materials, machinery and tools
    - Skills transfer plan

3. In complying with this condition, the following shall be adhered with:
    - The Contractor shall develop a Subcontracting Plan that sets out the details of the proposed Subcontracting arrangements including, but not limited to, competitive bidding process to be used for the appointment of SMME's, scope of work to be allocated, criteria for the selection of Subcontractor(s), Subcontractor agreements, cost of the work to be Subcontracted, etc.
    - The Subcontracting Plan shall be issued to the Employer's Agent for approval, prior to the engagement of any Subcontractor(s) by the Contractor. The activities, time periods, linkages, etc. associated with the development and approval of the Subcontracting Plan shall be included in the Project Programme, which Programme is subject to the approval of the Employer's Agent.
    - In the event that a rate supplied by the Contractor for a specific BoQ work item is not sufficient to cover Subcontractor costs/rates for that specific item, the Contractor shall provide a detailed rate breakdown for that specific BoQ item (and each and every subsequent BoQ work item where the rate is not sufficient to cover Subcontractor cost); and shall indicate costs (amongst others) for labour, material, handling, mark-ups, etc. to prove that the rate that was submitted during tender stage was in fact market related; and in balance with other rates that were submitted for work items that will not be undertaken by Subcontractors.

4. A Subcontracting agreement between the Main Contractor and the Subcontractor shall be submitted to JW upon appointment and must include the following minimum information:
    - Name of Subcontractor and BBBEE status
    - Subcontractor *domicilium* and registered address of business, as well as status of compliance with all applicable legal requirements.
    - Area and location of project
    - Scope of Work issued to the Subcontractor
    - Value of the Work issued including P&G's (this information must be submitted in a format that is readily auditable).
    - Assistance provided/to be provided to the Subcontractor by the Contractor, e.g. acquisition of materials, machinery, tools, etc.
    - Indicate the remuneration rate of all local labourers (the latest Gazetted labour rates)
    - A Skills Transfer Plan which will indicate, amongst others, the proposed skills that will be transferred to the Subcontractor, individuals that will be identified for skills transfer, the amount that will be spent by the Contractor on skills transfer, evidence that will be produced by the Contractor (such as training certificates, training registers, etc.), etc.
    - A specific provision that enables the Contractor to pay the Subcontractor's suppliers, labour (skilled, local, etc.) or any other service provider of the Subcontractor, should the Subcontractor fail to do so. This provision shall include (but not be limited to) the following conditions/proviso's:
        - Invoices that are due for payment from suppliers and the like must be invoices that have been approved for payment, and be based on work or services that have actually been completed or delivered. Payments that are due to labour will be based on approved timesheets.
        - The Contractor is to ensure that any invoice presented for payment is indeed an approved invoice, and that the necessary work or services have been delivered or completed. The approved invoice shall be settled (paid) by the Contractor (on behalf of the Subcontractor) by the due date for payment.
        - The Contractor will be entitled to deduct payments made to any third party, on behalf of the Subcontractor, from subsequent payments that may become due to the Subcontractor.
        - The Contractor will be entitled to bill the Subcontractor a mark-up on the payments made on behalf of the sub-contractor. The mark-up shall not be more than 10% (ten percent) of the amount actually paid (i.e. the amount (excluding VAT) reflected on the invoice that has been settled). The mark-up amount shall be deducted from subsequent payments that may become due to the Subcontractor.
        - Proof of any such payments made on behalf of the Subcontractor shall be issued to the Employer's Agent, on request, with all necessary supporting information that the Employer's Agent may request
        - Payments made on behalf of the Subcontractor are not subject to the Contractor first being paid by the Employer. Therefore, the Contractor shall pay approved invoices, on behalf of the Subcontractor, irrespective of whether the Contractor has first been paid by the Employer. The Contractor will be entitled to levy interest on all payments that have been made in this regard, in accordance with the necessary interest payment provisions contained in the General and Special Conditions of Contract.

5. The successful Contractor shall submit periodic SMME/Subcontractor reports to the Employer's

Agent as follows:

- Status of progress against the Subcontracting Plan (described above), to the approval of the Employer's Agent
- Subcontractor *domicilium* and registered address of business, as well as ongoing status of compliance with all applicable legal requirements.
- Name of Subcontractor and BBBEE status
- Area and location of project
- Scope of work issued to the Subcontractor
- Value of the work issued (this information must be submitted in a format that is readily auditable)
- Monthly payments made to the subcontractor (this information must be submitted in a format that is readily auditable)
- Assistance provided to the Subcontractor e.g. advance payments, acquisition of materials, machinery, tools, etc.
- Performance of the Subcontractor, with evidence to support this performance assessment.

6. Upon completion of the project, the Contractor is required to provide a final report to JW on skills transferred to / acquired by the Subcontractor(s) engaged on the Project, description and value of work performed, as well as their overall performance.

7. The Contractor shall also indicate whether the experience gained by the Subcontractor is sufficient to assist the Subcontractor to improve their CIDB grading, with full details of supporting information.

C1.2.1.2.15 Competent Employees

Competent Employees	Qualifications	Experience
Contracts Manager	Minimum Qualifications of **Contract Manager** Bachelors' Degree or Bachelor of Technology (Civil Engineering) or higher AND ECSA Professional Registration (Pr. Eng. / Pr. Tech Eng) or SACPCMP Professional Registration (PrCPM / PrCM). The date of registration of Contract Manager will not impact post qualification number of years	More than 5 years experience as a construction contracts manager after obtaining minimum qualification.
Construction Manager	Minimum Qualifications of **Construction Manager** National Diploma in Civil Engineering or higher. AND Registered as a Candidate or Professional Registration with ECSA or Candidate SACPCMP or Professional Registration (PrCPM / PrCM).	Three or more completed water steel welded pipeline projects with valves, chambers and a minimum pipe diameter of 700mm as a construction manager AND and one completed project with culvert jacking beneath a national or provincial road with minimum dimensions of 3m x 2.5m and 50m in length.
Safety Officer	Minimum Qualifications of **Safety Officer.** **Minimum Qualification** / **EXP**: National Diploma Safety (NQF 6) / 2 years **AND** Registered with SACPCMP in the **"Construction Health and Safety"** Sector **Or**	

	<table><tr><th>Minimum Qualification</th><th>EXP</th></tr><tr><td>Safety Officers Course (NQF 5)</td><td>3 years</td></tr></table> **AND** Registered with SACPCMP in the **"Construction Health and Safety"** Sector **Or** <table><tr><th>Minimum Qualification</th><th>EXP</th></tr><tr><td>SAMTRAC / SHEOMTRAC/ SHEMTRAC / MESHTRAC /NEBOSH</td><td>4yrs</td></tr></table> **AND** Registered with SACPCMP in the "Construction Health and Safety" Sector. However, the time of registration of Safety Officer will not impact post qualification number of years.
Environmental Officer	Minimum Qualifications of **Environmental Officer.** <table><tr><th>Minimum Qualification</th><th>EXP</th></tr><tr><td>BA / BSc Environmental Management (NQF 7)</td><td>2 years</td></tr></table> **Or** <table><tr><th>Minimum Qualification</th><th>EXP</th></tr><tr><td>National Diploma Environmental Management (NQF 6)</td><td>3 years</td></tr></table>

C1.2.1.2.16 Continuation of Works During Dispute Resolution

Notwithstanding any dispute or disagreement between the Employer and the Contractor, the Contractor shall continue to perform the Works as scheduled. Both parties agree that the resolution of any disputes shall proceed in parallel with the ongoing performance of the Works, ensuring that the project timeline is maintained without interruption.

C1.2.2 Part 2: data provided by the Contractor

GCC Clause	Information
Clause 1.1.9	The name of the Contractor is ..... The Contact person is.....
Clause 1.2.1.2	The address of the Contractor is: Physical …….. Postal …….. Tel: …… …….. …….. Fax: …… …….. …….. …….. …….. …….. …….. Email: …….. …….. …….. ……..…….. …….. …….. ……
Clause 6.8.3	The variation in cost of special materials is Type Unit Rate ***NOT APPLICABLE***

Johannesburg Water (SOC) Ltd

Johannesburg Water

CONTRACT NO: JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 1

PART 1.3 FORMS AND SECURITIES

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C1.3 FORMS AND SECURITIES

FORMS FOR COMPLETION BY THE CONTRACTOR

THE FOLLOWING FORMS ARE TO BE COMPLETED BY THE CONTRACTOR AFTER THE TENDER HAS BEEN AWARDED TO THE SUCCESSFUL TENDERER

a) Form of Guarantee
b) Blasting Indemnity
c) Agreement in terms of the Occupational Health and Safety Act
d) Occupational Health And Safety Indemnity Undertaking

The forms will be completed by the Contractor who will be instructed to do so in the Form of Acceptance. The completed forms will become part of the Contract.

The Form of Guarantee is a pro forma document. The Contractor will provide an original document, from a financial institution, with the same text within the time stated in the Contract Data. Only a Bank or approved Insurance Company or Guarantee Corporation is acceptable as Guarantor.

C1.3.1 Form of Guarantee

TO BE PRINTED ON THE OFFICIAL LETTERHEAD 0F THE GUARANTOR.

PERFORMANCE GUARANTEE

For use with the General Conditions of Contract for Construction Works, ……. Edition, ….

GUARANTEE REFERENCE NUMBER: [***]

Whereas [insert the full name of the Employer], registration number: [insert registration number], of [insert full physical address] (the "Employer") has awarded a contract for [insert a detailed description of the contract], under contract number: [insert details] (the "Contract"), to [insert full names of the Contractor], registration number [insert details], of [insert full physical address] (the "Contractor").

And whereas the Contract requires the Contractor to provide to the Employer an on-demand performance guarantee for the due and proper performance by the Contractor of its obligations in terms of the Contract.

Now therefore:

[insert full names of the Guarantor], registration number **[Insert details],** of **[insert the full physical address]** (the "**Guarantor**"), duly represented by the undersigned: **[insert the full names of the signatory]**, and **[insert the full names of the signatory]**, acting herein in their respective capacities as: **[insert full title]** and **[insert full title]** respectively, of the Guarantor, and being duly authorized to sign this on demand performance guarantee (this "**Guarantee**") and to incur obligations in relation thereto, in the name, and on behalf, of the Guarantor under, and in terms of, a Resolution of the Board of Directors or other written authority of the Guarantor, hereby irrevocably and unconditionally guarantees and undertakes:

1. To pay the Employer the sum or sums not exceeding the following aggregate amount: R **[insert the amount]** (the "**Guaranteed Amount**") upon receipt of the documents identified in clauses 1.1 to 1.3 below

    1.1. A copy of a first written demand issued by the Employer to the Contractor stating that payment of a sum certified by the Employer's Agent in an Interim or Final Payment Certificate has not been made in terms of the Contract and failing such payment within seven (7) calendar days, the Employer intends to call upon the Guarantor to make payment in terms of 1.2;

    1.2. A first written demand issued by the Employer to the Guarantor e-mailed to ……with a copy to the Contractor stating that a period of seven (7) days has elapsed since the first written demand in terms of 1.1 above and the sum certified has still not been paid;

    1.3. A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum.

2. To pay to the Employer the Guaranteed Amount or the full outstanding balance upon receipt of a first written demand from the Employer to the Guarantor emailed to …… calling up this Performance Guarantee, such demand stating that:

    2.1. The Contract has been terminated due to the Contractor's default and that this Performance Guarantee is called up in terms of 2; or

2.2. A provisional or final sequestration or liquidation court order has been granted against the Contractor and that the Performance Guarantee is called up in terms of 2; and

2.3. The aforesaid written demand is accompanied by a copy of the notice of termination and/or the provisional/final sequestration and/or the provisional liquidation court order.

3. To pay to the Employer on demand any sum or sums not exceeding the Guaranteed Amount on presentation of a written demand signed by the Employer (the "**Demand**"), supported by a written statement signed by the Employer certifying that the Contractor, in the opinion of the Employer as at the date of issue of such Demand, is in breach of its obligations under the Contract or that a defect had occurred following the performance by the Contractor of its obligations under the Contract, and without being required to prove or set out the nature of any such breach or defect.

4. Payment by the Guarantor in terms of 1 to 3 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.

5. The Guarantor hereby acknowledges that:

5.1. Any reference in this Performance Guarantee to the Contract is made for the purpose of convenience and shall not be construed as any intention whatsoever to create an accessory obligation or any intention whatsoever to create a suretyship;

5.2. Its obligation under this Performance Guarantee is restricted to the payment of money.

6. The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer may deem fit and the Guarantor shall not have the right to claim his release from this Performance Guarantee on account of any conduct alleged to be prejudicial to the Guarantor.

7. Neither the failure of the Employer to enforce strict or substantial compliance by the Contractor with its obligations under the Contract nor any act, conduct or omission by the Employer prejudicial to the interests of the Guarantor will discharge the Guarantor from liability under this Guarantee.

8. This Performance Guarantee, with the required demand notices in terms of 1 to 3, shall be regarded as a liquid document for the purpose of obtaining a court order.

9. This Performance Guarantee is neither negotiable nor transferable.

10. The Guarantor's period of liability shall be from and including the date of issue of this Performance Guarantee and up to and including the date on which the Certificate of Completion of the Works has been issued or payment in full of the Guaranteed Sum, whichever occurs first. The Employer's Agent and/or the Employer shall advise the Guarantor in writing of the date on which the Certificate of Completion of the Works has been issued.

11. The Guarantor chooses the physical address [**insert the full physical address]** care of [**insert the full names]**, as well as the e-mail address ……., for the service of all notices for all purposes in connection herewith.

12. This Guarantor is governed by the laws of the Republic of South Africa and any dispute arising hereunder shall be subject to the jurisdiction of the South African courts. In respect of such proceedings, each of the Parties specifically consents to the non-exclusive jurisdiction of the High Court of South Africa (Gauteng Local Division, Johannesburg).

Signed at **……** for and on behalf of **……..**

Guarantor's signatory (1)

Name: ……

Designation: ……..… …….

Guarantor's signatory (2)

Name: ……..

Designation: ……..…… ……

C1.3.2 Blasting Indemnity

Given by _____

*Company Registration No. _____

Address _____

a *Company incorporated with limited liability according to the company laws of the Republic of South Africa, *Partnership, *Close Corporation, *Public Company (hereinafter called the Contractor), represented herein by _____ in his capacity as the Contractor's

_____ duly authorised hereto by a resolution of the Contractor dated

_____ a certified copy of which resolution is attached to this Indemnity.

WHEREAS the Contractor has entered into a Contract with the Johannesburg Water (SOC) Ltd (hereinafter called the Employer) for,

_____
and the Company requires this Indemnity from the Contractor

NOW THEREFORE THIS DEED WITNESSETH that the Contractor does hereby indemnify and hold harmless the Company in respect of all loss or damage that may be incurred or sustained by the Employer by reason of or in any way arising out of or caused by blasting operations that may be carried out by the Contractor in connection with the aforementioned Contract and also in respect of all claims that may be made against the Employer in consequence of such blasting operations, by reason of or in any way arising out of any accidents or damage to persons, life or properly or any other cause whatsoever, and also in respect of all legal or other expenses that may be incurred by the Employer in examining, resisting or settling any such claims; for the due performance of which the Contractor binds itself according to law.

THUS DONE AND SIGNED for and on behalf of the Contractor at _____ on the

_____ day of _____ 20____ in the presence of the subscribing

witnesses.

As witnesses

1. _____

_____
Signature

2. _____

Duly authorised to sign on behalf of _____

Address _____

_____

_____

C1.3.3 Health and Safety Contract Between Employer and Contractor In Terms of Section 37(2) Of The Occupational Health and Safety Act No 85 Of 1993

Written agreement between Johannesburg Water ((Proprietary) Limited (hereinafter referred to as "the

Employer) and _____ (hereinafter referred to as "the mandatary") as envisaged by Section 37(2) of the Occupational Health and Safety Act, No. 85, of 1993 as amended.

I _____ representing

_____ (mandatary) do hereby acknowledge that

_____ (mandatary) is an employer in its own right and shall be regarded as the employer for purposes of the contract work specified in the body of the principal agreement with duties as prescribed in the Occupational Health and Safety Act, No. 85 of 1993 as amended so as to ensure that all work will be performed or machinery and plant used in accordance with the provisions of the said Act. I furthermore agree to comply with the requirements of the Employer as contained in the Occupational Health and Safety Specification included with the principal agreement and to liaise with the employer should I, for whatever reason, be unable to perform in terms of this agreement.

Signed this _____ day of _____ at _____

Signature on behalf of mandatary _____

Signature on behalf of Employer _____

Compensation Fund Registration No. of mandatary _____

Good Standing Certificate : ☐ yes ☐ no (tick one box)

C1.3.4 Health and Safety Contract: General Information

1. The Occupational Health and Safety Act comprises Sections 1 to 50 and all un-repealed regulations promulgated in terms of the former Machinery and Occupational Safety Act No 6 of 1983 as amended, as well as other regulations which may be promulgated in terms of the OHS Act.

2. 'Mandatary' is defined as including an agent, a contractor or a subcontractor for work, but without derogating from his status in his own right as an employer or user of plant and machinery

3. Section 37 of the Occupational Health and Safety Act potentially punishes employers (principals) for the unlawful acts or omissions of mandataries (contractors) save where a written agreement between the parties has been concluded containing arrangements and procedures to ensure compliance with the said Aid by the mandatary.

4. All documents attached or referred to in the above agreement from an integral part of the agreement.

5. To perform in terms of this agreement mandataries must be familiar with the relevant provisions of the Act.

6. Mandataries who utilise the services of their own mandataries (subcontractors) are advised to conclude a similar written agreement.

7. Be advised that this agreement places the onus on the mandatary to contact the Employer in the event of inability to perform as per this agreement. The Employer, however, reserves the right to unilaterally take any steps as may be necessary to enforce this agreement.

8. The contractor shall be responsible for the full and proper implementation of the terms and provisions of the Act and its regulations in the area in which the work is to be undertaken by the Contractor.

9. The Contractor shall be responsible for the well-being, in relation to health and safety, of all persons coming upon or into such area in accordance with that legislation, including the implementation of any directives issued by management of the Employer in this respect.

10. The work to be done is _____

11. The area in which the work is to be conducted is _____

12. The Contractor shall familiarise himself with such area and all risks existing thereon and undertakes to report to the representative of the Employer any hazard or risk to health and safety which arises during the contract work in the area concerned and over which the Contractor may have no control. All necessary and appropriate safety / health equipment shall be issued by the Contractor to all persons working on or coming into the area.

C1.3.4.1 Occupational Health and Safety Indemnity Undertaking

I, the undersigned _____

in my capacity as _____

of the firm _____

1.0 hereby undertake to ensure that I/my firm and/or employees and/or subcontractors and/or his employees -

1.1 comply strictly with the provisions of the Occupational Health and Safety Act of 1993 (as amended) and/or the regulations promulgated in terms thereof, with specific reference to section 37(2) of the said act, as well as any relevant legislation, in the course of the performance/execution of any service and/or work in, to or on any of the Employer's buildings, construction sites and/or premises;

1.2 ensure that consultants and/or visitors comply with any instructions and measures relating to occupational health and safety, as prescribed by the Employer; and

1.3 comply strictly with the statutorily prescribed work systems, operational equipment, machinery and occupational health and safety conditions;

2.0 and as an independent employer and contractor, hereby indemnify, in terms of the above undertakings, the Employer -

2.1 in respect of any costs that I/my firm and/or employees and/or subcontractors and their employees may incur of necessity in compliance with the above undertakings; and

2.2 against any claims that may be instituted against the Employer and/or any liability that the Employer may incur, whether instituted and/or caused by me/my firm's employees, agents, consultants, subcontractors and/or their employees and visitors or the Employer's clients or neighbours in respect of any incidents related to my/my firm's activities and as a result of which the occupational health and safety of the persons involved have been detrimentally affected; and

2.3 against similar claims that I, managers or directors of my firm may have against the Employer and any damages for which I, managers or directors of my firm hold the Employer liable.

3.0 My firm's compensation commissioner number is _____ and I confirm that my firm and its subcontractors' fees have been paid up and obligations in respect of the compensation commissioner have been complied with and further that I shall furnish proof thereof in writing on request.

4.0 I hereby confirm that I have the authority to sign this indemnity undertaking and that the Employer is not obliged to confirm such confirmation.

Signed at _____ This _____ day

of _____ _____

_____ _____

Signature Capacity

As witnesses:

1 _____

2 _____

Johannesburg Water SOC Ltd

Johannesburg Water

CONTRACT NO. JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 1

PART 2: PRICING DATA

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C2 PRICING DATA

C2.1 PRICING INSTRUCTIONS

C2.1.1 GENERAL PREAMBLE TO THE BILL OF QUANTITIES

a) The Contract is to be constructed using labour intensive methods. In exceptional cases where the use of plant is required, the Contractor must motivate and obtain written permission before the work is undertaken with plant. Payment will not be made for unauthorized use of plant to carry out work.

b) All items in the Bill of Quantities, except where otherwise specified in Clause 8 of a Standardised Specification or in the Project Specification, shall be measured and shall cover operations as recommended in the standard system of measurement of civil engineering quantities, published under the title “Civil Engineering Quantities”, by the South African Institution of Civil Engineering.

c) The basis and principles of measurement and payment are described in this section (Pricing Instructions) and Clause 8 of each of the Standardised Specifications for Civil Engineering Construction. The applicable SANS 1200 Standardised Specifications are listed in the Scope of Work, Portion 1: Project Specification. Portion 2: comprises the Technical specifications for the works of each discipline in this contract.

d) Descriptions in the Bill of Quantities are abbreviated and comply generally with those in the Standardised Specifications. Clause 8 of each Standardised Specification, read together with the relevant clauses of the Scope of Work, set out what ancillary or associated activities are included in the rates for the operations specified. Should any requirements of the measurement and payment clause of the applicable Standardised Specification or the Scope of Work, conflict with the terms of the Bill of Quantities, the requirements of the Standardised Specification or Scope of Work, as applicable, shall prevail.

e) The clauses in a specification in which further information regarding the Schedule item may be found are listed in the “Payment Refers” column in the Schedule. The reference clauses indicated are not necessarily the only sources of information in respect of listed items. Further information and specifications may be found elsewhere in the Contract Documents. Standardised Specifications are identified by the letter or letters which follow SANS in the SANS 1200 series of specifications, e.g. G for SANS 1200G.

f) Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.

g) The quantities set out in the Bill of Quantities are the estimated quantities of the Contract Works, but the Contractor shall be required to undertake whatever quantities may be directed by the Engineer from time to time. The Contract Price for the completed Works shall be computed from the actual quantities of work done, valued at the relevant unit rates and/or prices.

h) The rates and/or prices to be inserted in the Bill of Quantities are to be the full inclusive prices for the work described under the several items. Such rates and/or prices shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the documents, as well as overhead charges and profit. Reasonable charges shall be inserted as these shall be used as a basis for assessment of payment for additional work that may have to be carried out.

i) A price or rate is to be entered against each item in the bill of Quantities, whether the quantities are stated or not. An item against which no price is entered will be considered to be covered by the other prices or rates in the Schedule. The above excludes items of the Bill of Quantities that have rates and amounts scratched out by the Employer.

j) The units of measurement described in the Bill of Quantities are metric units. Alternatives used are as follows :

mm	=	millimetre	h	=	hour
m	=	metre	kg	=	kilogram
km	=	kilometre	t	=	ton (1000kg)
m^2	=	square metre	No.	=	number
m^2 pass	=	square metre pass	sum	=	lump sum
ha	=	hectare	MN	=	meganewton
m^3	=	cubic metre	MN.m	=	meganewtom-metre
m^3km	=	cubic metre-kilometre	P Csum	=	Prime Cost sum
l	=	litre	Prov sum	=	Provisional sum
kl	=	kilolitre	%	=	percent
MPa	=	megapascal	kW	=	kilowatt

k) For the purpose of this Bill of Quantities, where applicable, the following words shall have the meanings hereby assigned to them:

Unit : The unit of measurement for each item of work as defined in the SANS Standard Specification for South African National Standards.
Quantity : The number of units of work for each item.
Rate : The agreed payment per unit of measurement.
Amount : The product of the quantity and the agreed rate for an item.
Lump sum: An agreed amount for an item, the extent of which is described in the Bills of Quantities, but the quantity of work of which is not measured in any units.

l) Arithmetical errors in the Bill of Quantities shall be corrected in accordance with Clause C3.9 of the Conditions of Tender. Should there be any discrepancy between rates and/or prices written in the Assessment Schedule and the Bill of Quantities, the latter shall govern.

m) The Bill of Quantities shall be completed by hand **in INK or TYPED.** Tenderers are permitted to complete and submit the electronic Bill of Quantities (BOQ) instead of filling out the BOQ in the tender document. The original pages of the tender document should not be removed. The electronic version may be submitted as an annexure or inserted as additional pages within the tender document. Tenderers are not permitted to alter the document by amending the descriptions and / or quantities specified in the BOQ. Alterations by document by amending the descriptions and / or quantities specified in the BOQ will result in disqualification.

C2.1.2 Special payment conditions

This clause shall be read in conjunction with the 'Penalties' clause(s). Where the penalty clause shall always receive precedence over this clause, should it be found that duplicative financial corrective measures exists.

C2.1.2.1 Provided previously

The Contractor shall not re-execute works under this Contract where he has successfully executed works for the Employer under a previous contract(s) that comply with the requirements of this Contract. However, where applicable the Contractor shall:
a) clearly state this in his qualifications; and

b) still provide the associated rates and prices in the schedule in the associated line item, but not calculate an associated amount.

The Employer shall at his sole discretion decide to re-execute such works.

C2.1.2.2 Security

The Contractor shall have been deemed to have included all security related costs in the Provisional and General item rates, including allowing for minimum 60% (high risk areas) of the sites requiring security provision for the Employer and Engineer representative(s).

C2.1.2.3 Materials and equipment

The Employer shall not provide any works material and equipment, as this shall be provided by the Contractor and deemed to have been included in his provided activity rates or prices.

C2.1.2.4 Permits and way-leaves

All associated costs to obtain permits and way-leaves as required for the execution of the works, where such affect other services, shall be deemed to have been included in the scheduled rates for SANS 1200A or SANS 1200AA or SANS 1200AB where pricing provision for such items have been allowed for in the pricing schedules, alternatively it shall be deemed to be included in the various scheduled activity rates or prices provided by the Contractor.

C2.1.2.5 Confined space

The Contractor shall note that work activities shall be executed within confined spaces and it shall be deemed that allowance has been made in all activity pricing.

C2.1.2.6 Payment ONLY for works completed

The Contractor shall note that payment shall only be made for Works activities successfully (delivering the end result) executed, complying with the quality requirements and provided to the Engineer or his duly authorised representative.

C2.1.3 Health and safety

The principal Contractor's health and safety plan has to follow the framework as laid out in the HEALTH AND SAFETY SPECIFICATION AND ENVIRONMENTAL MANAGEMENT PLAN, as a minimum.

No payment shall be applicable where equipment is not provided and services are not rendered in terms of the approved Health and Safety Plan. Additionally, the Contractor shall also be penalised in terms of Clause (30) of the Occupational Health and Safety Act 183 (1993), Construction Regulations (2014).

C2.1.3.1 Compilation of health and safety plan

Unit: Sum

The rate shall include the complete cost for the provision of resources (human and equipment), communication, transportation and travelling, documentation of activities and reporting activities required to compile a Health and Safety Plan as per the Health and Safety Specifications contained in Volume 2, and approval of such plan thereof. Remuneration shall be a lump sum.

C2.1.3.2 Implementation of health and safety plan

Unit: Sum

The rate shall include the complete cost for the provision of resources (human and equipment), communication, transportation and travelling, documentation of activities and reporting activities required to fully comply with the implementation and maintenance of the Health and Safety Plan. Remuneration shall be on a monthly basis for services rendered, by dividing the total sum tendered by the construction duration.

Safety officer

Unit: Sum

The rate shall include the wages and salary that is to be paid to the safety officer/s, whose responsibility it is to ensure that all activities required fully comply with the Health and Safety Plan as per the Health and Safety Specifications contained in Volume 3 for the duration of the Contract. The rate shall be on a monthly basis for services rendered, by dividing the total sum tendered by the construction duration.

NOTE: The Contractor shall clearly state the number of Health and Safety officers in the provided space in the Bill of Quantities that he has allowed for in his price. Where no number is provided the Employer shall assume that adequate provision, minimum one (1) per site, has been made to implement the provided Health and Safety Plan successfully.

C2.1.4 EMP Implementation and Maintenance

Unit: Sum

The rate shall include the complete cost for the provision of resources (human and equipment), communication, transportation and travelling, documentation of activities and reporting activities required to fully comply with the implementation and maintenance of the EMP contained in Volume 2 for the duration of the Contract. Remuneration shall be on a monthly basis for services rendered, by dividing the total sum tendered by the construction duration.

No payment shall be applicable where equipment is not provided and services are not rendered in terms of the approved EMP.

C2.1.5 SMME Portion of the Works

A particular portion of the works has been allocated for completion by an appointed SMME, as per the Scope of Works. These items have the Rate and Amount Column crossed out. These items must not be priced by the Contractor. An indicative provisional sum for all the SMME items has been allowed for in the Preliminary and General items. The Contractor will identify additional SMME scope where the provisional sum amounts to a percentage less than the set target participation by local SMMEs.

The Contractor shall retain liability and responsibility for the management, scheduling, and quality control of all works performed by the subcontractors. In line with the approved subcontracting plan, the Contractor will procure local subcontractors to implement SMME scope.

The Contractor will be expected to conduct a competitive process to recommend a Subcontractor or Subcontractors to Johannesburg Water. Johannesburg Water will then evaluate all rates provided by the Subcontractor for fairness. Johannesburg Water will then either a) approve the appointment of the Sub-Contractor or Subcontractors or b) enter into negotiations with the Main Contractor and sub-contractor / s or c) request that the Contractor recommend a different sub-contractor.

Further an allowance has been made for the contractor to complete the following tasks:
The Contractor shall ensure that the Subcontractor(s) complies with the paying all amounts due in respect of his employees and himself in terms of all relevant legislation and regulations including, but not confined to, the

- Income Tax Act, the
- Compensation for Occupational Injuries and Diseases Act,
- Unemployment Insurance Act,
- Basic Conditions of Employment Act
- Monitoring of the Quality of Work completed by the Sub-contractor/SMME
- Skills transfer during the execution of the project
- Compliance with all aspects of the Scope of Work
- Assistance with sourcing of applicable material in line with the technical data sheets

C2.1.6 RECOMMENDED LABOUR INTENSIVE TASKS

Construction Activities

ACTIVITY	TOOLS	TASK
Bush clearing	Axe, saw, rope	Medium dense bush (4 to 7 bushes per 100 m^2) 350 m^2/md Dense bush (10 to 15 bushes per 100 m^2) 200 m^2/md Very dense bush (20 to 30 bushes per 100 m^2) 100 m^2/md
Grass clearing	Slasher, spade, hoe, fork, rake.	Dense grass 85 m^2/md
Stripping ground cover and grubbing out roots, haul to nearby dump and spread	Pick, shovel, fork, rake	Light vegetation, dig to 50 mm deep 150 m^2/md Medium vegetation, dig to 100 mm deep 75 m^2/md Heavy vegetation, dig to 150 mm deep 40 m^2/md
Grubbing out roots to 250 mm deep	Pick, shovel, fork, rake	Dig in soft ground to remove roots 42 m^2/md
Destumping (removal of stumps and large roots)	Pick, shovel, axe	Medium dense bush 60 m^2/md
Removal of bush and tree cuttings	Bush hook, rope, axe, saw	Cut, bundle and load branches, tree trunk pieces, other vegetation 8 m^3/md
Boulder removal	Crowbar	Daily paid
Excavation (measured in place)		Throwing distance: up to 4 m / 4 to 6 m
Loose soil	Shovel	5 to 6 m^3/md / 4.5 to 5 m^3/md
Sticky soil	Spade, fork, forked hoe	2 to 3 m^3/md / 1.5 to 2 m^3/md
Firm soil	Pick, shovel, spade, hoe	3 to 4.5 m^3/md / 2.5 to 4 m^3/md
Hard stony gravel	Pick, shovel, crowbar	1.5 to 2 m^3/md / 1 to 1.5 m^3/md
Loading (measured loose) into:	Shovel	Loose soil or gravel:
Wheelbarrow		12 to 15 m^3/md
Trailer		7 to 10 m^3/md
Truck		4 to 6 m^3/md

Wheel-barrow haul (measured loose; haul and unload only)	Wheelbarrow (Note production increases 30% for good haul route and decreases 30% for poor haul route)	Equivalent haul distance = length + 10(rise + fall) 20 m 40 60 80 100 120 140 160 180 200	Production in loose m3/md over average haul route 4.44 3.16 2.44 2.00 1.70 1.44 1.28 1.15 1.02 0.95		
Levelling roadbed (measured loose)	Shovel, spreader	60 m^2/md			
Picking loose roadbed (bank m^3)	Pick, shovel, fork	40 m^2/md			
Spreading loose material (loose m^3)	Shovel, spreader, hoe	Soil 12 loose m^3/md Gravel 10 loose m^3/md			
Watering, mixing, spreading and levelling	Shovel, spreader, hoe, string-lines, water bowser	Sandy soil 4.5 m^3/md Gravel 3 m^3/md (measured tight after compaction)			
Compaction and re-levelling	Roller, string lines, straightedge, shovel, spreader.	Depends upon chosen roller (see below)			
Compaction by pedestrian-controlled double drum vibro-roller	"Stampede" rollers: R75/50 S R90/55 S	Mass kg 980 1 350	Passes 5 4	Layer 100 mm 100 mm	Output 8 m^3/h 13 m^3/h (tight)
Loosen material in trench with pneumatic tools	Compressor, pneumatic tools, team of 4 people	Intermediate 19 m^3 for team Rock 12 m^3 for team			
Screen bedding material	Sieve, shovel	7 m^3 loose /md			
Offload flat-bed truck or trailer	Shovel	15 m^3 loose /md			
Trench backfill, hand compaction	Shovel, spreader, hand-stamper, watering can	Backfill, compact, clean-up and load spoil 4.5 m^3/md			
Collecting loose stone	Gloves, wheelbarrows	Up to 20 m 2.5 m^3/md 20 to 50 m 2.0 m^3/md			
Quarrying, prying out cracked rock	Crowbar, gloves, sledgehammer.	Up to 20 m 0.5 to 1 m^3/md			
Rock crushing	New Dawn Engineering hand-turned rock crusher, shovel	0.25 m^3/md (depends on size of feed-stock and size of product)			
Backfill trench and compact	Shovel, watering can, hand stamper	3.0 m^3/md			
Lay kerbing on level base	Shovel, rubber mallet, string-line, trowel, wheelbarrow	Straight 6.5 to 10.0 m/md Curved 2.0 to 5.0 m/md			

Stone pitching: Plain stone pitching Grouted stone pitching Wired and grouted stone pitching	Club hammer, gloves, string-line, shovel, wheelbarrow, stiff broom, pliers, short crowbar	10 to 15 m^2/md, 200 mm thick 6 to 10 m^2/md, 200 mm thick 3 to 5 m^2/md, 200 mm thick
Block paving: placing bedding sand, laying blocks, compacting, joint filling, clean up	Shovel, screed rails and beam, rubber mallet, plate compactor, bass broom, wheelbarrow, gloves	16 to 20 m^2/md
Stormwater drainage pipes: trimming, bedding, laying, backfilling, compaction	Shovel, rake, boning rods, hand stamper, watering can, rope and ground anchors	450 mm dia concrete: 1.2 m/md (needs team of 10) 600 mm dia concrete: 1.0 m/md (needs team of 10) 450 mm dia plastic: 3.5 m/md (needs team of 5)
Concrete base slab: batch, mix, transport, pour and finish off	Batching boxes, wheelbarrow, shovel, screed beam, wood float	0.8 m^3/md (needs team of 5)
Stone masonry walls	Wheelbarrow, shovel, trowel, club hammer, string line, spirit level, batching box.	1.0 m^3/md
Gabion work	Gloves, string-line, shovel, wheelbarrow, pliers, short crowbar	1.5 m^3/md

ABBREVIATIONS USED
md = man-day
dia = diameter

Source :
Construction Education and Training Authority, Learning Material for Unity Standard 15165: “Use LIC

C2.2 BILL OF QUANTITIES

JOHANNESBURG WATER

CONTRACT NO **JW 14463**

FOR **HALFWAY HOUSE WATER UPGRADE PROJECT**

SUMMARY OF SCHEDULE OF QUANTITIES: BULK WATER PIPELINE

SANS 1200 A	:	GENERAL	**R**
SANS 1200 A.1	:	GENERAL (SMME VALUE OF WORK)	**R**
SANS 1200 C	:	SITE CLEARANCE	**R**
SANS 1200 D	:	EARTHWORKS	**R**
SANS 1200 DB	:	EARTHWORKS (PIPE TRENCHES)	**R**
SANS 1200 DK	:	GABIONS AND PITCHING	**R**
SANS 1200 F	:	PILING	**R**
SANS 2001 CC	:	CONCRETE (STRUCTURAL)	**R**
SANS 1200 HA	:	STRUCTURAL STEELWORK (SUNDRY ITEMS)	**R**
SANS 1200 L	:	MEDIUM-PRESSURE PIPELINES.	**R**
SANS 1200 LB	:	BEDDING (PIPES)	**R**
SANS 1200 LE	:	STORMWATER DRAINAGE	**R**
SANS 1200 LG	:	PIPE JACKING	**R**
SANS 1200 ME	:	SUBBASE	**R**
SANS 1200 MF	:	BASE	**R**
PARTICULAR SPECIFICATION PC: DIRECTIONAL DRILLING			**R**
PARTICULAR SPECIFICATION PD: BUILDING WORK			**R**
ELECTRICAL	:		**R**
MECHANICAL	:		**R**

TOTAL OF SCHEDULE OF QUANTITIES CARRIED TO CALCULATION OF ESCALATION	**R**
ESCALATION The tenderer shall add 5% of the total of Schedule of Quantities for Escalation and this Sum shall be utilised as per Clause 6.8.2 of the Contract Data and may be deducted in whole or in part	**R**
SUBTOTAL A The tenderer shall add the total of Schedule of Quantities for Escalation and Escalation	**R**
CONTINGENCIES The tenderer shall add 10% of Subtotal A for Contingencies and this Sum shall be under the sole control of the Engineer and may be deducted in whole or in part	**R**
SUBTOTAL B The tenderer shall add Subtotal A and Contingencies	**R**
VALUE-ADDED TAX (VAT) The tenderer shall add 15% of Subtotal B for value-added tax.	**R**
TENDER SUM CARRIED TO FORM OF TENDER	**R**

GENERAL

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SANS 1200 A SMME	**111.00**	**GENERAL**				
PSSC 1	110.11.01.19	Value of Subcontracted works	P.Sum	1	12,951,609.83	12,951,609.83
PSSC 2	110.11.01.20	Management fee for the Main Contractor	%	12,951,609.83		-
	TOTAL SECTION 1200 A SMME CARRIED TO SUMMARY					12,951,609.83

GENERAL

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SANS 1200 A	**110.00**	**GENERAL**				
		FIXED CHARGE ITEMS				
8.3	**110.01**	**Contractual Requirements**	Sum	1		
8.3.2	**110.02**	**Establishment of Facilities on Site**				
SANS 1200 AB	**110.02.01**	**Facilities for the Engineer**				
PSA 8.2.1	110.02.01.01	Furnished offices (3 No - 1 No Type 1, 1 No Type 2, 1 No Type 3)	Sum	1		
PSA 8.2.1	110.02.01.02	Computer equipment	Sum	1		
PSA 8.2.1	110.02.01.03	Nameboards (2 No)	Sum	1		
PSA 8.2.1	110.02.01.04	Carport	Sum	1		
SANS 1200 A 8.3.2.1	110.02.01.05	Kitchen	Sum	1		
	110.02.01.06	Ablution and latrine facilities both male and female	Sum	1		
	110.02.01.07	Survey equipment and assistance	Sum	1		
	110.02.01.08	Safety equipment, including safety shoes, hard hat, eye protection, gloves, ear protection, dust mask, removable revolving orange light for vehicle & reflective vest for 10 No people	Prov sum	1	30,000.00	30,000.00
	110.02.01.09	Overheads, charges and profit on safety equipment	%	30,000.00	10%	3,000.00
8.3.2.2	**110.02.02**	**Facilities for the Contractor**				
	110.02.02.01	Offices and storage sheds	Sum	1		
	110.02.02.02	Workshops	Sum	1		
	110.02.02.03	Laboratories	Sum	1		
	110.02.02.04	Ablution and latrine facilities	Sum	1		
	110.02.02.05	Tools and equipment	Sum	1		
	110.02.02.06	Water Supply, Electrical power and communications	Sum	1		
	110.02.02.07	Dealing with water	Sum	1		
	110.02.02.08	Access	Sum	1		
	110.02.02.09	Transport to and establish on site all Construction plant and equipment	Sum	1		
1200 A	Carried forward					

GENERAL

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		Brought forward				
SANS 1200A 8.3.4	**110.03**	**Remove Contractors Site Establishment and make good**	Sum	1		
	110.03.01	Other fixed charge obligations not covered above (Tenderer to list)				
	110.03.01.01		Sum	1		
	110.03.01.02		Sum	1		
	110.03.01.03		Sum	1		
	110.03.01.04		Sum	1		
PSA 8.3.5	**110.04**	**Additional Contractual Obligations**				
PSA 8.3.5.1	110.04.01	Notice and warning to consumers	Sum	1		
PSA 8.3.5.2	110.04.02	OHS Act Obligations	Sum	1		
PSA 8.3.5.3	110.04.03	EMP Obligations	Sum	1		
8.3.5.4	110.04.04	Dilapidation Survey	Sum	1		
		TIME RELATED ITEMS				
PSA 8.4.1	**110.05**	**Contractual Requirements**	Sum	1		
8.4.2	**110.06**	**Operation and maintenance of facilities on site, for duration of construction, except where otherwise stated**				
SANS 1200 AB	**110.06.01**	**Facilities for the Engineer**				
PSAB 8.2.2	110.06.01.01	Furnished offices (3 No - 1 No Type 1, 1 No Type 2, 1 No Type 3)	Sum	1		
PSAB 8.2.2	110.06.01.02	Telephone (and computer equipment)	Sum	1		
PSAB 8.2.2	110.06.01.03	Carport	Sum	1		
SANS 1200 A PSAB 8.3.2.1	110.06.01.04	Kitchen	Sum	1		
	110.06.01.06	Ablution and latrine facilities both male and female	Sum	1		
	110.06.01.07	Survey equipment and assistance	Sum	1		
	110.06.01.08	Safety equipment, including safety shoes, hard hat, eye protection, gloves, ear protection, dust mask, removable revolving orange light for vehicle & reflective vest for 10 No people	PC Sum	1		
1200 A	Carried forward					

GENERAL

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		Brought forward				
SANS 1200A 8.4.2.2	**110.06.02**	**Facilities for the Contractor**				
	110.06.02.01	Offices and storage sheds	Sum	1		
	110.06.02.02	Workshops	Sum	1		
	110.06.02.03	Laboratories	Sum	1		
	110.06.02.04	Ablution and latrine facilities	Sum	1		
	110.06.02.05	Tools and equipment	Sum	1		
	110.06.02.06	Water Supply, Electrical power and communications	Sum	1		
	110.06.02.07	Dealing with water	Sum	1		
	110.06.02.08	Plant	Sum	1		
	110.06.02.09	First aid & medical services	Sum	1		
	110.06.02.10	Transport arrangements for labour from all communities to and from workplace to central collection / drop-off point	Sum	1		
	110.07	**Supervision for Duration of Contract**				
8.4.3	110.07.01	Company and head office overhead costs for the duration of the Contract	months	18		
8.4.5	110.08	Other time related obligations not covered above (Tenderer to list)				
	110.08.01		months	18		
	110.08.02		months	18		
	110.08.03		months	18		
	110.08.04		months	18		
PSA 8.4.6	**110.09**	**Additional Obligations**				
PSA 8.4.6.1	110.09.01	OHS Act Obligations	Sum	1		
PSA 8.4.6.2	110.09.02	Security Services Costs	Month	18		
PSA 8.4.6.3	110.09.03	Electrical Safety Officer	Month	18		
PSA 8.4.6.4	110.09.04	CLO	Prov sum	1	900,000.00	900,000.00
	110.09.05	Overheads, charges and profit on item 110.09.04	%	900,000.00	10%	90,000.00
1200 A	Carried forward					

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		Brought forward				
SANS 1200 A PSA 8.5	**110.10**	**Sums stated provisionally by the Engineer:**				
	110.10.01	**Works executed by Nominated Subcontractors**				
PSA 8.5.2	110.10.01.01	Alteration to existing services by authorities	Prov sum	1	714,609.60	714,609.60
	110.10.01.02	Overheads, charges and profit on item 110.10.01.01	%	714,609.60	10%	71,460.96
	110.10.01.03	Control survey by independent surveyor	Prov sum	1	360,000.00	360,000.00
	110.10.01.04	Overheads, charges and profit on item 110.10.01.03	%	360,000.00	10%	36,000.00
	110.10.01.05	Control tests by independent laboratory	Prov sum	1	119,101.60	119,101.60
	110.10.01.06	Overheads, charges and profit on item 110.10.01.05	%	119,101.60	10%	11,910.16
	110.10.01.07	Provision of photographic records	Prov sum	1	100,000.00	100,000.00
	110.10.01.08	Overheads, charges and profit on item 110.10.01.07	%	100,000.00	10%	10,000.00
	110.10.01.09	Temporary protection of services	Prov sum	1	595,508.00	595,508.00
	110.10.01.10	Overheads, charges and profit on item 110.10.01.09	%	595,508.00	10%	59,550.80
	110.10.01.11	Reinstatement of asphalt by JRA	Prov sum	1	2,000,000.00	2,000,000.00
	110.10.01.12	Overheads, charges and profit on item 110.10.01.11	%	2,000,000.00	10%	200,000.00
	110.10.01.13	Supply or hire of specialist equipment	Prov sum	1	2,000,000.00	2,000,000.00
	110.10.01.14	Overheads, charges and profit on item 110.10.01.13	%	2,000,000.00	10%	200,000.00
	110.10.01.15	Training of labour and SMMEs	Prov sum	1		
	110.10.01.16	Overheads, charges and profit on item 110.10.01.15	%	-		
PSA 8.4.2	110.10.01.17	Telephone and data charges for Engineers	Prov sum	1	50,000.00	50,000.00
	110.10.01.18	Overheads, charges and profit on item 110.10.01.17	%	50,000.00	10%	5,000.00
PSA 8.5.2	110.10.01.19	Fixed-Charge items for the sub-contractors Contractual Requirements	Prov sum	1	297,754.00	297,754.00
	110.10.01.20	Overhead, charges and profit for the Main Contractor to provide for fixed-charge items for the sub-contractors Contractual Requirements	%	297,754.00	10%	29,775.40
1200 A	Carried forward					

GENERAL

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		Brought forward				
SANS 1200 A PSA 8.5.2	110.10.01.21	Time Related items for the sub-contractors Contractual Requirements	Prov sum	1	535,957.20	535,957.20
	110.10.01.22	Overhead, charges and profit for the Main Contractor to provide for time related items for the sub-contractors Contractual Requirements	%	535,957.20	10%	53,595.72
PSA 8.5.2	110.10.01.23	Specials and fittings for tie-in to existing Water meter Chamber (Dale Road)	Prov sum	1	100,000.00	100,000.00
	110.10.01.24	Overheads, charges and profit on item 110.10.01.23	%	100,000.00	10%	10,000.00
PSA 8.5.2	110.10.01.25	Specials and fittings for tie-in to existing water pipe (Harry Galaun Drive)	Prov sum	1	100,000.00	100,000.00
	110.10.01.26	Overheads, charges and profit on item 110.10.01.25	%	100,000.00	10%	10,000.00
PSA 8.5.2	**110.11**	**Remove and grub trees as instructed by JPCZ**	Prov sum	1	200,000.00	200,000.00
	110.11.01	Overheads, charges and profit on control tests by independent laboratory	%	200,000.00	10%	20,000.00
PSA 8.7	**110.12**	**Daywork (Provisional)**				
	110.12.01	Allowance for labour	Prov sum	1	595,508.00	595,508.00
	110.12.02	Percentage adjustment to item 110.12.01	%	595,508.00	10%	59,550.80
	110.12.03	Alowance for material	Prov sum	1	595,508.00	595,508.00
	110.12.04	Percentage adjustment to item 110.12.03	%	595,508.00	10%	59,550.80
	110.12.05	Allowance for plant	Prov sum	1	595,508.00	595,508.00
	110.12.06	Percentage adjustment to item 110.12.05	%	595,508.00	10%	59,550.80
PSA 8.8	**110.13**	**Temporary Works**				
PSA 8.8.2	110.13.01	Accommodation of traffic	Sum	1		
	110.13.02	Location and protection of existing services				
PSA 8.8.4	110.13.02.01	Electrical and other cables	Sum	1		
PSA 8.8.5	110.13.03	Survey and setting out of works	Sum	1		
PSA 8.8.6	110.13.04	Special water control	Sum	1		
PSA 8.8.7	110.13.05	Dealing with other service authorities, application for wayleaves, etc.	Sum	1		
1200 A	Carried forward					

GENERAL

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		Brought forward				
SANS 1200A PSA 8.9	**110.14**	**Compliance with OHS Act Regulations (including the Construction Regulations, 2014)**				
PSA 8.10	**110.15**	**Quality Assurance and Management Plan**	Sum	1		
PSA 8.11	**110.16**	**Compliance with the Environmental Management Plan**	Sum	1		
	TOTAL SECTION 1200 A CARRIED TO SUMMARY					

SECTION 1200 C

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 C	**130.00**	**SITE CLEARANCE**				
PSC 8.2.1	**130.01**	**Clear and grub:**				
		.01 Areas (chambers, structures, etc)	m²	1,322		
		.02 Strips, 3,0 m wide (water)	m	6,847		
8.2.2	**130.02**	**Remove and grub large trees and tree stumps of girth:**				
		.01 Over 1,0 m and up to and including 2,0 m	number	50		
		.02 Over 2,0 m and up to and including 3,0 m	number	10		
	130.03	**Extra over item 130.02 above to Reinstate Trees:**				
		.01 Over 1,0 m and up to and including 2,0 m	number	30		
8.2.4	**130.04**	**Reclear surfaces (only on instructions from the Engineer):**				
		.01 Areas	m²	50		
		.02 Strips, 3,0 m wide (water)	m	100		
8.2.5	**130.05**	**Take down existing fences**	km	10		
8.2.8	**130.06**	**Demolish and remove structures or buildings and dismantle steelwork etc.**				
		.01 Carport and Name Boards	Number	115		
		.02 Carefully remove paving blocks for re-use (car parking)	m²	28,187		
		.03 Asphalt surfacing (car parking)	m²	1,000		
		.04 Carefully remove paving blocks for re-use (Erf 3544)	m²	775		
	130.07	**Extra over item 130.06 above for:**				
		.01 Re-erection and Reinstatement of Carport	Number	115		
		.02 Reinstatement of Paving Blocks (car parking)	m²	14,094		
		.03 Reinstatement of Asphalt/ concrete paving (car parking)	m²	1,000		
		.04 Reinstatement of paving blocks for re-use (Erf 3544)	m²	775		
	130.08	**Transport materials and debris to unspecified site and dump**	m³	10		
8.2.10	**130.09**	**Remove topsoil to nominal depth of 150 mm and stockpile**	m³	3,074		
1200 C	Carried forward					

SECTION 1200 C

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
PSC 8.2.11	**130.10**	**Temporary fencing:**				
		.01 1,8 m barbed wire class B fence	m	4,900		
PSC 8.2.13	**130.11**	**Take down and re-erect existing fences**				
		.01 Weldmesh fencing	m	30		
		.02 Boundary Brick wall	m	30		
		.03 Double Brick wall with Palisade fence	m	30		
		.04 Palisade fence	m	60		
		.05 Clear View(vu) fence or similar	m	150		
		.06 Electrical fence	Number	20		
	130.12	**Final finishing and cleaning up of the Site of the Works**	sum	1		
		TOTAL SECTION 1200 C CARRIED TO SUMMARY				

SECTION 1200 DB

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 DB	**142.00**	**EARTHWORKS (PIPE TRENCHES)**				
		TRENCHES FOR WATER PIPES				
PSDB 8.3.2	**142.01**	**Excavate in all materials for trenches, backfill, compact and dispose of surplus material:**				
		.01 Pipes over 125 mm dia up to 400 mm dia for depths:				
		.02 Over 1,0 m up to 2,0 m	m	62		
		.02 Pipes over 500 mm dia up to 850 mm dia for depths:				
		.01 Up to 1,0 m	m	28		
		.02 Over 1,0 m up to 2,0 m	m	838		
		.03 Over 2,0 m up to 3,0 m	m	4,152		
		.04 Over 3,0 m up to 4,0 m	m	1,311		
		.05 Over 4,0 m	m	513		
PSDB 8.3.2	**142.02**	**Extra over item 142.01 above for:**				
		.01 Intermediate excavation	m³	3,377		
		.02 Hard rock excavation	m³	3,608		
		.03 Hand excavation where ordered by the Engineer:				
		.01 Soft material	m³	200		
		.02 Intermediate material	m³	100		
		.03 Hard material	m³	10		
		.04 Backfill stabilized with 5% cement where directed by the Engineer	m³	10		
		.05 Soilcrete backfill where directed by the Engineer	m³	100		
8.3.2	**142.03**	**Excavate and dispose of unsuitable material from trench bottom**	m³	3,608		
8.3.3	**142.04**	**Excavation ancillaries:**				
		.01 Make up deficiency in backfill material:				
		.01 From other necessary excavations on Site	m³	10		
		.02 By importation from commercial or off-site sources selected by the Contractor	m³	10		
1200 DB	Carried forward					

SECTION 1200 DB

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.3.3	**142.04** (cont)	.02 Compaction in road crossings				
		.01 93% of modified AASHTO density	m^3	150		
		.03 Overhaul:	m^3-km	10		
8.3.4	**142.05**	**Particular items:**				
		.01 Shore trench opposite structure or service	m	7,847		
		.02 Temporary Works: Control water inflow in pipeline:				
		.01 For new tie-in connection to existing chamber pipework (Feeder pipeline)	sum	1		
		.02 For new tie-in connection into exisitng water pipes (Supply pipeline)	sum	5		
PSDB 8.3.5	**142.06**	**Existing services that intersect or adjoin a pipe trench:**				
		.01 Services that intersect a trench:				
		.01 Fence crossings (all types)	number	12		
		.02 Eskom electrical cable crossings	number	10		
		.03 DFA cable crossings	number	5		
		.04 Stormwater pipe crossings	number	5		
		.05 Water pipe crossings	number	5		
		.06 Sewer pipe crossings	number	3		
		.07 3 m wide driveways containing block paving	number	2		
		.08 3 m wide driveways containing concrete paving	number	2		
		.09 6 m wide driveways containing block paving	number	8		
		.10 6 m wide driveways containing concrete paving	number	2		
PSDB 8.3.5	**142.06**	.02 Services that adjoin a trench:				
		.01 Fencing (all types)	m	2,817		
		.02 Stormwater pipes	m	100		
		.03 Water pipes	m	485		
		.04 Sewer pipes	m	580		
		.05 Eskom electrical cable crossings	m	200		
1200 DB	Carried forward					

SECTION 1200 DB

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
PSDB 8.3.6	**142.07**	**Finishing:**				
		.01 Reinstate road surfaces complete with all courses:				
		.01 Gravel on shoulders	m³	10		
8.3.6	**142.07** (cont)	.02 Asphalt of thickness 40 mm in parking area	m²	450		
		.03 Gravel surfacing	m³	10		
PSDB 8.3.6	**142.06**	.04 Paving blocks/bricks	m²	450		
		.05 Kerbing	m	50		
PSDB 8.3.7	**142.07**	**Accommodation of traffic**	sum	1		
PSDB 8.3.13	**142.08**	**Supply all barricading and support as required for the construction of the bulk water line (within Erven 3544, Juskei View Property)**	Sum	1		
		TOTAL SECTION 1200 DB CARRIED TO SUMMARY				

SECTION 1200 D

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 D	**140.00**	**EARTHWORKS**				
PSD 8.3.3	**140.01**	**Restricted excavation:**				
		.01 Excavate for chambers, restricted foundations, etc. in all materials, and use for backfill or embankment, or dispose:				
		.01 Depth up to 2,0 m	m³	890		
		.02 Depth over 2,0 m and up to 4,0 m	m³	638		
		.03 Depth over 4,0 m and not exceeding 6m deep	m³	377		
		.04 Depth over 6,0 m and up to 15,0 m	m³	2,051		
		.02 Excavate for gabion boxes or mattresses in all all materials, and use for backfill or embankment, or dispose	m³	126		
		.03 Extra over items 140.01.01 to 140.01.03 above for:				
		.01 Intermediate excavation	m³	2,132		
		.02 Hard rock excavation	m³	971		
		.04 Extra over item 140.01 for hand excavation	m³	50		
8.3.5	**140.02**	**Extra excavation in all materials to provide working space around structure**	m²	2,360		
PSD 8.3.6	**140.03**	**Overhaul:**				
		.01 Long overhaul	m³-km	20,510		
8.3.9	**140.04**	**Extra over items 140.01 and 140.02 for backfill or for fill material against structures**	m³	720		
PSD 8.3.8	**140.05**	**Existing services:**				
		.01 Hand excavation for locating and exposing existing services:				
		.01 In roadways	m³	50		
		.02 In all other areas	m³	50		
PSD 8.3.10	**140.06**	**Topsoiling**	m³	3,074		
8.3.11	**140.07**	**Grassing or other vegetation cover:**	m²	2,700		
PSD 8.3.14	**140.08**	**Extra over items 140.02.01 and 140.02 for temporary stockpiling**	m³	1,646		
PSD 8.3.15	**140.09**	**Extra over items 140.02.01 and 140.02 for disposing of spoil material on site provided by the Contractor**	m³	2,873		
SANS 1200 DM 8.3.3	**140.10**	**Treatment of roadbed:**				
		.01 Roadbed preparation and compaction of material to (under structure floor slabs):				
		.01 Minimum of 90% of modified AASHTO maximum density	m³	10		
		.02 Minimum of 93% of modified AASHTO maximum density	m³	250		
	TOTAL SECTION 1200 D CARRIED TO SUMMARY					

SECTION 1200 F

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 F	**160.00**	**PILING**				
8.2.1	**160.01**	**Establishment on site for piling**	sum	1		
8.2.2	**160.02**	**Move equipment to and set up at each pile position**	number	27		
8.2.3	**160.03**	**Standing time**	h	54		
8.2.7	**160.04**	**Design, manufacture, supply, deliver and construction of 750mm dia tubular auger cast in-situ piles complete with casings,rebar,anchors etc at approximately 2200mm spacing apart:**				
		.01 Exceeding 10 m up to 15 m	m	405		
8.2.9	**160.05**	**Install piles through unscheduled obstructions**	Prov sum	1	1,000,000.00	1,000,000.00
8.2.13	**160.06**	**Extra over item for socketing piles into rock formation of:**				
		.01 Pile socket into hard rock to specialist details	m	405		
8.2.21	**160.07**	**Establishment on site for the load testing of piles**	sum	1		
8.2.22	**160.08**	**Load tests on piles:**				
		.01 Piles of 750mm dia to engineers specification	number	27		
	TOTAL SECTION 1200 F CARRIED TO SUMMARY					

SECTION 1200 HA

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 HA PSHA	**181.00**	**STRUCTURAL STEELWORK (SUNDRY ITEMS)**				
8.3.1	**181.01**	**Structural steel:**				
		.01 Pipe support brackets complete with 100 x 10mm flat bar clamp lined with 990 x 100 x 10mm thick rubber strip including 6mm thick gusset connected by M16 SS bolts with nyloc nuts and 10mm thick plate connected to 75 x 75 x 6mm SS angle with 6mm thick ribs. Fixed to concrete using 80 x 80 x 8mm SS angle and M16 stainless steel chemical anchors	number	3		
8.3.2	**181.02**	Handrails				
		.01 Handrail assembly complete:				
		.01 Horizontal	m	33		
8.3.3	**181.03**	**Ladders, complete and installed:**				
		.01 Galvanized mild steel ladders bolted to concrete walls complete as shown on Drawings				
		.01 Air Valve Chambers	number	9		
		.02 Isolating Valve Chambers	number	5		
		.03 Scour Valve Chambers	number	5		
		.04 Water Meter Chambers	number	2		
		.05 PRV Chambers	number	1		
		.02 Galvanized mild steel ladders bolted to concrete walls complete as shown on Drawing no. 111242-0000-DRG-WW-0515				
		.01 Access Chamber 1 (10m high cat-ladder)	number	3		
		.03 Galvanized mild steel ladders bolted to concrete walls complete as shown on Drawing no. 111242-0000-DRG-WW-0513				
		.01 Access Chamber 2 (4.45m high cat-ladder)	number	1		
8.3.4	**181.04**	**Walkway flooring, complete and installed with frames:**				
		.01 As shown on Drawing No 111242-0000-DRG-SS-3002 & 3003	m²	17		
	181.05	**Staircases, complete and installed :**				
		.01 As shown on Drawing No 111242-0000-DRG-SS-3002 & 3003	m²	1		
	TOTAL SECTION 1200 HA CARRIED TO SUMMARY					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 L	**210.00**	**MEDIUM-PRESSURE PIPELINES** 1 Fittings are regarded as special pipes and not measured as extra over items 2 Direction changes < 5° not measured as specials and must be accommodated in the laying of the pipes 3 All new specials to be manufactured and lined and coated as per pipe specifications included in this Project Document 4 All Steel Pipelines shall be Spirally welded and butt welded (Longitudinal Welded pipes shall not be considered in these circumstances)				
8.2.1	**210.01**	**Supply, lay and bed on bedding as shown on Drawings no. 111242-0000-DRG-WW-0301 to -0310 or fixed above ground inside structures, complete with on-site welding joints, testing, etc:** .01 Grade X42 to API 5L welded steel pipes, with Single Coat Solvent Free Liquid Epoxy lining (600 microns DFT) and coating with Rigid Polyurethane (2000 microns DFT) or similar approved by JW: .01 610 mm dia x 8 mm thickness	m	3,166		
		.02 710 mm dia x 8 mm thickness	m	2,886		
8.2.1	**210.02**	**Supply, lay, joint and install inside concrete sleeve pipe including skids, steel straps, malthoid packings, sand, cement, bentonite, grout, etc. complete with on-site welding joints, testing, etc as shown on Drawing no 111242-0000-WW-DRG-0506** .01 Grade X42 to API 5L welded steel pipes, with Single Coat Solvent Free Liquid Epoxy lining (600 microns DFT) and coating with Rigid Polyurethane (2000 microns DFT) or similar approved by JW: .01 609 mm dia x 8 mm thickness (pipes in 18 m lengths)	m	371		
		.02 710 mm dia x 8 mm thickness (pipes in 18 m lengths)	m	291		
8.2.1	**210.03**	**Supply, joint Horizontal Drilling pipes:** .01 HDPE PE 100 PN 16 SDR11 pipes, to SANS 4427, butt welded to SANS 0269 .01 630 mm dia (pipes in 6 m lengths)	m	371		
		.02 710 mm dia (pipes in 6 m lengths)	m	291		
1200 L	Carried forward					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.1	**210.03**	**Supply, lay and bed on flexible pipe bedding, complete with couplings:**				
		.02 mPVC class 16, to SANS 966 Part 2 pipes with spigot and socket ends:				
		.01 315 mm dia pipe	m	62		
8.2.2	**210.04**	**Extra over items 210.01 and 210.02 for the supplying laying, jointing and bedding below ground or installed in structures, of fittings, specials and valves on Grade X42 to API 5L welded or flanged steel pipes, with Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane (2000 microns DFT) or similar approved by JW:**				
		ISOLATING VALVE CHAMBER (x 5):				
		.01 Drawing No. 111242-0000-DRG-WW-0501: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lined and coated with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 219 mm dia x 90 degree steel bend, flanged, item 6	number	10		
		.02 219 mm dia x 446 mm steel straight pipe, flanged both sides, item 7	number	10		
		.02 Drawing No. 111242-0000-DRG-WW-0501: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 711 mm dia x 610 mm dia x 430 mm steel reducer with 1 500 mm long integral straight pipe, item 1	number	10		
		.02 610 mm dia x 1500mm integral straight pipe, item 1	number	10		
		.03 610 mm dia x 1 450 mm steel puddle pipe, flanged one end, item 2	number	10		
		.04 610 mm dia x 219 mm dia steel tee, all ends flanged, item 3	number	5		
		.05 600 mm dia VOSA non-rising wedge gate valve or similar approved, item 4 (Mech)	number	5		
		.06 610 mm dia x 219 mm dia steel tee, all ends flanged, item 5	number	5		
		.07 200 mm dia VOSA non-rising wedge gate valve or similar approved, item 8 (Mech)	number	5		
1200 L	Carried forward					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
		AIR VALVE CHAMBERS (x 9):				
8.2.2	**210.04** (cont)	.03 Drawing No. 111242-0000-DRG-WW-0500: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 711 mm dia x 355 mm dia x 1181 mm steel tee, flanged both ends, with crotch plates, item 1	number	5		
		.03 .02 610 mm dia x 355 mm dia x 1181 mm steel tee, flanged both ends, with crotch plates, item 1	number	4		
		.04 Drawing No. 111242-0000-DRG-WW-0500: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 150 mm x 60 mm x 25 mm triangular shaped support bracket welded on, item 2	number	36		
		.02 520 mm dia x 30 mm thick flange one end fitting with 100 mm dia x 250 mm steel spool pipe with 220 mm dia x 14 mm thick flange one end, and lifting hooks, item 3	number	7		
		.03 520 mm dia x 30 mm thick flange one end fitting with 200 mm dia x 250 mm steel spool pipe with 340 mm dia x 22 mm thick flange one end, and lifting hooks, item 3	number	2		
		.04 100 mm dia non-rising spindle resilient seal gate valve, item 4	number	7		
		.05 200 mm dia VOSA non-rising spindle wedge gate valve, or similar approved, item 4	number	2		
		.06 100 mm dia Vent-O-Mat Series RBX double orifice air valve with anti shock orifice mechanism, item 5	number	7		
		.07 200 mm dia Vent-O-Mat Series RBX double RBX double orifice air valve with anti shock orifice mechanism, item 5	number	2		
		.08 Site welding, testing and repairs:				
		.01 711 mm dia pipe to fitting or special	number	7		
		.02 610 mm dia pipe to fitting or special	number	2		
1200 L	Carried forward					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
		SCOUR VALVE CHAMBERS (x 5):				
8.2.2	**210.04** (cont)	.05 Drawing No. 111242-0000-DRG-WW-0502: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 711 mm dia x 4 800 mm double puddle pipe combination fitting with CP connection point, comprising 711 mm dia x 219 mm dia flanged scour outlet, item 1	number	3		
		.02 610 mm dia x 4 800 mm double puddle pipe combination fitting with CP connection point, comprising 610 mm dia x 219 mm dia flanged scour outlet, item 1	number	2		
		.03 200 mm dia wedge gate valve, both ends, flanged, item 2 (Mech)	number	10		
		.04 219 mm dia x 614 mm spool pipe, both ends flanged, item 3	number	5		
		.05 219 mm dia x 1 062 mm puddle pipe with CP connection point, item 5	number	5		
		.06 Site welding, testing and repairs:				
		.01 711 mm dia pipe to fitting or special	number	5		
		WATER METER CHAMBERS (x 2):				
		.06 Drawing No. 111242-0000-DRG-WW-0508: Steel grade X42, 8 mm wall thickness, 16 bar, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 315 mm dia x 219 mm dia steel reducer with 315 mm dia integral straight mPVC pipe, both ends flanged, item 1	number	4		
		.02 219 mm dia x 1 200 mm steel puddle pipe, both ends flanged, item 2	number	4		
		.03 200 mm dia VOSA non-rising wedge gate valve or similar approved, item 3 (Mech)	number	2		
		.04 219 mm dia x 1 000 mm dia steel pipe, both ends flanged, item 4	number	2		
		.05 Woltman WP-type water meter or similar approved, item 5	number	2		
		.06 219 mm dia x 582 mm dia steel pipe, one end flanged, item 6	number	2		
		.07 219 mm dia x 200 mm dia steel straight pipe, flanged both ends, item 7	number	2		
		.08 Sensus DN200 water strainer or similar approved, item 8	number	2		
1200 L	Carried forward					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
		ACCESS CHAMBER 1 (x 1):				
8.2.2	**210.04** (cont)	.07 Drawing No. 111242-0000-DRG-WW-0509: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 711 mm dia x 1500mm integral straight pipe, flanged one end, item 1	number	1		
		.02 711 mm dia x 1 550 mm steel puddle pipe, flanged both ends, item 2	number	1		
		.03 711 mm dia x 90 degree steel bend, flanged both ends, item 3	number	2		
		.04 711 mm dia x 4 000 mm steel straight pipe, flanged both ends, item 5	number	1		
		.05 711 mm dia x 7 453 mm steel straight pipe, flanged both ends, (length to be confirmed on site), item 6	number	1		
		ACCESS CHAMBER 2 (x 1):				
		.08 Drawing No. 111242-0000-DRG-WW-0513: Steel grade X42, 8 mm wall thickness, Single Coat Solvent Free Liquid Epoxy lining and coating with Rigid Polyurethane, flange drilling to SANS 1123 T1600/3:				
		.01 711 mm dia x 1 000 mm steel straight pipe, flanged both ends, item 1	number	1		
		.02 711 mm dia x 2 725 mm steel puddle pipe, flanged both ends, item 2	number	1		
		.03 711 mm dia x 4 000 mm steel straight pipe, flanged both ends, item 3	number	1		
8.2.2	**210.05**	**Extra over item 210.01.01 for the supplying laying, jointing and bedding below ground or installed in structures, of fittings, specials and valves on Grade X42 to API 5L (16 bar) flanged steel pipes with Single Coat Solvent Free Liquid Epoxy lining and external coating with Rigid Polyurethane or similar approved:**				
		.01 Bends:				
		.01 Bends in change of 610 mm dia pipe directions:				
		.01 Over 5° up to 10°	number	8		
		.02 Over 10° up to 15°	number	4		
		.03 Over 15° up to 20°	number	4		
		.04 Over 20° up to 25°	number	2		
		.05 Over 25° up to 30°	number	5		
1200 L	Carried forward					

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.2	**210.05** (cont)	.01 .01 .06 Over 30° up to 35°	number	3		
		.07 Over 35° up to 40°	number	2		
		.08 Over 40° up to 45°	number	3		
		.09 Over 45° up to 50°	number	1		
		.10 Over 50° up to 55°	number	1		
		.11 Over 55° up to 60°	number	1		
		.12 Over 70° up to 75°	number	1		
		.13 Over 75° up to 80°	number	1		
		.14 Over 80° up to 85°	number	3		
		.15 Over 85° up to 90°	number	4		
		.16 Over 95° up to 100°	number	1		
		.01 .02 Bends in change of 711 mm dia pipe directions:				
		.01 Over 5° up to 10°	number	18		
		.02 Over 10° up to 15°	number	5		
		.03 Over 15° up to 20°	number	3		
		.04 Over 20° up to 25°	number	2		
		.05 Over 25° up to 30°	number	3		
		.06 Over 40° up to 45°	number	2		
		.07 Over 45° up to 50°	number	1		
		.08 Over 55° up to 60°	number	1		
		.09 Over 65° up to 70°	number	1		
		.10 Over 70° up to 75°	number	1		
		.11 Over 80° up to 85°	number	2		
		.12 Over 85° up to 90°	number	4		
		.13 Over 90° up to 95°	number	4		
		.14 Over 105° up to 110°	number	2		
		.03 Site welding, testing and repairs:				
		.01 711 mm dia pipe to pipe fitting or special	number	10		
		.02 610 mm dia pipe to pipe fitting or special	number	10		
1200 L	Carried forward					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.2	**210.05** (cont)	.02 Tees:				
		.01 610 mm dia x 610 mm dia	number	2		
		.02 711 mm dia x 711 mm dia	number	3		
		.03 812 mm dia x 711 mm dia	number	1		
		.03 Reducers:				
		.01 610 mm dia x 315 mm dia	number	2		
		.02 711 mm dia x 315 mm dia	number	3		
		.03 711 mm dia x 610 mm dia	number	1		
		.04 Blank flange:				
		.01 610 mm dia	number	2		
		.02 711 mm dia	number	3		
8.2.2	**210.06**	**Extra over item 210.03.01 for the supplying, laying and bedding of mPVC specials complete with couplings:**				
		.01 Flange adaptor:				
		.01 315 mm dia	number	3		
		.02 Blank flange:				
		.01 315 mm dia	number	3		
		.03 End caps:				
		.01 315 mm dia	number	3		
	210.07	**Extra over item 210.03.02 for the supplying laying, jointing and bedding below ground or installed in structures, of fittings, specials and valves on PE 100 PN 16 SDR11, SANS 10269 HDPE pipes, butt welded:**				
		.01 HDPE stubs and backing rings for the following sizes:				
		.01 630 mm dia	number	12		
		.02 710 mm dia	number	4		
		.03 800 mm dia	number	2		
PSL 8.2.11	**210.08**	**Anchor/thrust blocks and pedestals:**				
		.01 Concrete:				
		.01 Class 20 MPa/19 mm	m^3	200		
1200 L	Carried forward					

SECTION 1200 L

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.15	**210.09**	**Special wrapping in corrosive soil:**				
		.01 Denso tape wrapping to steel pipes, fittings etc:				
		.01 610 mm dia	m	100		
		.02 711 mm dia	m	100		
		.03 812 mm dia	m	100		
	210.10	**Extra over item 210.01 above for on-site cutting of straight pipes to suite fixed chainage lengths, fittings or specials and chamber positions including site welding, testing and repairing of new joints, for:**				
		.01 610 mm dia x 8 mm thickness	number	30		
		.02 711 mm dia x 8 mm thickness	number	40		
PSL 8.2.18	**210.11**	**Pipeline route markers:**				
		.01 Type as shown on Drawing No. 111242-0000-DRG-WW-0507	number	160		
PSL 8.2.19	**210.12**	**Connection to existing main supply pipe:**				
		.01 Supply and install fittings and specials on bedding, complete with on-site welding, couplings, testing etc at existing water meter chamber tie-in:	number	1		
		.02 Supply and install fittings and specials on bedding, complete with on-site welding, couplings, testing etc at existing 800mm dia. water pipeline at Bridal Veil Road tie-in:	number	1		
		.03 Supply and install fittings and specials on bedding, complete with on-site welding, couplings, testing etc at existing water pipeline at Harry Galaun Drive tie-in:	number	1		
PSL 8.2.20	**210.13**	**Cathodic Protection Work by Contractor**	P. Sum	1	875,000.00	875,000.00
PSL 8.2.22	**210.14**	**AC Mitigation Work by Contractor**	P. Sum	1	875,000.00	875,000.00
	210.15	**CCTV pipe inspections**	m	6,847		
	210.16	**Non-Destructive Testing (NDT) for pipe welding on site**	sum	194		
		TOTAL SECTION 1200 L CARRIED TO SUMMARY				

SECTION 1200 LB

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 LB	**211.00**	**BEDDING (PIPES)**				
		BEDDING FOR WATER PIPES				
		Note: Beddings as shown on Drawing No 111242-0000-DRG-WW-0504				
PSLB 8.2.1	**211.01**	**Provision of bedding from trench excavation:**				
		.01 Selected granular material	m³	20		
		.02 Selected fill material	m³	20		
PSLB 8.2.2	**211.02**	**Supply only of bedding by importation:**				
		.01 From other necessary excavations:				
		.01 Selected granular material	m³	100		
		.02 Selected fill material	m³	100		
		.02 From commercial sources:				
		.01 Selected granular material	m³	3,389		
		.02 Selected fill material	m³	4,612		
8.2.4	**211.04**	**Encasing of pipes in concrete:**				
		.01 30MPa/19mm concrete encasing, incl formwork				
		.01 710 mm dia steel pipe	m³	100		
8.2.7	**211.05**	**Extra over item 211.04 above for:**				
		.01 Mild steel reinforcement	t	10		
SANS 2001 CC 8.3.2	**211.07**	**High-tensile welded mesh in the following:**				
		.01 Ref 395 in concrete encasing around pipes	m²	100		
		TOTAL SECTION 1200 LB CARRIED TO SUMMARY				

SECTION 1200 LE

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 LE	**214.00**	**STORMWATER DRAINAGE**				
8.2.10	**214.01**	**Accessories:**				
		.01 Submersible pump connected to 160mm dia pipe	No	2		
PSLE 8.2.14	**214.02**	**Pipes in subsurface drains:**				
		.01 Normal duty uPVC pipes complete with couplings:				
		.01 160 mm internal dia, perforated	m	100		
		.02 160 mm internal dia, perforated	m	28		
PSLE 8.2.15	**214.03**	**Geofabric**				
		.01 A4 Bidum Geotextile or similar approved	m²	8		
PSLE 8.2.16	**214.04**	**Crushed stone in subsurface drains**				
		.01 Single sized crushed stone, ,nominal size 19mm clean washed aggregate	m³	4		
	TOTAL SECTION 1200 LE CARRIED TO SUMMARY					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 LG	**216.00**	**PIPE JACKING**				
		ROAD CROSSING:1				
8.2.1	**216.01**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.02**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	77		
8.2.3	**216.03**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	77		
8.2.4	**216.04**	**Excavation for jacking:**				
		.01 Soft excavation	m³	114		
		.02 Intermediate excavation	m³	34		
		.03 Hard rock excavation	m³	11		
8.2.5	**216.05**	**Extra over items 216.01 and 216.04 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.06**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	53		
8.2.10	**216.07**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.01**	h	40		
		ROAD CROSSING:2				
8.2.1	**216.11**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.12**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	46		
8.2.3	**216.13**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	46		
8.2.4	**216.14**	**Excavation for jacking:**				
		.01 Soft excavation	m³	68		
		.02 Intermediate excavation	m³	20		
		.03 Hard rock excavation	m³	7		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.5	**216.15**	**Extra over items 216.11 and 216.14 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.16**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	32		
8.2.10	**216.17**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.11**	h	40		
		ROAD CROSSING:3				
8.2.1	**216.21**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.22**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	62		
8.2.3	**216.23**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	62		
8.2.4	**216.24**	**Excavation for jacking:**				
		.01 Soft excavation	m³	92		
		.02 Intermediate excavation	m³	28		
		.03 Hard rock excavation	m³	9		
8.2.5	**216.25**	**Extra over items 216.21 and 216.24 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.26**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	43		
8.2.10	**216.27**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.21**	h	40		
		ROAD CROSSING:4				
8.2.1	**216.31**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.2	**216.32**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	49		
8.2.3	**216.33**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	49		
8.2.4	**216.34**	**Excavation for jacking:**				
		.01 Soft excavation	m³	73		
		.02 Intermediate excavation	m³	22		
		.03 Hard rock excavation	m³	7		
8.2.5	**216.35**	**Extra over items 216.31 and 216.34 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.36**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	34		
8.2.10	**216.37**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.31**	h	40		
		ROAD CROSSING:5				
8.2.1	**216.41**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.42**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	52		
8.2.3	**216.43**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	52		
8.2.4	**216.44**	**Excavation for jacking:**				
		.01 Soft excavation	m³	76		
		.02 Intermediate excavation	m³	23		
		.03 Hard rock excavation	m³	8		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.5	**216.45**	**Extra over items 216.41 and 216.44 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.46**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	36		
8.2.10	**216.47**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.41**	h	40		
		ROAD CROSSING:6				
	216.51	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.52**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	65		
8.2.3	**216.53**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	65		
8.2.4	**216.54**	**Excavation for jacking:**				
		.01 Soft excavation	m³	96		
		.02 Intermediate excavation	m³	29		
		.03 Hard rock excavation	m³	10		
8.2.5	**216.55**	**Extra over items 216.51 and 216.54 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.56**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m³	38		
8.2.10	**216.57**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.51**	h	40		
		ROAD CROSSING:8				
8.2.1	**216.61**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.2	**216.62**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	60		
8.2.3	**216.63**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	60		
8.2.4	**216.64**	**Excavation for jacking:**				
		.01 Soft excavation	m^3	89		
		.02 Intermediate excavation	m^3	27		
		.03 Hard rock excavation	m^3	9		
8.2.5	**216.65**	**Extra over items 216.61 and 216.64 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.66**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m^3	34.92		
8.2.10	**216.67**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.61**	h	40		
		ROAD CROSSING:9 (N1 Crossing)				
8.2.1	**216.71**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.72**	**Supply of culverts to be jacked:**				
		.01 3000 mm dia x 2500 mm dia x 275mm thick, concrete jacking box culvert with bolts holes for longitudinal ties interlocking joint	m	88		
1200 LG		Carried forward				

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.3	**216.73**	**Jacking of culverts:**				
		.01 3000 mm dia x 2500 mm dia x 275mm thick, concrete jacking box culvert with bolts holes for longitudinal ties interlocking joint, including but not limited to drag sheet inserted in slots on jacking shield	m	88		
8.2.4	**216.74**	**Excavation for jacking:**				
		.01 Soft excavation	m³	569		
		.02 Intermediate excavation	m³	285		
		.03 Hard rock excavation	m³	95		
8.2.5	**216.75**	**Extra over items 216.71 and 216.74 for unforeseen rock or boulders**	Prov sum	1		
8.2.9	**216.76**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	40		
		.03 Grouting to voids with cement/bentonite mix	m³	93		
		.03 Materials used	m³	314		
8.2.10	**216.77**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.71**	h	40		
	216.78	**Miscellaneous**				
		.01 Risk allowance for potential cracking of road	sum	1		
		ROAD CROSSING:10				
8.2.1	**216.81**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.82**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	38		
8.2.3	**216.83**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	38		
8.2.4	**216.84**	**Excavation for jacking:**				
		.01 Soft excavation	m³	56		
		.02 Intermediate excavation	m³	17		
		.03 Hard rock excavation	m³	6		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.5	**216.85**	**Extra over items 216.01 and 216.04 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.86**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	22		
8.2.10	**216.87**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.81**	h	40		
		ROAD CROSSING:11				
8.2.1	**216.91**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**216.92**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	45		
8.2.3	**216.93**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	45		
8.2.4	**216.94**	**Excavation for jacking:**				
		.01 Soft excavation	m³	66		
		.02 Intermediate excavation	m³	20		
		.03 Hard rock excavation	m³	7		
8.2.5	**216.95**	**Extra over items 216.91 and 216.94 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**216.96**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	26		
8.2.10	**216.97**	**Standing time for pipe jacking gang and the jacking equipment covered by item 216.91**	h	40		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
		ROAD CROSSING:12				
8.2.1	**217.01**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**217.02**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	30		
8.2.3	**217.03**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	30		
8.2.4	**217.04**	**Excavation for jacking:**				
		.01 Soft excavation	m³	44		
		.02 Intermediate excavation	m³	13		
		.03 Hard rock excavation	m³	4		
8.2.5	**217.05**	**Extra over items 217.01 and 217.04 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**217.06**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	21		
8.2.10	**217.07**	**Standing time for pipe jacking gang and the jacking equipment covered by item 217.01**	h	40		
		ROAD CROSSING:13				
8.2.1	**217.21**	**Jacking establishment:**				
		.01 Fixed charges	sum	1		
		.02 Time-related charges	sum	1		
8.2.2	**217.22**	**Supply of pipes to be jacked:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	55		
8.2.3	**217.23**	**Jacking of pipes:**				
		.01 1 371 mm dia (OD), 100D concrete sleeve pipe (in-the-wall joint), according to SANS 677	m	55		
1200 LG	Carried forward					

SECTION 1200 LG

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
8.2.4	**217.24**	**Excavation for jacking:**				
		.01 Soft excavation	m³	81		
		.02 Intermediate excavation	m³	24		
		.03 Hard rock excavation	m³	8		
8.2.5	**217.25**	**Extra over items 217.21 and 217.24 for unforeseen rock or boulders**	Prov sum	1	20,000.00	20,000.00
8.2.9	**217.26**	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	2		
		.03 Materials used	m³	38		
8.2.10	**217.27**	**Standing time for pipe jacking gang and the jacking equipment covered by item 217.21**	h	40		
	TOTAL SECTION 1200 LG CARRIED TO SUMMARY					

SECTION 1200 ME

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SABS 1200 ME	**223.00**	**SUBBASE**				
PSDM 8.3.3	**223.01**	**Treatment of roadbed** **Roadbed preparation and compaction of material to (Rip and compact in-situ) :**				
PSME 8.3.3	**223.02**	.01 Minimum of 90% of modified AASHTO maximum density	m^3	20		
PSME 8.3.3	**223.03**	**Construct the subbase course with material from commercial sources** .01 G5 material compacted to 97% modified AASHTO	m^3	20		
		TOTAL SECTION 1200 ME CARRIED TO SUMMARY				

SECTION 1200 MF

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 MF	**224.00**	**BASE**				
8.3.3	**224.01**	**Construct base with material from commercial sources or designated borrow areas:**				
		.01 Graded crushed stone	m^3	14		
	TOTAL SECTION 1200 MF CARRIED TO SUMMARY					

SECTION 2001 CC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 2001 CC	**170.00**	**CONCRETE (STRUCTURAL)**				
		SCHEDULED FORMWORK ITEMS				
SD8.2.1	**170.01**	**Rough:**				
		.01 Vertical formwork to:				
		.01 Outsides of sumps (floor edge and sides)	m²	19		
		.02 Outsides of base	m²	50		
		.03 Outsides of walls	m²	93		
		.02 Boxing out				
		.01 600 x 600 x 750mm deep Sump	number	1		
SD8.2.2	**170.02**	**Smooth:**				
		.01 Vertical formwork to:				
		.01 Insides of chamber walls	m²	1,157		
		.02 Outsides of chamber walls	m²	1,228		
		.03 Insides of sumps	m²	11		
		.04 Outsides of plinths and thrust blocks	m²	641		
		.05 Outsides of floor slabs	m²	72		
		.06 Outsides of beams	m²	164		
		.07 Outsides of columns	m²	103		
		.08 Sides of Capping Beams	m²	86		
		.04 Horizontal formwork to:				
		.01 Soffits of roof slabs	m²	83		
		.02 Soffits of roof slabs (propped up exceeding 3,0m up to 4,5m)	m²	7		
		.03 Soffits of roof slabs (propped up exceeding 11,5m up to 12,5m)	m²	70		
		.04 Soffits of Beams (propped up exceeding 3,0m up to 4,5m)	m²	17		
		.05 Soffits of Beams (propped up exceeding 5,0m up to 5,5m)	m²	37		
		.06 Soffits of Beams (propped up exceeding 11,5m up to 12,5m)	m²	25		
		.07 Soffits of Capping Beams (propped up exceeding 11,5m up to 12,5m)	m²	69		
2001 CC	Carried forward					

SECTION 2001 CC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
SD8.2.6	**170.04**	**Box out holes/form voids:**				
		.01 Small circular, of diameter up to and including 0,35 m, and in the following depth ranges:				
		.01 0 m up to and including 0,5 m (for 100 mm dia ventilator sleeve in roof slab)	number	18		
		.02 Large, circular, of diameter over 0,35 m up to and including 0,7 m and in the following depth ranges:				
		.01 0 m up to and including 0,5 m (for 700 mm dia manhole cover and frame in roof slab)	number	16		
		SCHEDULED REINFORCEMENT ITEMS				
SD8.3.1	**170.05**	**Mild-steel and high-tensile steel bars (all diameters)**	t	131		
		SCHEDULED CONCRETE ITEMS				
SD8.4.2	**170.06**	**Blinding layer:**				
		.01 Class 15 MPa/19 mm concrete of:				
		.01 50 mm thickness	m²	10		
		.02 75 mm thickness	m²	389		
SD8.4.3	**170.07**	**Strength concrete:**				
		.01 Class 20 MPa/19 mm concrete in:				
		.01 Thrust blocks	m³	280		
		.02 Plinths	m³	183		
		.02 Class 30 MPa/19 mm concrete in:				
		.01 Floor slabs and sumps	m³	155		
		.02 Walls	m³	498		
		.03 Roof slabs and upstands	m³	138		
		.04 Beams	m³	12		
		.05 Capping Beams	m³	52		
SD8.4.4	**170.08**	**Unformed surface finishes:**				
		.01 Wood-floated finishes to:				
		.01 Floors and sumps	m²	71		
		.02 Steel-floated finishes to:				
		.01 Roof slabs and upstands	m²	102		
		.02 Plinths and thrust blocks including forming half round segments for pipes	m²	31		
2001 CC	Carried forward					

SECTION 2001 CC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
SD8.4.4	**170.08** (cont)	.03 Beams	m²	75		
		.04 Top of slab	m²	80		
SD8.4.8	**170.09**	**Screeds**				
		.01 70mm thick average screed to falls	m²	579		
	170.10	**Joints:**				
		.01 .01 15 mm Jointex between concrete surface and brickwork	m	39		
SD8.5		.02 Isolation joints:				
		.01 15 mm Jointex between concrete surface and 230mm brickwork	m	78		
		.02 12 mm Jointex between concrete surface and 230mm brickwork	m	234		
SD8.6	**170.11**	**Manufacture (or supply) and erect precast elements for units bigger than 0,5 m³ of formed concrete:**				
		.01 The following types and sizes, complete with box-outs for covers, etc, lifting handles or hooks, reinforcing (allow 120 kg/m³), smooth off-shutter finish to all surfaces, drip grooves, etc:				
		.01 3,275 m x 1,370 m x 200 mm thick roof slab panel as shown on Drawing No. 111242-0000-DRG-WW-0501	number	15		
		.02 2,820 m x 1,350 m x 200 mm thick roof slab panel as shown on Drawing No. 111242-0000-DRG-WW-0502	number	5		
		.03 2,820 m x 1,050 m x 200 mm thick roof slab panel as shown on Drawing No. 111242-0000-DRG-WW-0502	number	20		
		.04 2,45 m x 2,45 m x 150 mm thick roof slab panel, tapered down to 125 mm thick around edges as shown on Drawing No. 111242-0000-DRG-WW-0500	number	9		
		.05 Square manhole shaft unit size 2,0 m x 2,0 m x 1,0 m high internally with 125 mm thick walls complete with toggle type joints as supplied by SPC or equal approved as shown on Drawing No. 111242-0000-DRG-WW-0500	number	18		
		.06 2,700 m x 1,443 m x 150 mm thick roof slab panel as shown on Drawing No. 111242-0000-DRG-WW-0508	number	6		
		.07 4,428 m x 1,200 m x 150 mm thick roof slab complete with and including 12mm stainless steel round bar lifting hooks	number	5		
2001 CC	Carried forward					

SECTION 2001 CC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
SD8.6	**170.11** (cont)	.08 4,658 m x 1,200 m x 150 mm thick roof slab complete with and including 12mm stainless steel round bar lifting hooks 111242-0000-DRG-WW-0509	number	5		
		.09 4681 x 1200 x 150mm Precast pre-stressed slab complete with and including 12mm stainless round bar lifting hooks,removable slab	number	5		
		.10 1,000 m x 1,000 m x 350 mm thick precast lockable lid over concrete slab	number	1		
		.11 1,050 m x 5,300 m x 200 mm thick roof slab complete with and including 12mm stainless steel round bar lifting hooks, 700mm dia sans 558 type 4 steel manhole cover and frame with lockable cover	number	1		
		.12 1,050 m x 5,300 m x 200 mm thick roof slab complete with and including 12mm stainless steel round bar lifting hooks and vent pipe	number	1		
		.13 1,050 m x 5,300 m x 200 mm thick roof slab complete with and including 12mm stainless steel round bar lifting hooks	number	4		
		.14 5,300 m x 1,050 m x 200 mm thick roof slab panel as shown on Drawing No. 111242-0000-DRG-WW-0513	number	6		
		.02 Dowels / guides:				
		.01 Piles -Dowel Y16 Into vertical piles using hilti-hit HY-200 Into 18dia x 250mm deep holes	number	124		
		.02 Plinths -Dowel Y16 Into vertical piles using hilti-hit HY-200 Into 18dia x 200mm deep holes	number	184		
SD8.8	**170.12**	**HD bolts and miscellaneous metal work:**				
		.01 Steel strap pipe fixing bracket complete with malthoid packings as shown on Drawing No's 111242-0000-DRG-WW-0502-0503				
		.01 200 mm dia pipe	number	10		
		.02 700 mm dia pipe	number	48		
		.02 10 mm thick x 2.020 m long x 1,60 m girth L-shaped galvanized steel plate fixed with chemical anchors at maximum 200 mm centres in both directions to concrete walls and floors as shown on Drawing No. 111242-0000-DRG-WW-0502	number	5		
		.03 Galvanized mild steel grid formed of 100 mm x 3 mm thick x 1 600 mm long flat section base plate with 20 mm dia x 150 mm long studs welded on at 150 mm centres and six times bolted to concrete with chemical anchors as shown on Drawing No. 111242-0000-DRG-WW-0502	number	70		
2001 CC	Carried forward					

SECTION 2001 CC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
SD8.8	**170.12** (cont)	.04 254 x 146 x 32 I- Section Crawl Beam with manual chain blocks fixed to soffits of culverts with "Hilti Hit RE-500 inside the jacking tunnel	m	92		
		.05 254 x 146 x 43 crawl beam fixed to soffits of beams with 'Hilti HIT RE-500' complete as per drawing 111242-0000-DRG-SS-3003	m	33		
		.06 Pipe support brackets complete with 100 x 10mm flat bar clamp lined with 990 x 100 x 10mm thick rubber strip. Including 6mm thick gusset connected by M16 SS bolts with nyloc nuts and 100 mm thick plate connected to 75 x 75 x 6mm SS angle with 6 mm thick ribs. Fixed to concrete using 80 x 80 x 8mm SS angle and M16 stainless steel chemical anchors. As seen on Drawing No. 111242-0000-DRG-WW-0509	number	6		
		.07 Pipe support brackets bolted to concrete base (TBC)	number	12		
SD8.13	**170.13**	**Miscellaneous work other than metal work:**				
		.01 Malthoid insulation between steel pipes and steel straps:				
		.01 3 mm thick x 50 mm wide strips	m	119		
		.02 3 mm thick x 60 mm wide strips	m	119		
		.03 10 mm thick x 70 mm wide strips	m	10		
		.02 Malthoid insulation between steel pipes and concrete surfaces:				
		.01 3 mm thick x 200 mm wide strips	m	80		
		.02 3 mm thick x 250 mm wide strips	m	80		
		.03 HPDE insulation pads 1,6 mm thick between steel pipes and concrete surfaces (at thrust blocks)	m²	10		
		.04 Cement : sand floor screeds with falls including a smooth towelled finish to top	m²	250		
SD8.12	**170.14**	**Cast in of pipes with or without puddle flanges:**				
		.01 Up to 300 mm nominal bore:				
		.01 Through 200 mm thick wall	number	10		
		.02 Through 300 mm thick wall	number	5		
2001 CC	Carried forward					

SECTION 2001 CC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
SD8.12	**170.14** (cont)	.02 Over 300 mm up to 700 mm nominal bore:				
		.01 Through 200 mm thick floor slab	number	9		
		.02 Through 250 mm thick wall	number	10		
		.03 Through 450 mm thick wall	number	2		
SANS 1200 LE 8.2.10	**170.15**	**Accessories:**				
		.01 Manhole covers including frames:				
		.01 700mm diameter manhole cover and frame with lockable cover to SANS 558 Type 4 Mild Steel as seen on Drawing No. 111242-0000-DRG-WW-0501 (Detail B)	number	18		
		.02 Step irons:				
		.01 Calcamite 4 Ever type step irons	number	176		
		.03 Air breather as shown on Drawing No. 111242-0000-DRG-WW-0502 complete including casting into precast or in-situ concrete roof slabs	number	4		
		.04 Submersible pump connected to 160mm dia pipe	number	1		
SANS 1200 DB PSDB 8.3.2	**170.16**	**Soilcrete:**				
		.01 Soilcrete backfill where directed by the Engineer	m^3	100		
SANS 1200 DB PSDB 8.3.2	**170.17**	**Pipes in subsurface drains:**				
		.01 Normal duty uPVC pipes complete with couplings:				
		.01 160 mm internal dia, perforated	m	100		
	170.18	**Shotcrete to walls - complete with mesh, anchor bolts and wick drain at 1m c/c to specialists details**				
		.01 Class 15 MPa/19 mm concrete of:				
		.01 200 mm thick average	m^2	109		
		.02 200 mm thick average gunite between piles	m^2	683		
	TOTAL SECTION 2001 CC CARRIED TO SUMMARY					

SECTION 1200 DK

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SANS 1200 DK	**146.00**	**GABIONS AND PITCHING**				
8.2.1	**146.01**	**Surface preparation for bedding of gabions: 5 no. Scour Valves**				
		.01 Cavities filled with approved excavated material or rock	m²	126		
8.2.2	**146.02**	**Gabions:**				
		.01 Gabion boxes of galvanized wire:				
		.01 100 mm x 100 mm mesh, 2,7 mm dia wire, 1,0 m x 1,0 m x 0,5 m boxes	m³	25		
		.02 Gabion mattresses of galvanized wire, up to 0,3 m deep:				
		.01 80 mm x 100 mm mesh, 2,6 mm dia wire, 6,0 m x 2,0 m x 0,3 m mattress	m³	38		
8.2.4	**146.03**	**Geotextile:**				
		.01 Grade 4 or approved equivalent	m²	147		
	TOTAL SECTION 1200 DK CARRIED TO SUMMARY					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		ELECTRICAL WORKS				
		BILL 1: ELECTRICAL APPLICATION				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. All rates shall include Supply and Install. The items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.				
		3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		5. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.				
	100.00	**Electricity application**				
	100.01	Application to the electricity power supply authority of Eskom to install 285kW of generated electricity to feed back into the grid.	Sum	1		
	100.02	Liaison with Eskom including all documentation as may be required.	Sum	1		
	100.03	Liaison with main contractor	Sum	1		
	100.04	Notices and safety / danger signs as per the OHS Act.	Sum	1		
	101.00	**Ancillaries and accessories**				
	101.01	Any other item required for completion of the installation,	Sum	1		
	Total carried to summary					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 2: PRELIMINARY AND GENERAL				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. All rates shall include Supply and Install. These items shall the items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.				
		3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		5. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.				
	200.00	**Liason with other parties**				
	200.01	Liaison with main contractor	Sum	1		
	201.00	**Documentation**				
	201.01	For Construction drawings, hard copy and CD	Sets	3		
	201.02	Detailed Scope of Works, Project Safety Plan and Safe Work Method Statement	Sets	3		
	201.03	As-built drawings in Auto CAD/Revit format, on a CD	Sets	3		
	201.04	Operators and Maintenance Manuals, hard copy and CD	Sets	3		
	201.05	Commissioning Sheets and Installation Checklists	Sets	3		
	201.06	Labeling of all devices, equipment and cables	Sum	1		
	201.07	Drawings for approval (Engineers approval)	Sum	1		
	202.00	**Testing and commissioning**				
	202.01	Tes Tes Test and commission of the electrical installation and and and area lighting system and issue reports and and and certificates as required by the standards and and and specifications	Sum	1		
	203.01	**Training**				
	203.02	End-user training	Sum	1		
	Carried forward					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
	204.02	**Warranty**				
	204.03	Mounting structure: Workmanship guarantee/Product replacement warranty of 10 years	Sum	1		
	204.04	All inclusive post practical completion 12 month SLA for complete installation	Sum	1		
	204.05	Balance of mechanical and electrical Works: Workmanship guarantee/Product replacement warranty of 10 years	Sum	1		
	205.02	**Preliminary and General**				
	205.03	Time related P&G's	Sum	1		
	205.04	Fixed P&G's	Sum	1		
	205.05	Site establishment and disestablishment	Sum	1		
	206.02	**Other costs**				
	206.03	Allow for all costs which the Contractor may incur in terms of any or all of description in these documents and of the drawings which costs are not specifically covered in the schedule below. Submit full details. NOTE: *Value related P&G's should be included in the tendered rates*	Sum	1		
	Total carried to summary					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 3: HYDRO POWER GENERATOR *(RFER TO DETAIL SPECIFICATION AND HYDRO POWER SCHEMATIC AS SHOWN ON DWG No 111242-0000-DRG-EL-4100 Hydropower Installation Schematic* **1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.** **2. All rates shall include Supply and Install. These items shall the items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.** **3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.** **4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.** **5. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.**				
	300.00	**HYDROPOWER TURBINE**				
	300.01	Supply, deliver, install and commissioning of a 285kW Micro-Hydro Synchrous Generator including a plinth sleeves and associated installation including earthing & accessories. Other Items to be included are:	Sum	1		
	300.02	Generator Panel including a bi-directional meter, AVR and synchronising devices.	Sum	1		
	300.03	All additional items necessary to provide a complete motor control centre installation as per speicification.				
	300.04	All cabling required between the Generator Panel and the generator.	Sum	1		
	300.05	All associated pipework and accessories including valves, flanges, chambers to complete this installation.	Sum	1		
	300.06	SCADA system for remote operation	Sum	1		
	300.07	Battery back up system for protection and signalisation.	Sum	1		
	300.08	Control, Instrumentation and a Telemetry system including a Human Machine Inetrface System.	Sum	1		
	300.09	All associated control cables, cabling and wiring for the control, instrumentation and telemetry.	Sum	1		
	300.10	Radio Link - for communication to the client	Sum	1		
	300.11	12-month SLA	Sum	1		
		Carried forward				

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT

	301.00	**Ancillaries and accessories**				
	301.01	Any other item required for completion of the installation, not specified else where - specify	Sum	1		
	302.01	**Certificate of Compliance** (Inclusive of commissioning and testing)				
	302.02	Issue CoC completion of complete electrical installation	Sum	1		
		Total carried to summary				

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 4: DISTRIBUTION BOARDS **1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.** **2. All rates shall include Supply and Install. These items shall the items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.** **3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.** **4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.** **5. The electrical cable and wiring shall comply with the SANS wiring colour codes:** **Protective earth (PE) - green-yellow** **Neutral (N) - black** **Line, single phase (L) - red** **Line, three phase (L1) - red** **Line, three phase (L2) - yellow** **Line, three phase (L3) - blue** **6. Supply, testing, deliver, off-loading, and commissioning of distribution boards complete with test certifications as per SANS 61439-1 and IEC 61439-1 standards for distribution boars, including factory inspection, all equipment pre fitted in the factory complete with busbars, accessories, earthing and conduit terminations in accordance with electrical specifications.** **7. The distribution board requirements are shown on the single line diagrams (schematic diagrams) drawings.** **8. Shop drawings shall be submitted to the Engineer for formal approval before any manufacturing commences.**				
	400.00	**Distribution Boards**				
	400.01	Distribution Kiosk - DK-01	No	1		
	400.02	DB - 01 (Valve Access Chamber) Refer to single line diagram for size and rating	No	1		
	401.00	**Ancillaries and accessories**				
	401.01	Any other item required for completion of the installation, not specified else where - specify	Sum	1		
	402.00	**Certificate of Compliance**				
	402.01	Issue CoC completion of complete electrical installation	Sum	1		
	Total carried to summary					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 5: LOW VOLTAGE CABLES				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. All rates shall include Supply and Install. These items shall the items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.				
		3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		5. The electrical cable and wiring shall comply with the SANS wiring colour codes: **Protective earth (PE) - green-yellow** **Neutral (N) - black** **Line, single phase (L) - red** **Line, three phase (L1) - red** **Line, three phase (L2) - yellow** **Line, three phase (L3) - blue**				
		6. The Contractor shall supply, install and commission all the reticulation and distribution cables as specified in the cable schedules. The rate shall include for all the labeling materials required to complete the instalaltion. All cables will be installed in the ground and enter the DB's via sleeves.				
	500.00	**PVC/PVC/SWA/PVC Cu**				
	500.01	95mm², 4-Core	m	340		
	500.02	10mm², 4-Core	m	100		
	500.03	6mm², 3-Core	m	100		
	500.04	4mm², 3-Core	m	100		
	501.00	**BCEW (Bare Cu Earth Wire)**				
	501.01	95mm², 1-Core	m	340		
	501.02	6mm², 1-Core	m	100		
	501.03	4mm², 1-Core	m	200		
	502.00	**Ancillaries and accessories**				
	502.01	Any other item required for completion of the installation, not specified else where - specify	Sum	1		
	Total carried to summarv					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 6: CABLE ROUTING & WIRE WAYS				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. All rates shall include Supply and Install. These items shall the items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.				
		3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		5. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.				
	600.00	**Marker tape**				
	600.01	Supply and install PVC marker type suitably to be laid in cable trenches, 150mm wide, yellow coloured and marked "DANGER: ELECTRIC CABLE BELOW"	m	450		
	601.00	**Cable route marker**				
	601.01	500x300x300mm Concrete cable route marker plate as per specification drawing	No	8		
	602.00	**Cable trenching**				
	602.01	Excavation, backfilling, leveling and carting away of excess material to cable trenches as specified, 600mm deep for LV cabling.	m	200		
	602.02	Extra over excavation for excavation in soft rock (Provisional)	m	100		
	602.03	Extra over excavation for excavation in hard rock (Provisional)	m	100		
	602.04	Backfilling and compact of trench with imported soil (Provisional)	m	200		
	602.05	Backfilling of cable trench with imported sifted soft soil 200mm thick (Provisional)	m	200		
	603.00	**Services holes (Man holes)**				
	603.01	800mm deep, 800mm x 800mm services holes (manhole) with a heavy duty cast iron cover and frame for sleeves and to pull cabling and wiring through	No	4		
	Carried forward					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
	604.00	**Trunking, for *Electrical Wiring-(Gray)*** ***Cross-arm supports shall be wide enough to accommodate specified tray only, unless otherwise satted. Hangers to be M8, not not exceeding 1,2m spacings***				
	604.01	P9000	m	150		
	604.02	Bend	No	20		
	604.03	T-Off	No.	10		
	605.00	**Cable tray** **MILD STEEL HOT DIPTED GALV.** **PT-76 mild duty** **Supply and install galv steel cable trays complete with all wall and floor mounting P2000 supports, splicing other fixing materials required as per suppliers speifications. Cable tray earth wire at every joint.**				
	605.01	300mm x 76mm - striaght runs (excluding cover)	m	150		
	606.00	**Cable tray - Wire Mesh** **MILD STEEL HOT DIPTED GALV.** **GS-50 gridspan Wire Mesh** **Supply and install galv steel cable trays complete with all wall and floor mounting P2000 supports, splicing other fixing materials required as per suppliers speifications. Cable tray earth wire at every joint.**				
	606.01	300mm x 50mm - striaght runs	m	300		
	606.02	300mm - T-off	No	4		
	607.00	**Cable ladder -** **MILD STEEL HOT DIPTED GALV.** **Supply and install galv steel cable ladders complete with all wall and floor mounting supports, splicing other fixing materials required as per suppliers speifications. Cable tray earth wire at every joint.**				
	607.01	50mm x 50mm	m	200		
	607.02	T-offs	No	12		
	608.00	**Conduits & Wire Ways**				
	608.01	110mm diameter PVC sleeves	m	250		
	608.02	50mm diameter PVC sleeves	m	250		
	608.03	25mm GALV. steel conduit	m	250		
	608.04	32mm GALV. steel conduit	m	250		
	608.05	25mm PVC. conduit	m	250		
	609.00	**Ancillaries and accessories**				
	609.01	Any other item required for completion of the installation, not specified else where - specify	Sum	1		
	Total carried to summary					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 7: SMALL POWER & LIGHTING				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. All rates shall include Supply and Install. These items shall the items in this Bill shall include all wiring, cabling, connections, terminations, installation and termination accessories, possible cable-joints, cable-glands, cable-ties, cable-clips, clamps, shrouds, couplers, lugs, screw-caps, nuts, connectors, terminal strips, heat-shrink, insulating material, etc. for the electrical cables and conductors. It is the responsibility of the contractor to make a fully working system.				
		3. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		4. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		5. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.				
	700.00	**Supply, and install switched & unswitched socket outlets points, surface/flush mounted or flush in power skirting mounted, complete with cradle, galvanized wall-draw box, cover plate, including PVC/GALV. conduits and all conduit accessories, all mounting accessories, and wiring:**				
	700.01	16A, Dual switched socket outlet, New ZA Plug recessed in wall. (SANS-164-1&2)	No	6		
	700.02	16A, Dedicated switched socket outlet (RED)	No	6		
	700.03	16A, IP65 (water & dust proof) single switched socket outlet, surface mounted on wall. (SANS-164-1&2)	No	6		
	700.04	32A, IP65 (water & dust proof) 5-PIN, 400V, industrial welding socket outlet, surface mounted on wall. (IEC 60 309-1, -2, -4)	No	2		
	700.05	Power Skirting 2 Tier - Grey	m	10		
	701.00	**Supply, and install isolator switch power outlets points, surface/flush mounted, complete with conduits and all conduit accessories, mounting accessories, and wiring:**				
	701.01	32A, IP65 (water & dust proof) 3-Pole lockable isolator switch, for extractor fans, surface mounted.	No	4		
	702.00	**Supply, deliver and install luminaires, complete with all mounting accessories, wiring terminations. Install luminaires as per luminaire schedule in Annexure 3**				
	Carried forward					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
	702.01	**Type L5: 49W LED, 4000K** LED vapor proof industrial luminaire, surface mounted, IP66,	No	30		
	0.01	**Type L5E: 49W LED, 4000K** LED vapour proof industrial luminaire, surface mounted IP66, with electronic control gear, 60min self maintained battery back-up,	No	10		
	0.02	**Type L6: 52W LED, 4000K** LED Linear Floodlight industrial luminaire, surface mounted, IP66,	No	15		
	0.03	**Type L6E: 52W LED, 4000K** LED Linear Floodlight industrial luminaire, surface mounted IP66, with electronic control gear, 60min self maintained battery back-up,	No	5		
	0.04	**Type L2: 15-18W LED BULKHEAD, 4000K** LED industrial luminaire, surface mounted, IP65,	No	10		
	0.05	**Type L4 STREET LIGHT 55W, LED luminaire**	No	1		
	703.00	**Glavanised steel light pole, including internal wiring, circuit breakers, connectors for 4-core cabling + earth, earthing electrode, surge protection, mounting accessories and concrete foundation with reinforcement, etc.**				
	703.01	Galvanised steel light pole, 6m	No.	1		
	703.02	Cheery Picker Hire -	Sum	1		
	704.00	**Supply, deliver and install light switch points complete with cradle, cover plate, including all mounting and installation accessories with PVC/GALV. conduits and all conduit accessories, wall boxes, wiring, etc.:**				
	704.01	1 lever 1 way light switch, surface mounted	No.	2		
	704.02	1 lever 1 way WATER TIGHT light switch (water & dust proof), surface mounted	No.	2		
	704.03	Weather proof photo-cell light switch	No.	2		
	705.00	**Ancillaries and accessories**				
	705.01	Any other item required for completion of the installation, not specified else where - specify	Sum	1		
	706.00	**Test Commission and Issue CoC**	Sum	1		
	Total carried to summary					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 8: EARTHING & LIGHTNING PROTECTION				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		3. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		4. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.				
	800.00	**Design, supply, deliver and install all equipment and materials required to complete the earthing and bonding installation system for the complete valve valve, reservior, water tower, guard house and external light poles as indicated below, by a specialist installation contractor. All rates shall allow for material and labour required per item to complete the installation.**				
	800.01	E&L, Bonding Protection: Access Chamber	Sum	1		
	800.02	E&L, Bonding Protection: MCC Room	Sum	1		
	800.03	Final testing of equipment earth grid systems on completion and issuing of test certificate	Sum	1		
	801.00	**Ancillaries and accessories**				
	801.01	Any other item required for completion of the installation, not specified else where - specify	Sum	1		
	Total carried to summary					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		BILL 9: FIRE DETECTION				
		1. This Bill of Quantities shall be read in conjunction with the Installer's Scope of Work, Technical Specifications and the Engineer design drawings with all other Engineering decipline drawings.				
		2. It is the responsibility of the contractor to ensure all items are allowed for in this Bill of Quantities.				
		3. NB: It is the responsibility of the contractor to supply a fully operational and compliant system.				
		4. All items in this Bill of quantities are remeasurable and only installed Quantities will be paid for.				
		Design, supply, deliver and install all equipment and materials required to complete the earthing and bonding installation system for the complete valve valve, reservior, water tower, guard house and external light poles as indicated below, by a specialist installation contractor. All rates shall allow for material and labour required per item to complete the installation.				
	900.00	**Design, Supply and Install**				
	900.01	Design, supply, install and commissioning of a complete automated addressable Fire Detection system, by a specialist contractor.	Provisional Sum	1	R 85,000.00	R 85,000.00
	901.00	**Fire Alarm control panel**				
	901.01	Addressable fire alarm control panel, equipped for multi loops and networked together, with power supply and other specified requirements to be linked to a repeater fire panel in the guard house, and to link with the Johannesburg Water main control room via the telemetry panel.	Incl.			
	902.00	**Fire detectors**				
	902.01	Addressable smoke sensor, with an detector base	Incl.			
	902.02	Addressable thermal/smoke combination sensor, with an detector base	Incl.			
	903.00	**Break glass units**				
	903.01	Addressable, indoor, resettable break glass unit with surface box	Incl.			
	904.00	**Strobes & sounders**				
	904.01	Addressable combined sounder and strobe to be mounted on a detector base	Incl.			
	905.00	**Interface units**				
	905.01	Addressable input unit to monitor potential free contacts	Incl.			
	Carried forward					

ELECTRICAL WORKS

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
	905.02	Addressable relay output unit to switch off valve chambers, water pump units, smoke extractor fans, trigger access control fire doors, etc. and other systems.	Incl.			
	905.03	Addressable Zone Interface Unit				
	906.00	**Emergency exit sign lighting**				
	906.01	Emergency "EXIT" sign luminaire, switched by by fire alarm signal.	Incl.			
	907.00	**Ancillaries and accessories**				
	907.01	Any other item required for completion of the installation, not specified else where - specify	Incl.			
	Total carried to summary					

ELECTRICAL WORKS

REFERENC	BILL	ITEM	UNIT	QUAN-TITY	RATE	AMOUNT
	Bill 1:	ELECTRICAL APPLICATION				
	Bill 2:	PRELIMINARY AND GENERAL				
	Bill 3:	GENERATOR				
	Bill 4:	DISTRIBUTION BOARDS				
	Bill 5:	LOW VOLTAGE CABLES				
	Bill 6:	CABLE ROUTING & WIRE WAYS				
	Bill 7:	SMALL POWER & LIGHTING				
	Bill 8:	EARTHING & LIGHTNING PROTECTION				
	Bill 9:	FIRE DETECTION				R -
	TOTAL ELECTRICAL WORKS CARRIED TO SUMMARY					

OPERATING AND MAINTENANCE MANUALS

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
ZUT 0002	**20**	**OPERATING AND MAINTENANCE MANUALS** **DRAWING 111242-0000-DR-WW-0516 to 0519**				
	20.01	Supply and Deliver O&M manual (for all components shown and referenced in drawings)	Sum	1		
Total carried to summary						

MANUALLY OPERATED CHAIN HOIST

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
ZUT 1003	**30**	**MANUALLY OPERATED CHAIN HOIST**				
1003.15.1	**30.01**	**Supply and Deliver**				
	30.01.01	3 Ton manually operated chain hoist complete with accessories	No.	1		
	30.01.02	1 Ton manually operated chain hoist complete with accessories	No.	1		
1003.15.2	**30.02**	**Installation, Testing and Commissioning**				
	30.02.01	3 Ton manually operated chain hoist complete with accessories	No.	1		
	30.02.02	1 Ton manually operated chain hoist complete with accessories	No.	1		
Total carried to summary						

VENTILATION

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
ZUT 1008	**40**	**VENTILATION** **DRAWING 111242-0000-DR-WW-0516 and 0518**				
1008.17.1	**40.01**	**Supply and Deliver**				
	40.01.01	Louvred roof cowls, complete with shoe, upstand base bracket and vermin mesh 1000 mm (W) x 1000 mm (B) x 660 mm (H)	No.	2		
	40.01.02	400 Diam. Jet Fans, complete with anti-vibration ceiling mount foot brackets and earthing connections	No.	3		
1008.17.2	**40.02**	**Installation, Testing and Commissioning**				
	40.02.01	Louvred roof cowls, complete with shoe, upstand base bracket and vermin mesh 1000 mm (W) x 1000 mm (B) x 660 mm (H)	No.	2		
	40.02.02	400 Diam. Jet Fans, complete with anti-vibration ceiling mount foot brackets and earthing connections **DRAWING 111242-0000-DR-WW-0516 to 0517**	No.	3		
1008.17.1	**40.03**	**Supply and Deliver**				
	40.03.01	Ventilation supply system for Chamber PI22: - 2 x Axial fans complete with floor mouted foot brackets and earthing connection - 3240 l/s @ 400 Pa. - 2 x 2.2 kW, 3 phase isolators. - Associated air terminals, spiral ducting, fittings, plenums, filter banks, support brackets and ancillaries as per drawing 111242-DR-WW-0516	No.	1		
	40.03.02	Ventilation extraction system for the Chamber PI23: - 2 x Axial fans complete with floor mouted foot brackets and earthing connection - 3240 l/s @ 200 Pa. - 2 x 2.2 kW, 3 phase isolators. - Associated air terminals, spiral ducting, fittings, support brackets and ancillaries as per drawing 111242-DR-WW-0517.	No.	1		
	40.03.03	Control panel, thermostats and connections	No.	1		
Total carried to summary						

VENTILATION

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
1008.17.2	**40.04**	**Installation, Testing and Commissioning**				
	40.04.01	Ventilation system for the Hydropower unit (see item 40.03.01 and 40.03.03)	No.	1		
	40.05	**Others**				
	40.05.01	Others (please state any other items necessary to complete the installation and allow full functionality the ventilation system)	Sum	1		
		P&G's for Ventilation system	**Sum**	**1**		
Total carried to summary						

HYDROPOWER

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
	900	**HYDROPOWER**				
	900.01	**Supply, Deliver and Commission**				
	900.01.01	One pump as turbine for 189 kW capacity, including associated generator, isolation valves, instrumentation, cooling and lubrication unit for generator, intermediate spool pieces, auxiliary electrical and mechanical equipment where required. Price to include for the design, transport, installation, commissioning, testing and training	Sum	1		
	900.02	**Others**				
	900.02.01	Others (please state any other items necessary to complete the installation and allow full functionality the hydropower system)	Sum	1		
Total carried to summary						

SUMMARY

PAYMENT REFERS	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
SUM		**SUMMARY**				
ZUT 0002		Operating and Maintenance Manuals				
ZUT 1003		Lifting Equipment				
ZUT 1008		Ventilation				
-		Hydropower				
TOTAL MECHANICAL WORKS CARRIED TO SUMMARY						

PARTICULAR SPECIFICATION PC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
PART PC	**PC 10**	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 2				
	PC.11	**Design and site establishment**	sum	1		
	PC.12	**Temporary works for directional drilling**	sum	1		
	PC.13	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 630 mm dia hdpe pipe	m	46		
	PC.14	**Extra over items PC 12 and PC 13 for unforeseen rock or boulders**	m^3	14		
	PC.16	**De-establish quipment on site**	sum	1		
	PC.17	**Standing time for directional drilling team and equipment**	h	40		
	PC.18	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
	PC 20	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 3				
	PC.21	**Design and site establishment**	sum	1		
	PC.22	**Temporary works for directional drilling**	sum	1		
	PC.23	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 630 mm dia hdpe pipe	m	62		
	PC.24	**Extra over items PC 22 and PC 23 for unforeseen rock or boulders**	m^3	19		
	PC.26	**De-establish quipment on site**	sum	1		
	PC.27	**Standing time for directional drilling team and equipment**	h	40		
	PC.28	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
PART PC	Carried forward					

PARTICULAR SPECIFICATION PC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
	PC 30	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 4				
	PC.31	**Design and site establishment**	sum	1		
	PC.32	**Temporary works for directional drilling**	sum	1		
	PC.33	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 630 mm dia hdpe pipe	m	49		
	PC.34	**Extra over items PC 32 and PC 33 for unforeseen rock or boulders**	m^3	15		
	PC.36	**De-establish quipment on site**	sum	1		
	PC.37	**Standing time for directional drilling team and equipment**	h	40		
	PC.38	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
	PC 40	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 5				
	PC.41	**Design and site establishment**	sum	1		
	PC.42	**Temporary works for directional drilling**	sum	1		
	PC.43	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 630 mm dia hdpe pipe	m	52		
	PC.44	**Extra over items PC 42 and PC 43 for unforeseen rock or boulders**	m^3	16		
	PC.46	**De-establish quipment on site**	sum	1		
	PC.47	**Standing time for directional drilling team and equipment**	h	40		
	PC.48	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
PART PC	Carried forward					

PARTICULAR SPECIFICATION PC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
	PC 50	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 10				
	PC.51	**Design and site establishment**	sum	1		
	PC.52	**Temporary works for directional drilling**	sum	1		
	PC.53	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 710 mm dia hdpe pipe	m	38		
	PC.54	**Extra over items PC 52 and PC 53 for unforeseen rock or boulders**	m^3	15		
	PC.56	**De-establish quipment on site**	sum	1		
	PC.57	**Standing time for directional drilling team and equipment**	h	40		
	PC.58	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
	PC.58	.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
	PC 60	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 11				
	PC.61	**Design and site establishment**	sum	1		
	PC.62	**Temporary works for directional drilling**	sum	1		
	PC.63	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 710 mm dia hdpe pipe	m	45		
	PC.64	**Extra over items PC 62 and PC 63 for unforeseen rock or boulders**	m^3	18		
	PC.66	**De-establish quipment on site**	sum	1		
	PC.67	**Standing time for directional drilling team and equipment**	h	40		
	PC.68	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
PART PC	Carried forward					

PARTICULAR SPECIFICATION PC

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		Brought forward				
	PC 70	**DIRECTIONAL DRILLING**				
		DRILLING: ROAD CROSSING 12				
	PC.71	**Design and site establishment**	sum	1		
	PC.72	**Temporary works for directional drilling**	sum	1		
	PC.73	**Directional drilling and installation of pipe or cable sleeve:**				
		.01 630 mm dia hdpe pipe	m	30		
	PC.74	**Extra over items PC 72 and PC 73 for unforeseen rock or boulders**	m^3	9		
	PC.76	**De-establish quipment on site**	sum	1		
	PC.77	**Standing time for directional drilling team and equipment**	h	80		
	PC.78	**Stabilization of unstable areas or grouting of voids where ordered:**				
		.01 Provision and establishment of equipment on Site, and removal on completion of operation	sum	1		
		.02 Operation of equipment	day	10		
		.03 Materials used	m^3	10		
	TOTAL SECTION PARTICULAR SPECIFICATION PC CARRIED TO SUMMARY					

PARTICULAR SPECIFICATION PD

PAYMENT REFERS TO	ITEM NO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
PD 10		**BUILDING WORK**				
	PD.01	**Brickwork:**				
		.01 230 mm thick, outside face: face brick standard/extra/aesthetic, inside face: non-facing plastered/extra, engineering bricks	m²	548		
		.02 230 mm thick, NFX solid plastered/ extra, engineering bricks	m²	548		
	PD.02	**Plaster work:**				
		.01 15mm thick, steel-float finish	m²	460		
	PD.08	**Miscellaneous work:**				
		.01 2 x 50mm dia nextube sleeves @ 2500c/c	sum	1		
	PD.09	**4 mm Derbigum fusion bonded waterproofing including turn-ups, sealing along edges and** bituminous paint coat:				
		.01 Flat roofs including sides and tops of upstand beams	m²	114		
		.02 Soild insecticide poisoning under footings, bases, floors, etc as specified by the Architect with a ten year guarantee	m²	140		
	TOTAL PARTICULAR SPECIFICATION PD CARRIED TO SUMMARY					

Johannesburg Water SOC Ltd

Johannesburg Water

CONTRACT JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 2A

PART 3: SCOPE OF WORK

C3.1 SCOPE OF WORK

C3 PREAMBLE TO SCOPE OF WORK

GENERAL

The Standard Specification for all associated civil work shall be the SANS 1200 and the SANS 2001 – Standardized Specification for Civil Engineering Construction.

The Standardized Specifications applicable to this Contract are listed in the Project Specification.

These Specifications are not issued with this volume but are available at the Contractor's expense from: SA Bureau of Standards, Private Bag X191, Pretoria, 0001.

SCOPE

This Project Specification is set out in three portions:

Portion 1: SCOPE OF WORK covers a general description of the project, the facilities available and the requirements to be met.

Portion 2: GENERIC SPECIFICATIONS covers variations to the standardized specifications which are applicable to the contract.

Portion 3: PARTICULAR SPECIFICATIONS covers particular specifications which are applicable to the contract.

STATUS

The Project Specifications together with the drawings and Schedule of Quantity indicate the section of Standard Specification applicable to this Contract.

In the event of any discrepancy between parts of the Standard Specification and the Project Specifications, the latter shall take precedence and shall govern.

Should any requirement of the Particular Project Specification conflict with any requirement of the Project Specification or Variations and Additions to the Standardised Specifications, the requirements of the Particular Project Specifications shall prevail.

C3.1 SCOPE OF WORK

In the event of any discrepancy between the Scope of Works and a part or parts of the SANS 1200 Standardized Specifications, the Bill of Quantities or the Drawings, the Project Specifications shall take precedence and prevail in the Contract.

C3.1.1 DESCRIPTION OF THE WORKS

C3.1.1.1 EMPLOYER'S OBJECTIVES

The employer's objective is to augment the current water supply in the Halfway House Water Distribution Sib-district and increase storage capacity within the Halfway House Water Distribution Sub-District. This will result in the improvement of availability of water for the current and future demands. This project entails the construction of bulk water pipelines to commission the new 25ML Halfway House Reservoir.

C3.1.1.2 OVERVIEW OF THE WORKS

This Contract comprises inter alia of the construction of new bulk water pipelines to commission the new 25ML Halfway House Reservoir.

The work is broadly described, but not limited to deliver:

(a) The installation of pipelines including:

a. A new bulk water steel feeder pipeline, 600mm in diameter, extending approximately 3km from an existing water meter chamber located at the intersection of Dale Road and K101 Old Pretoria Main Road, running parallel to the K101 Main Road, and terminating at the location of a new 25ML Halfway House Reservoir.

b. A new bulk water steel supply pipeline, 700mm in diameter, extending approximately 1.4km from the new 25ML Halfway House Reservoir and terminating at the connection point to the start of an existing 800mm diameter steel pipeline. This connection point is located at the intersection of K101 Old Pretoria Main Road and Bridal Veil Road.

c. A new bulk water steel supply pipeline, 700mm in diameter, extending approximately 2.8km from the connection point to the end of the existing 800mm diameter steel pipeline and terminating at a point located at the intersection of Jukskei View Drive and Maxwell Drive.

d. A new bulk water steel supply pipeline, 600mm in diameter, extending approximately 0.6km from the point located at the intersection of Jukskei View Drive and Maxwell Drive and terminating at a point located at the intersection of Allandale Road and Harry Gaulaun Drive.

(b) Thirteen pipe crossings, comprising of:

a. Five pipe jacking crossings, and

b. Eight horizontal drilling crossings.

(c) Location of existing services not identified by other Utilities and Agencies.

(d) Cathodic protection of the entire steel pipeline.

(e) Installation of new valves and valve chambers as shown on the drawings.

(f) Reinstatement along the pipeline route of the same or higher condition as the original.

(g) Correction of defects in the Works in accordance with the requirements specified in the Contract Documents.

C3.1.1.3 LOCATION OF THE WORKS

The pipeline will be constructed into two sections. The first section will extend from an existing water meter chamber located at the intersection of Dale Road and K101 Old Pretoria Main Road, run parallel to the K101 Main Road, and terminate at the location of a new 25ML Halfway House Reservoir. The second section will extend from the new 25ML Halfway House Reservoir, terminate at the connection point to the start of an existing 800mm diameter steel pipeline, the continue from the connection point to the end of the existing 800mm diameter steel pipeline and terminate at a point located at the intersection of Allandale Road and Harry Gaulaun Drive.

Figure1: Locality Plan – Section One of Pipeline Route

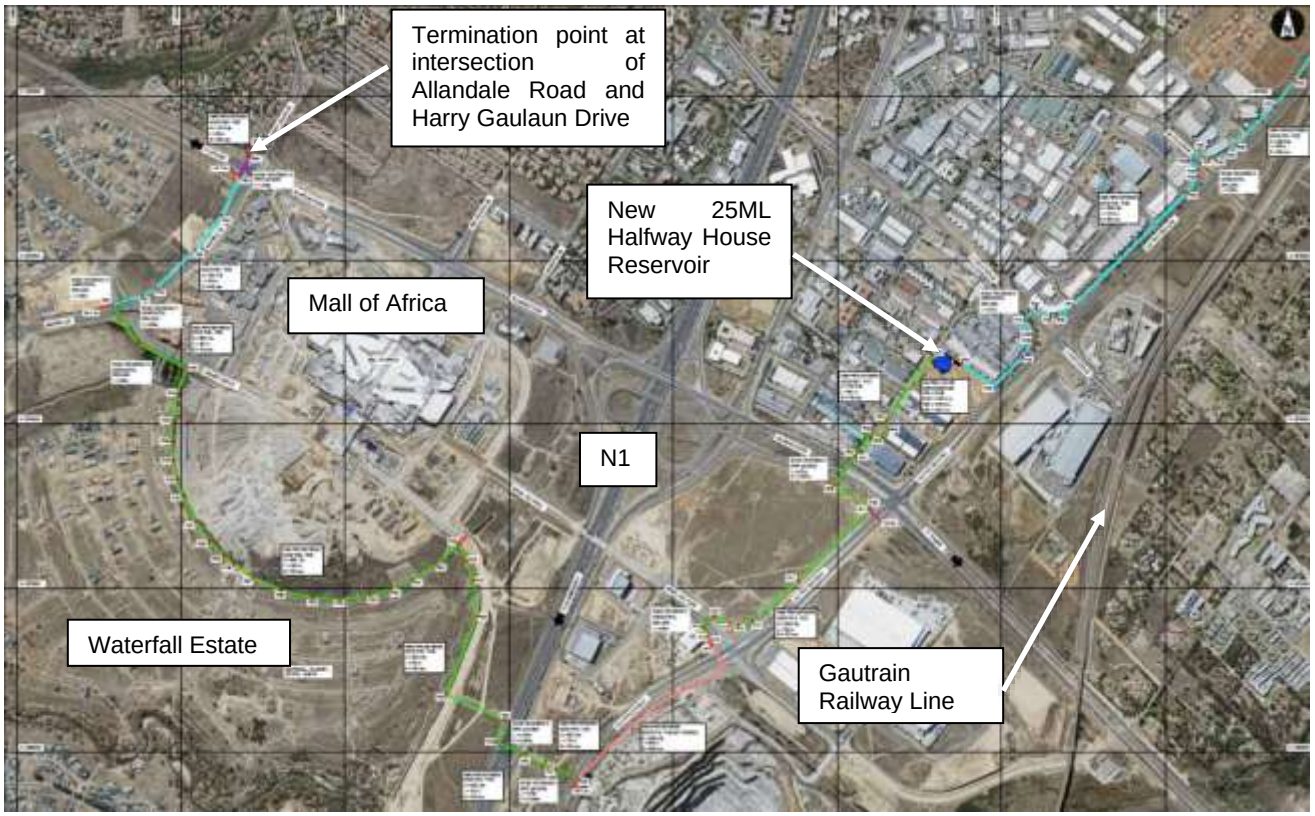

Figure1: Locality Plan – Section Two of Pipeline Route

C3.1.1.4 TEMPORARY WORKS

The Contractor shall construct all temporary works as required by the Contractors Construction method. The tendered rates shall include full compensation for all temporary works.

Furthermore the Contractor must ensure that no stockpiling of materials, plant, Excavated materials or any other construction related infrastructure shall be allowed in locations that may interfere with the operations of the Employer and the general public.

C3.1.2 ENGINEERING

C3.1.2.1 DESIGN

(a) The Employer is responsible for the design of the permanent Works as reflected in the Contract Documents unless otherwise stated.

(b) The Contractor is responsible for the design of the temporary Works and their compatibility with the permanent Works.

(c) The Contractor shall supply all details necessary to assist the Engineer in the compilation of the as-built drawings.

C3.1.2.2 EMPLOYER'S DESIGN

The employer's design is as detailed in the documentation and on the drawings.

C3.1.2.3 CONTRACTOR'S DESIGN

Where the Contractor is to supply the design of designated parts of the permanent Works or temporary Works he shall supply full working drawings supported by a professional engineer's design certificate. Approval from the Engineer is required prior to the commencement of any works.

C3.1.2.4 DRAWINGS

The Contractor shall use only the dimensions stated in figures on the Drawings in setting out the Works, and dimensions shall not be scaled from the Drawings, unless required by the Engineer. A list of the tender drawings is provided in Volume 4 of the tender document. Construction drawings will be issued to the successful tenderer, prior to commencement of construction. The Engineer will, on the request of the Contractor in accordance with the provisions of the Conditions of Contract, provide such dimensions as may have been omitted from the Drawings.

The Contractor shall ensure that accurate as-built records are kept of all infrastructure installed or relocated during the contract. The position of pipe bends, junction boxes, duct ends, and all other underground infrastructure shall be given by either co-ordinates, or stake value and offset. Where necessary, levels shall also be given. A marked-up set of drawings shall also be kept and updated by the Contractor. This information shall be supplied to the Engineer's Representative on a regular basis.

All information in possession of the Contractor, required by the Engineer and/or the Engineer's Representative to complete the as-built/record drawings, must be submitted to the Engineer's Representative before a Certificate of Completion will be issued.

The Drawings prepared by the Employed for the permanent Works are listed and bound at the back of this volume. The Employer reserves the right to issue amended and/or additional drawings during the Contract.

C3.1.2.5 DESIGN PROCEDURES

All design and modifications thereto shall be communicated in writing and the Contractor and engineer shall maintain lists to record and track all transactions.

C3.1.3 PROCUREMENT

C3.1.3.1 PREFERENTIAL PROCUREMENT

The Employer's promotes preferential procurement. The philosophy of the process and mechanics of the points scoring system are described in section JW10, which is included in the returnable documents section T2.2.

C3.1.3.2 SUBCONTRACTING

Some specialized work could be subcontracted, including CP and AC Mitigation installations, horizontal drilling and the Hydropower supply and design. The Contractor must take note of the following clause in the Standard Conditions of Contract.

The minimum requirements of the sub-contractors are as follows:

1. Valid CK registration

2. SA ID copies of owners

3. Active CIDB membership

4. Valid Tax clearance certificate

5. Valid BBBEE certificate

6. COID certificate

7. Company Profile including similar experience and skilled personnel CVs

8. Health and Safety Plan

The main contractor is:

a) to enter into contract with the above sub-contractor(s) including any other subcontractors (for specialised work, if any) in accordance with the requirements of the Standard Conditions of Contract. The sub-contractor(s)' nomination will be determined by the scope of work and the amount of work that is to be carried out.

b) required to utilise local labour for the completion of unskilled labour-based sections of the works, where practical.

c) Responsible for all work executed (QUALITY, CONTRACTUAL LIABILITIES) on his behalf or under his supervision and/or management by all sub-contractors, including nominated subcontractors. The Engineer shall, prior to the commencement date of the contract, determine the scope of work and the amount of work that is to be carried out by the nominated subcontractor(s). If applicable, the Contractor shall be expected to enter into a contract with the nominated subcontractor(s) in accordance with the requirements of the Standard Conditions of Contract.

***NOTA BENE**: The Engineer shall not negotiate directly with sub-contractors and all problems relating to payments, programming, workmanship, etc., are matters between the Contractor and his sub-contractors.*

C3.1.4 CONSTRUCTION

C3.1.4.1 WORKS SPECIFICATIONS

C3.1.4.1.1 Applicable SANS 2001 and SANS 1200 Standardized Specifications

These specifications are included under section C.3.2 of this document.

C3.1.4.1.2 Particular Specifications

The following Particular Specifications for work not covered by the SANS 1200 and SANS 2001 Standardized Specifications are also included hereunder:

C3.1.4.1.2.1 Civil

These additional specifications are included under section C.3.3.1 of this document.

C3.1.4.1.2.2 Mechanical

These additional specifications are included under section C.3.3.2 of this document.

C3.1.4.1.2.3 Structural

These additional specifications are included under section C.3.3.3 of this document.

C3.1.4.1.2.3 Electrical

These additional specifications are included under section C.3.3.4 of this document.

C3.1.4.1.2.3 Control and Instrumentation

These additional specifications are included under section C.3.3.5 of this document.

C3.1.4.1.3 Variations and Additions to the SANS 1200 Standardized Specifications

These specifications are included under section C.3.2 of this document.

C3.1.4.2 CONSTRUCTION PROGRAMMING

C3.1.4.2.1 Programmes and reports required

In addition to the requirements of Clause 5.6.2 of the Conditions of Contract, the following requirements shall prevail:

Contractual programme

A contractual programme, meaning: a chart showing the different sections of construction making up the Works and the order, resourcing, and sequence in which the work is to be carried out in order to achieve completion on the prescribed dates shall be submitted with the Contractor's tender. This programme shall, upon the Engineer's agreement in writing, become binding on the parties to the contract. Such a programme shall include for possible delays for inclement weather. The Contractual programme shall in addition clearly indicate any Contractor's float as may be applicable.

Construction programme

A construction programme, meaning: an agreed chart which shall be used to monitor the progress of the works, shall be submitted within 14 days of agreement of the contractual programme by the Engineer. This chart shall, as far as is practical, be based upon the agreed contractual programme,

but shall not in any way relieve either party of their obligations or rights in terms of the contractual programme or the contract. The chart shall show the different sections of the Works suitably divided into elements and activities, clearly indicating the start and completion dates of each activity and element against which the progress shall be monitored. The Contractor is advised to determine the programming requirements of clause 5.6 in the Standard Conditions of Contract described below.

Reports required

The Contractor shall provide the Engineer a fortnightly report detailing the following:

a) Date of report.

b) Working days elapsed from start.

c) Working days left to contractual completion and/or key dates and forecast of any slippage envisaged.

d) Percentage of work complete per activities on construction programme and forecast remaining time and resources required.

e) Supervisory staff and labour force on site.

f) List of constructional plant.

g) Delays encountered.

h) Information required.

i) Variation Orders and site instructions received.

j) Claims status (if any).

k) Weather delays.

l) Signature of site agent.

The Contractor shall in addition provide the Employer with weekly returns showing the number and grade of Employees employed and the number and type of Constructional Plant on site.

C3.1.4.2 SITE ESTABLISHMENT

C3.1.4.2.1 Services and facilities provided by the Employer

(a) Water sources

A reticulated potable water supply is available in the vicinity of the Site. The responsible water supply authority in the area of the Site is Johannesburg Water. Should the Contractor wish to utilise such water supply, he shall himself be responsible for making his own arrangements with the responsible water supply authority for the supply of all water that he may require from such reticulation network for construction purposes as well as for domestic consumption. If so required by the responsible water supply authority, the Contractor shall further be responsible, at his own cost, for making or otherwise providing metered connections to the available services at the positions specified by the water authority, as well as for the removal of such connections on completion of the Contract. No warranty is offered or given by the Employer that the existing available reticulated water supply will necessarily be adequate for the Contractor's purposes nor that such supply is in any way is guaranteed.

All charges as may be levied by the responsible water supply authority in respect of water consumed by the Contractor shall be for the Contractor's account and payment to the Contractor in respect thereof shall, be deemed to be included in the sums bid by the Contractor for the various Preliminary and General items listed in the Bill of Quantities, as well as in the rates bid by the Contractor for the various other items listed in the Bill of Quantities which require the consumption of water.
The Contractor shall, when reasonably required by the Engineer, produce documentary proof that all amounts as may have become due and payable by the Contractor to the responsible water authority have been promptly paid in full.

(b) Electricity supply

A reticulated electrical power supply is available in the vicinity of the Site. The responsible electricity supply authority in the area of the Site is City Power. Should the Contractor, wish to avail himself of such supply, he shall, at his own cost, be responsible for making his own arrangements with the responsible electricity supply authority for the supply of all electrical power he may require from such reticulation network for construction purposes as well as for domestic consumption. If so required by the responsible electricity supply authority, the Contractor shall, at his own cost, be responsible for making metered connections to the available services at the positions specified by the electricity supply authority, as well as for the removal of such connections on completion of the Contract. No warranty is offered or given by the Employer that the existing available reticulated electrical power supply will necessarily be adequate for the Contractor's purposes nor that its supply is in any way guaranteed.

All charges as may be levied by the responsible electricity supply authority in respect of electrical power consumed by the Contractor shall be for the Contractor's account and payment to the Contractor in respect thereof shall, be deemed to be included in the sums bid by the Contractor for the various Preliminary and General items listed in the Bill of Quantities, as well as in the rates bid by the Contractor for the various other items listed in the Bill of Quantities which require the consumption of electricity.

The Contractor shall, when reasonably required by the Engineer, produce documentary proof that all amounts as may have become due and payable by the Contractor to the responsible electricity supply authority have been promptly paid in full.

(c) Excrement disposal

The Contractor shall make use of Chemical Toilets. All costs for the maintenance and cleaning of the facilities shall be borne by the Contractor and shall be deemed to be included in the sums bid by the Contractor for the Various Preliminary and General items listed in the Bill of Quantities.

(d) Area for Contractor's site establishment

A specific area in close proximity to or on the Site of the Works will be made available by the Employer to the Contractor for the Contractor's site establishment. The specific area for the Contractor's site establishment will be identified to the Contractor by the Engineer and the Contractor shall have sole use of such area, free of charge, for the duration of the Contract. The Contractor shall use this area only for the purposes of erecting his site offices, workshops, stores and other facilities required for the execution of the Contract. The Contractor shall not use the area nor allow it to be used for any purposes not directly associated with the execution of the Contract. The Contractor shall be responsible for arranging, at his own cost, for the provision of all services he may require in the area, as well as elsewhere on the Site.

Should the Contractor deem the area made available by the Employer to be inadequate or unsuitable for the Contractor's particular needs, then the Contractor shall be at liberty to make

his own arrangements with the owners of other sites which he considers are better suited to his needs; provided always that the use by the Contractor of any area other than that made available to him by the Employer shall be subject to the prior written approval of the Engineer, which approval shall not be unreasonably withheld; and provided further that the Contractor shall have no claim against the Employer in respect of any costs incurred by him, either directly or indirectly in consequence of utilising any area other than that made available to him by the Employer, and which costs exceed those costs allowed for by the Contractor in his Bid.

C3.1.4.2.2 Facilities provided by the Contractor

(a) Facilities for the Engineer

The Contractor shall provide on the Site, for the duration of the Contract and for the exclusive use of the Engineer and/or his Representative (as applicable), the various facilities described hereunder. All such facilities shall be provided promptly on the commencement of the Contract and failure on the part of the Contractor to provide any facility required in terms of this specification shall constitute grounds for the Engineer to withhold payment of the Contractor's tendered Preliminary and General items until the facility has been provided or restored as the case may be.

(i) Office accommodation

The Contractor shall provide on the Site one (1) office for the exclusive use of the Engineer. Such office shall comply with and be furnished in accordance with the requirements of subclause 3.2 of SANS 1200 AB. The Contractor shall maintain the office(s) in accordance with the requirements of subclause 5.2 of SANS 1200 AB. Such office accommodation shall be provided within the Contractor's site establishment facilities.

(ii) Carports

The Contractor shall provide on Site for the duration of the Contract, **eight** (8) carports for the sole use of the Client, the Engineer and his staff. Each carport shall be constructed so that the vehicle parked under it is always protected against the direct rays of the sun. The carport area shall be at least 20 m² and the floor shall be covered with a layer of crushed stone to alleviate dusty and muddy conditions. The carport(s) shall be positioned to provide easy and convenient access to the Engineer's office.

(iii) Site meeting venue

The Contractor shall provide within his own site establishment facilities, a suitably furnished office or other venue capable of comfortably accommodating a minimum of **twenty-four** (24) persons at site meetings. The Engineer shall be allowed free use of such venue for conducting any other meetings concerning the Contract at all reasonable times.

(iv) Contract nameboards

The Contractor shall provide, erect and maintain **two** (2) contract nameboards at such positions and locations directed by the Engineer, which nameboards shall, unless otherwise specified elsewhere in the Contract, comply with the recommendations for the standard board of the South African Association of Consulting Engineers, with regard to size, painting, decorating and detail, and the requirements described hereunder.

Each nameboard shall be made of tempered hardboard with a thickness of at least 12 mm, so braced on the reverse side as to prevent warping and shall be mounted on two

or more, as necessary, firmly planted poles. The painting of the boards shall comply with the relevant requirements of CKS 193 and the colours of the paints shall be an acceptable match to the applicable colours given in SANS 1091. The Contractor shall keep the contract nameboards in good state of repair for the duration of the Contract and shall remove them on completion of the Contract.

(v) Survey equipment and assistants

Survey equipment

The Contractor shall, for the duration of the Contract, provide the following survey equipment for the exclusive use of the Engineer and his staff:

- 1 upright reading automatic level with tripod;
- 1 metric levelling staff with protective cover bag;
- 6 ranging rods;
- 1 100 metre Stilon tape measure;
- 1 ± 2 kg hammer.

Whenever reasonably required by the Engineer, the Contractor shall make available to the Engineer or his representative, the following additional survey equipment:

- 1 tacheometer with tripod;
- 1 survey staff for tacheometer;
- 1 Distomat, complete with tripod and fully charged battery.

All such survey equipment provided by the Contractor shall be in good condition, properly calibrated and fit for the purpose and shall be kept fully serviceable at all times by the Contractor at his own cost. The Contractor shall have any defective equipment repaired or replaced at his own cost within 12 hours after notification by the Engineer's staff. Where required by the Engineer, the Contractor shall at his own cost, promptly arrange for the recalibration of survey equipment provided.

(vi) Telephone facilities

Cellphones
The Contractor shall pay the Engineer the fixed cost items scheduled in the bill to provide these services.

(viii) Electricity supply for the Engineer

All electricity supply to the Engineer's office(s) and laboratory (if applicable), whether provided by the Contractor by way of a reticulated supply from a local authority or other authorised electricity supply, or by way of on-site generators, shall be regulated by the Contractor to within limits such as to prevent damage due to fluctuations in the electrical current supply that may occur to any electrical plant and equipment provided by the Contractor or the Engineer.

The Contractor shall be liable for and pay to the Engineer on demand, all costs that the Engineer may incur in the repair or replacement of any electrical equipment provided by the Engineer on the Site. Reliance by the Contractor on the regulation of the electrical supply by the supplier or on current regulators fitted to generators

shall not absolve the Contractor of his liabilities in terms of this Subclause and, where appropriate, the Contractor shall provide and install at his own cost, all such electrical current-regulating equipment as is necessary to prevent damage to the said equipment.

(ix) Site instruction book

The Contractor shall keep a triplicate book for site instructions on the Site at all times.

(b) Water

The Contractor shall, at his own expense, be responsible for obtaining and providing all water as may be required for the purposes of executing the Contract, including water for both construction purposes and domestic use, as well as for making all arrangements in connection therewith. The Contractor shall further, at his own expense, be responsible for providing all necessaries for procuring, storing, transporting and applying water required for the execution of the Contract, including but not limited to all piping, valves, tanks, pumps, meters and other plant and equipment, as well as for all work and superintendence associated therewith. The sources of all water utilised for the purposes of the Contract shall be subject to the prior approval of the Engineer, which approval shall not be unreasonably withheld. The Contractor shall comply with all prevailing legislation in respect of drawing water from natural and other sources and shall, when required by the Engineer, produce proof of such compliance. The distribution of water shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations.

All water provided by the Contractor for construction purposes shall be clean, free from undesirable concentrations of deleterious salts and other materials and shall comply with any further relevant specifications of the Contract. The Contractor shall, whenever reasonably required by the Engineer, produce test results demonstrating such compliance. Water provided by the Contractor for human consumption shall be healthy and potable to the satisfaction of the health authorities in the area of the Site.

No separate payment will be made to the Contractor for the obtainment, providing and consumption of water, the costs of which will be deemed to be included in the Contractor's bid rates.

(c) Electricity

The Contractor shall, at his own expense, be responsible for obtaining and providing all electricity as he may require for the purposes of executing the Contract, including electricity for both construction purposes and domestic use, as well as for making all arrangements in connection therewith. The distribution of electricity shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations. No separate payment will be made to the Contractor for the obtainment, providing and consumption of electricity, the costs of which will be deemed to be in the Contractor's tendered rates and prices.

(d) Excrement disposal

The Contractor shall, at his own expense, be responsible for safely and hygienically dealing with and disposing of all human excrement and similar matter generated on the Site during the course of the Contract, to the satisfaction of the responsible health authorities in the area of the Site and the Engineer. All such excrement shall be removed from the Site and shall not be disposed of by the Contractor on the Site. The Contractor shall further comply with any other requirements in this regard as may be stated in the Contract.

No separate payment will be made to the Contractor in respect of discharging his obligations in terms of this subclause and the costs thereof shall be deemed to be included within the Contractor's tendered Preliminary and General items.

C3.1.4.2.3 Site usage

The site shall only be used for the construction of the works.

C3.1.4.2.4 Permits and wayleaves

The Employer shall if required, be responsible to obtain all the wayleaves required for this Contract.

C3.1.4.2.5 Features requiring special attention

(a) Site maintenance

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner and shall keep the Site free from debris and obstructions.

b) Testing and quality control

(i) Contractor to engage services of an independent laboratory

Notwithstanding the requirements of the Specifications pertaining to testing and quality control, the Contractor shall engage the services of an approved independent laboratory to undertake all testing of materials, the results of which are specified in, or may reasonably be inferred from, the Contract. These results will be taken into consideration by the Engineer in deciding whether the quality of materials utilised, and workmanship achieved by the Contractor comply with the requirements of the Specifications. The aforegoing shall apply irrespective of whether the specifications indicate that the said testing is to be carried out by the Engineer or by the Contractor. The Contractor shall be responsible for arranging with the independent testing laboratory for the timeous carrying out of all such testing specified in the Contract, at not less than the frequencies and in the manner specified. The Contractor shall promptly provide the Engineer with copies of the results of all such testing carried out by the independent laboratory. For the purposes of this clause, an "independent laboratory" shall mean an "approved laboratory" (as defined in subclause PSA 7.2) which is not under the management or control of the Contractor and in which the Contractor has no financial interest, nor which has any control or financial interest in the Contractor.

The Engineer shall be entitled at times during the Contract to require that the Contractor arrange with the independent laboratory to carry out any tests, at such times and at such locations in the Works as the Engineer shall prescribe. The Contractor shall promptly and without delay arrange with the independent laboratory for carrying out all such additional testing as required by the Engineer, and copies of the test results shall be promptly submitted to the Engineer.

(ii) Costs of testing

(a) <u>Tests</u>

The costs of all testing carried out by the independent laboratory, above shall be borne by the Contractor and shall be deemed to be included in the tendered

rates and prices for the respective items of work as listed in the Schedule of Quantities and which require testing in terms of the Specifications. No separate payments will be made by the Employer to the Contractor in respect of any testing.

Where, as a result of the consistency of the materials varying or as a result of failure to meet the required specifications for the work, it becomes necessary to carry out additional tests (eg re-tests on rectified work and/or replacement materials), the costs of such additional testing shall be for the Contractor's account.

(b) Additional tests required by the Engineer

The costs of any additional tests required by the Engineer shall be reimbursed to the Contractor against substitution of the Provisional Sum allowed therefore in the Schedule of Quantities; provided always that the costs of any such additional tests ordered by the Engineer, the results of which indicate that the quality of the materials utilised and/or the standard of workmanship achieved are/is not in accordance with the specifications, shall not be reimbursable to the Contractor.

(c) Subcontractors

All matters pertaining to Subcontractors (including Nominated Subcontractors) and the work executed by them shall be dealt with directly between the Engineer and the Contractor in the context of all subcontract work being an integral part of the Works for which the Contractor is responsible. The Engineer will not liaise directly with any Subcontractors nor will he issue instructions concerning the subcontract works directly to any Subcontractor. It is the responsibility of the Contractor to ensure that all documentation or instructions issued to the Contractor are adequately communicated to the relevant Subcontractor. All matters arising from the subcontract agreements shall be dealt with directly between the Contractor and the Subcontractors and the Engineer will not become involved.

The identical Safety, Health and Environment requirements shall apply to Subcontractors and it is the duty of the Contractor to enforce the application of such requirements.

(d) Access to properties

The Contractor shall organise the work to cause the least possible inconvenience to the public and to the property owners adjacent to or affected by the work, and except as hereunder provided, shall at all times provide and allow pedestrian and vehicular access to properties within or adjoining or affected by the area in which he is working.

The Contractor shall ensure access to the site for the affected land owners is available 24 hours per day. The Contractor shall notify the affected land owner in writing at least 72 hours but not more than 120 hours in advance prior to work commencement within the affected property. The Contractor shall carry out the work expeditiously and with minimum inconvenience to the occupiers and to owners of adjacent property. The Contractor shall take all necessary precautions for the protection of persons, livestock, buildings and property. The Contractor shall provide temporary fences separating the works from the Resident where required. Vehicular access must be maintained to properties at the end of each day's work unless the Contractor has made alternative arrangements with the occupiers.

If, as a result of restricted road reserve widths and the nature of the work, the construction of bypasses is not feasible, construction shall be carried out under traffic conditions to provide access to erven and properties. Notwithstanding the aforegoing, the Contractor may, with the prior approval of the Engineer (which approval shall not be unreasonably withheld), make arrangements with and obtain the acceptance of the occupiers of erven and properties to

close off part of a street, road, footpath or entrance temporarily, provided that the Contractor duly notifies the occupiers of the intended closure and its probable duration, and reopens the route as punctually as possible. Where possible, such streets, roads, footpaths and entrances shall be made safe and reopened to traffic overnight. Such closure shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs, drums and other safety measures appropriate to the circumstances shall be provided by the Contractor to suit the specific conditions.

(e) Existing residential areas

Electricity and water supply interruptions in existing residential areas shall be kept to a minimum. The Engineer's approval shall be obtained prior to such interruptions and residents shall be notified in writing at least 24 hours but not more than 48 hours in advance. Supplies shall be normalised by 16:00 on the same day.

(f) Employment of unskilled and semi-skilled workers in labour-intensive works

(i) Requirements for the sourcing and engagement of labour

1) Unskilled and semi-skilled labour required for the execution of all labour-intensive works shall be engaged strictly in accordance with prevailing legislation and SANS 10845-8, Participation of Targeted Labour.

2) The rate of pay shall be as per sectoral guidelines.

3) Tasks established by the Contractor must be such that:

(aa) the average worker completes 5 tasks per week in 40 hours or less; and
(bb) the weakest worker completes 5 tasks per week in 55 hours or less.

4) The Contractor must revise the time taken to complete a task whenever it is established that the time taken to complete a weekly task is not within the requirements of g.i.3.

5) The Contractor shall, through all available community structures, inform the local community of the labour-intensive works and the employment opportunities presented thereby. Preference must be given to people with previous practical experience in construction and/or who come from households:

6)

(aa) where the head of the household has less than a primary school education;

(bb) that have less than one full-time person earning an income;

(cc) where subsistence agriculture is the source of income;

(dd) those who are not in receipt of any social security pension income.

7) The Contractor must provide monthly statistics to Johannesburg Water indicating the number of new jobs created through this contract. This statistic must be provided with each monthly payment certificate using Councils electronic prescribed format, which will be provided by the Project Manager of this project to the successful Bidder. Failure to provide the required statistics Council may withhold payment.

(ii) Specific provisions pertaining to SANS 10845-8

1) Definition

Targeted labour: Unemployed persons who are employed as local labour on the project.

2) Contract participation goals

(aa) There is no specified contract participation goal for the contract. The contract participation goal shall be measured in the performance of the contract to enable the employment provided to targeted labour to be quantified.

(bb) The wages and allowances used to calculate the contract participation goal shall, with respect to both time-rated and task-rated workers, comprise all wages paid and any training allowance paid in respect of agreed training programmes.

3) Terms and conditions for the engagement of targeted labour

Further to the provisions of clause 3.4 of SANS 10845-8, written contracts shall be entered into with targeted labour.

4) Variations to SANS 10845-8

(aa) The definition for contract amount shall be amended as follows: Financial value of the contract upon completion, exclusive of any value-added tax or sales tax which the law requires the employer to pay the Contractor.

(bb) The schedule referred to in 5.2 shall in addition reflect the status of targeted labour as women, youth and persons with disabilities and the number of days of formal training provided to targeted labour.

(iii) Training of targeted labour

1) The Contractor shall provide all the necessary on-the-job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the contract in a manner that does not compromise worker health and safety.

2) The cost of the formal training of targeted labour, will be funded by the provincial office of the Department of Labour. This training will take place as close to the project site as practically possible. The Contractor must access this training by informing the relevant provincial office of the Department of Labour in writing, within 14 days of being awarded the contract, of the likely number of persons that will undergo training and when such training is required. The Employer must be furnished with a copy of this request.

3) A copy of this training request made by the Contractor to the DOL provincial office must also be faxed to the EPWP Training Director in the Department of Public Works – Cinderella Makunike, Fax: 012 328 6820 or email cinderella.makunike@dpw.gov.za, Tel: 083 677 4026.

4) The Contractor shall be responsible for scheduling the training of workers and shall take all reasonable steps to ensure that each beneficiary is provided with a minimum of six (6) days of formal training if he/she is employed for 3 months

or less and a minimum of ten (10) days if he/she is employed for 4 months or more.

5) The Contractor shall do nothing to dissuade targeted labour from participating in training programmes.

6) An allowance equal to 100% of the task rate or daily rate shall be paid by the Contractor to workers who attend formal training, in terms of g.iii.4 above.

7) Proof of compliance with the requirements of g.iii.2 to g.iii.6 must be provided by the Contractor to the Employer prior to submission of the final payment certificate.

(g) Employment of local labour

The Contractor shall make every effort to employ staff from the local communities within the Johannesburg Metropolitan Area. Skilled workers may only be brought in from outside the local communities if such personnel are not available locally. The Contractor shall pursue a programme of recruitment and training of persons from the local communities, through either the CLO and/or LDO . The Contractor shall carry out a training programme for the duration of the construction process for local staff employed or to be employed by him on the site. Apart from satisfying the immediate requirements for unskilled labour, the development of the proficiency of these staff in semi-skilled and skilled categories such as carpenters, steelfixers, shutter hands, drivers, clerks etc. is required. The minimum total number of man days of work provided to the community, local to the construction site, shall be 45 000 for the contract.

The contractor must report on local labour employment as well as SMME employment in the required format on a monthly basis. This information must accompany monthly Payment Certificates, and if not provided, Payment Certificates will not be processed for payment.

RATES OF COMPENSATION

The Contractor's attention is drawn to Clause 1.4(d) of the Environmental Management Plan (Volume 2) regarding the preferential employment from local communities of labourers and where available skilled artisans.

The Contractor's shall pay Local Labour rates in accordance with the following:

GOVERNMENT GAZETTE, 17 December 2021, No. 45645. DEPARTMENT OF EMPLOYMENT AND LABOUR NO. R. 1605, LABOUR RELATIONS ACT, 1995, BARGAINING COUNCIL FOR THE CIVIL ENGINEERING INDUSTRY (BCCEI): RENEWAL OF PERIOD OF OPERATION OF THE WAGE AND TASK GRADE COLLECTIVE AGREEMENT (**OR SIMILAR BARGAINING COUNCIL THAT MAY BE RELEVANT TO THE SCOPE OF WORKS**, FOR E.G. THE METAL AND ENGINEERING INDUSTRIES BARGAINING COUNCIL, OR THE NATIONAL BARGAINING COUNCIL FOR THE ELECTRICAL INDUSTRY SA, etc.)

and any subsequent update to the relevant Collective Bargaining Agreement, that may be gazetted by the Department of Employment and Labour or Bargaining Council during the execution of this Contract.

It is expressly noted that the rates contained in the aforementioned Gazette or Collective Bargaining Agreement will apply to the Contractor or subcontractor(s) irrespective of whether the Contractor or subcontractor(s) is a member of the employer's organisations listed in the Bargaining Council, or not. It is equally noted that the rates contained in the aforementioned Gazette or Collective Bargaining Agreement will apply to all employees employed for the purposes of executing the Contract (and specifically those defined as

local labour) irrespective of whether those employees are members of the trade unions listed in the gazette, or not.

In the absence of a relevant Collective Bargaining Agreement, the labour rates as stipulated by the City of Johannesburg shall apply.

(h) Monthly statements and payment certificates

The statement to be submitted by the Contractor in terms of Clause 6.10 of the Conditions of Contract shall be prepared by the Contractor at his own cost, strictly in accordance with the standard payment certificate prescribed by the Engineer, in digital electronic computer format. The Contractor shall, together with a copy of the digital electronic computer file of the statement, submit two (2) A4 size paper copies of the statement.

For the purposes of the Engineer's payment certificate, the Contractor shall subsequently be responsible, at his own cost, for making such adjustments to his statement as may be required by the Engineer for the purposes of accurately reflecting the actual quantities and amounts which the Engineer deems to be due and payable to the Contractor in the payment certificate.

The Contractor shall, at his own cost, make the said adjustments to the statement and return it to the Engineer within three (3) normal workings days from the date on which the Engineer communicated to the Contractor the adjustments required. The Contractor shall submit to the Engineer five (5) sets of A4 size paper copies of such adjusted statement, together with a copy of the electronic digital computer file thereof.

Any delay by the Contractor in making the said adjustments and submitting to the Engineer the requisite copies of the adjusted statement for the purposes of the Engineer's payment certificate will be added to the times allowed to the Engineer in terms of Subclause 6.10.4 of the Conditions of Contract to submit the signed payment certificate to the Employer and the Contractor. Any such delay will also be added to the period in which the Employer is required to make payment to the Contractor.

(j) Construction in restricted areas

Working space is sometimes restricted. The construction method used in these restricted areas largely depends on the Contractor's Plant. Notwithstanding, measurement and payment will be strictly according to the specified cross-sections and dimensions irrespective of the method used, and the rates and prices tendered will be deemed to include full compensation for any difficulties encountered by the Contractor while working in restricted areas. Neither extra payment nor any claim for payment due to these difficulties will be considered.

(k) Notices, signs, barricades and advertisements

All notices, signs and barricades, as well as advertisements, may be used only if approved by the Engineer. The Contractor shall be responsible for their supply, erection, maintenance and ultimate removal and shall make provision for this in his tendered rates.

The Engineer shall have the right to instruct the Contractor to move any sign, notice or advertisement to another position, or to remove it from the Site of the Works if in his opinion it is unsatisfactory, inconvenient or dangerous.

(l) Workmanship and quality control

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality control system and provide suitably qualified and

experienced Engineers, foremen, surveyors, materials technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times. The cost of supervision and process control, including testing carried out by the Contractor, will be deemed to be included in the rates tendered for the related items of work.

The Contractor's attention is drawn to the provisions of the various Standardized Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Engineer for examination and measurement, the Contractor shall furnish the Engineer with the results of the relevant tests, measurements and levels to demonstrate the achievement of compliance with the Specifications.

C3.1.4.2.6 Extension of time due to abnormal rainfall

(a) Extension of time in respect of delays resulting from wet climatic conditions on the Site will only be considered in respect of abnormally wet climatic conditions and shall be determined for each calendar month or part thereof, in accordance with the formula given below:

$$V = (Nw - Nn) + (Rw - Rn)/X$$

in which formula the symbols shall have the following meanings:

V = Potential extension of time in calendar days for the calendar month under consideration:
If V is negative and its absolute value exceeds Nn, then V shall be taken as equal to minus Nn.
When the value of V for any month exceeds the number of days in the particular month, V will be the number of days in the month.

Nw = Actual number of days in the calendar month under consideration on which a rainfall of Y mm or more was recorded on the Site

Nn = Average number of days, derived from existing records of rainfall in the region of the Site, on which a rainfall of Y mm or more was recorded for the calendar month

Rw = Actual rainfall in mm recorded on the Site in an approved rain gauge for the calendar month under consideration

Rn = Average rainfall in mm for the calendar month, derived from existing records of rainfall in the region of the Site

The factor (Nw - Nn) shall be deemed to be a fair allowance for variations from the average number of days during which the rainfall exceeds Y mm.

The factor (Rw - Rn)/X shall be deemed to be a fair allowance for variations from the average number of days during which the rainfall did not exceed Y mm but wet conditions prevented or disrupted work.

(b) The rainfall records at rainfall station at the Johannesburg International Airport for the period 2003 to 2012 are reproduced in the accompanying table, and the monthly averages (Rn and Nn) for this period shall, for the purposes of this Contract be taken as normal and as the values to be substituted for Rn and Nn in the formula above. The values of X and Y shall be 20 and 10 respectively.

The potential extension of time V has been calculated for each month and year of the period concerned to indicate the possible effect of the rainfall formula. The values of V were obtained by applying the rainfall formula and using the actual rainfall figures and the calculated values of Rn and Nn indicated in the table.

(c) The Contractor shall, at his own cost, provide and erect on the Site at a location approved by the Engineer, an approved rain gauge, which shall be fenced off in a manner which will prevent any undue interference by workmen and others. The Contractor shall, at his own cost, arrange for the reading of the rain gauge on a daily basis for the duration of the Contract. The gauge readings, as well as the date and time at which the reading was taken shall be recorded in a separate record book provided by the Contractor for this purpose. All entries in the rainfall record books shall be signed by the person taking the reading and the gauge shall be properly emptied immediately after each reading has been taken. If required by the Engineer, the Engineer shall be entitled to witness the reading of the gauge.

(d) The Contractor's claims in terms of Subclause 5.12 of the Conditions of Contract for extension of time in respect of delays resulting from wet climatic conditions on the Site during each month, shall be submitted in writing to the Engineer monthly; provided always that

(i) the period allowed to the Contractor in terms of Clause 10.1 of the Conditions of Contract in which to submit his claim for each month shall be reduced to seven (7) days, calculated from the last day of the month to which the claim applies; and

(ii) the 28-day period allowed to the Engineer in terms of Subclause 10.1.5 of the Conditions of Contract in which to give his ruling on the claim, shall be reduced to fourteen (14) days.

The Contractor's monthly claim shall be accompanied by a copy of the signed daily rainfall readings for the applicable month.

(e) The extent of any extension of time which may be granted to the Contractor in respect of wet climatic conditions (whether normal or abnormal) shall be determined as the algebraic sum of the "V" values for each month between the Commencement Date and the Due Completion Date of the Contract, calculated in accordance with subclause C3.4.2.6(a) above; provided always that

(i) rainfall occurring within the period of the Contractor's Christmas shut-down period (referred to in the Conditions of Contract) shall not be taken into account in the calculation of the monthly "V" values;

(ii) rainfall occurring during any period during which the Contractor was delayed due to reasons other than wet climatic conditions on the Site, and for which delay an extension of time is granted by the Engineer, shall not be taken into account in the calculation of the monthly "V" values;

(iii) if the algebraic sum of the "V" values for each month is negative, the time for completion will not be reduced on account of subnormal rainfall, and

(iv) where rainfall is recorded only for part of a month, the "V" value shall be calculated for that part of the month using pro rata values for Nn and Rn.

(f) The Engineer shall, simultaneous with granting any extension of time in terms of this clause, revise the Due Completion Date of the Contract to reflect an extension of time having been granted in respect of wet climatic conditions, to the extent of the algebraic sum of all the "V" values for all the preceding months of the Contract, less the aggregate of the "Nn" values for the remaining (unexpired) months of the Contract (viz less aggregate of the potential maximum negative "V" values for the remaining Contract Period). Thus, provided that where such period is negative, the Due Completion Date shall not be revised.

(h) Any extension of time in respect of wet climatic conditions granted in terms of this clause shall not be deemed to take into account delays experienced by the Contractor in repairing or reinstating damage to or physical loss of the Works arising from the occurrence of abnormal climatic conditions. Extension of time in respect of any such repairs or reinstatement regarding damage shall be the subject of a separate application for extension of time in accordance with the provisions of Clause 5.12 and Clause 10 of the Conditions of Contract.

Table 2: Statistical rainfall

STATISTICAL INFORMATION: JOHANNESBURG INTERNATIONAL AIRPORT: 2003-2012		
Month	**RAINFALL**	
	Nn = Actual number of days during the calendar months in which a rainfall of more than Y-mm has been received	**Rn Average monthly rainfall**
January	6.3	164.06
February	3.7	113.59
March	3.2	95.65
April	1.2	43.47
May	0.4	13.16
June	0.5	11.43
July	0.1	1.79
August	0.1	5.94
September	0.5	15.64
October	2.3	64.62
November	2.8	93.86
December	5.2	142.34
TOTAL	**26.3**	**765.55**

C3.1.4.3 PLANT AND MATERIALS

C3.1.4.3.1 Plant and materials supplied by the employer

The Employer shall not supply any plant or materials.

C3.1.4.3.2 Materials, samples and shop drawings

(a) Samples

Materials or work which do not conform to the approved samples submitted, will be rejected. The Engineer reserves the right to submit samples to tests to ensure that the material represented by the sample meets the specification requirements. The costs of any such tests conducted by

or on behalf of the Engineer, the results of which indicate that the samples provided by the Contractor do not conform to the requirements of the Contract, shall be for the Contractor's account.

C3.1.4.4 CONSTRUCTION EQUIPMENT

C3.1.4.4.1 Requirements for equipment

The Contractor's equipment shall be adequate to construct the works.

C3.1.4.4.2 Equipment provided by the employer

The Contractor shall be responsible for the supply of all equipment, labour and materials for the Works. The Employer will not provide any equipment.

C3.1.4.5 EXISTING SERVICES

C3.1.4.5.1 Known services

All known services are indicated on the drawings. Exact positions cannot be guaranteed.

C3.1.4.5.2 Treatment of existing services

The Contractor shall ascertain and observe all conditions laid down by the relevant authorities for the execution of the work in the vicinity of their services. The Contract may include certain work involved in the moving, reinstating and protection of existing services that are affected by construction of the works. The Contractor's attention is drawn to all of the requirements as set out in the Amendments to the Standardised Specifications.

The Contractor shall expose by hand, and confirm the position and size of all existing services, and report back to the Engineer on its findings prior to commencing with work relating to the existing services. Any excavation in such areas shall only be executed after approval by the Engineer.

C3.1.4.5.3 Damage to services

If any services are damaged during excavations, the relevant service provider and the Engineer shall be notified immediately. The Contractor shall be responsible for all costs to repair damaged services.

C3.1.4.5.4 Reinstatement of services and structures damaged during construction

When the service provider does the permanent reinstatement, the cost involved shall be payable by the Contractor. When the Contractor does the permanent reinstatement, the method of reinstatement shall be approved by the services provider.

Johannesburg Water SOC Ltd

Johannesburg Water

CONTRACT JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 2A

PART 3:

SCOPE OF WORK

C3.2 PARTICULAR SPECIFICATIONS

PREAMBLE TO SCOPE OF WORK

General

The Standard Specification for all associated civil work shall be the SANS 1200 and SANS 2001 – Standardized Specification for Civil Engineering Construction.

The Standardized Specifications applicable to this Contract are listed in the Project Specification.

These Specifications are not issued with this volume but are available at the Contractor's expense from: SA Bureau of Standards, Private Bag X191, Pretoria, 0001.

Scope

This Project Specification is set out in three portions:

Portion 1: SCOPE OF WORK covers a general description of the project, the facilities available and the requirements to be met.

Portion 2: GENERIC SPECIFICATIONS covers variations to the standardized specifications which are applicable to the contract.

Portion 3: PARTICULAR SPECIFICATIONS covers particular specifications which are applicable to the contract.

Status

Should any requirement of the Project Specification conflict with any requirement of the standardized or particular specifications, the requirements of the Project Specifications shall prevail.

C3 SCOPE OF WORKS

C3.3 PARTICULAR SPECIFICATIONS

C3.3.1 CIVIL

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C3.3.1.1 PA FENCING

C3.3.1.1.1 PA 01 SCOPE

This is a Particular Specification and covers the erection of new fences.

C3.3.1.1.2 PA 02 TYPE OF FENCE

The fence shall be a security fence and shall be erected in accordance with the dimensions shown on the Drawings.

C3.3.1.1.3 PA 03 MATERIALS

C3.3.1.1.3.1 PA 03.1 POSTS, STAYS AND STANDARDS

Posts, stays and standards shall be of the type and size indicated on the Drawings. Posts shall include gate posts, straining posts, and corner posts.

Metal posts, stays and standards shall comply with the requirements of CKS 82 and SABS 280. "Acceptable" in CKS 82 means "acceptable to the Engineer".

Tubular posts, standards and stays shall be galvanized in accordance with SANS 10684 Table 1 for type B articles. All rail and Y-sections shall be provided with a protective coating of tar or other approved material.

Corner, gate, and straining posts shall be suitably drilled for stay bolts or gate fittings as indicated on the Drawings.

C3.3.1.1.3.2 PA 03.2 BOLTS FOR STAYS

Bolts shall be of mild steel and galvanized in accordance with SANS 10684 Table 1 for type C articles. The length and diameter of the bolts shall be as shown on the Drawings. All the necessary bolts, together with nuts and washers, shall be supplied with each post.

C3.3.1.1.3.3 PA 03.3 WIRE

All wire shall conform to the requirements of SABS 675 and shall be class B galvanized, except where otherwise specified below.

(a) Barbed wire

Barbed wire shall be one or both of the following types:

(i) High-tensile grade, oval shaped, single-strand wire, 2,60 mm x 2,00 mm
(ii) Mild-steel grade, double-strand, uni-directional twist wire, each strand 2,50 mm in diameter

Barbs shall be spaced at not more than 150 mm intervals.

(b) Smooth wire

Smooth wire shall be of the types specified below:

(i) Straining wire shall be mild-steel wire, 4,00 mm in diameter.
(ii) Fencing wire shall be high-tensile grade 2,24 mm diameter wire.
(iii) Tying wire or binding wire shall be 2,50 mm diameter, mild-steel, class C galvanized wire for tying fencing wire to standards and 1,60 mm diameter, mild-steel, class C galvanized wire for tying wire mesh to fencing wire.

(c) Barbed-tape concertinas

Barbed-tape concertinas shall comply with the requirements for type A in CKS Specification 592 and shall consist of close-coiled high-tensile wire with a continuous strip of flat steel barbs (barbed tape) crimped to the wire along the entire length of the wire. The coils shall further be attached to each other by clips to give a concertina configuration when pulled apart. The coils shall be of the diameter as shown on the Drawings. Each concertina shall have a minimum of 55 coils, and the maximum effective length of open concertina, when pulled apart, shall depend on the diameter of the roll, but shall be at least 12 m.

The high-tensile wire shall be class B galvanized and the barbed tape shall be made of cold-rolled carbon steel galvanized to class Z450. The concertina clips shall be manufactured from steel strip galvanized to class Z450.

C3.3.1.1.3.4 PA 03.4 DIAMOND MESH

Diamond mesh (chain-link fencing) shall comply with the requirements of SABS 1373. The width shall be as shown on the Drawings, and both edges shall be clinched.

The diameter of the wire shall be 2,5 mm and the mesh size shall be as shown on the Drawings and the wire shall be class B galvanized.

C3.3.1.1.3.5 PA 03.5 GATES

Gates shall comply with the requirements of CKS 146 and shall be manufactured to the dimensions shown on the Drawings.

Gates shall be complete in every respect, and shall include hinges, washers, bolts, and the locking mechanism shown on the Drawings.

C3.3.1.1.3.6 PA 03.6 CONCRETE

Concrete used for fencing shall comply with the requirements of SANS 1200 G.

C3.3.1.1.4 PA 04 CLEARING FENCE LINE

Strip clearing for the fence shall be carried out in accordance with SANS 1200 C and will be measured and paid for under Section 1200 C of the Schedule of Quantities.

C3.3.1.1.5 PA 05 INSTALLING POSTS AND STANDARDS

Straining posts shall be erected at all ends, corners, and bends in the line of fencing and at all junctions with other fences. Straining posts shall not be spaced further apart than shown on the Drawings. The height of the posts above the ground shall be such that the correct clearance between the lowest wire and the ground can be obtained.

Posts shall be accurately set in holes and, where indicated, shall be provided with concrete bases to the dimensions shown on the Drawings.
Holes shall be dug to the full specified depth. Where, due to the presence of rock, the holes cannot be excavated by hand or by pneumatic tools and the Contractor has to resort to the use of explosives, he will be paid separately for the drilling and blasting operations required.
Corner, gate, end and straining posts shall be braced by means of stays or anchors, as shown on the Drawings. Pipe stays shall be bolted to the posts. Gate posts shall not be used as straining posts, but at each gate post a straining post shall be placed as shown on the Drawings and stayed by means of an anchor consisting of six strands of wire.

Standards shall be firmly planted in the ground at the spacing shown on the Drawings or as directed by the Engineer. The spacing of standards between any two straining posts shall be uniform. In rock or hard material standards shall either be driven or set in holes drilled into the rock. The size of drilled holes shall be such that a tight fit is obtained. Care shall be taken not to buckle or damage the standards when driven. Where indicated, standards shall be provided with concrete bases to the dimensions shown on the Drawings.

All posts and standards shall be accurately aligned and set plumb and shall be planted with the overhang as shown on the Drawings and at right angles to the direction of the fence. After posts and standards have been firmly set in accordance with the aforegoing requirements, the fencing wire shall be attached thereto as described below.

C3.3.1.1.6 PA 06 INSTALLING WIRE

All fencing wire shall be carefully stretched and hung without sag and with true alignment, and care shall be taken not to stretch the wire so tightly as to cause breaking, pulling up straining posts, or being easily damaged during veld fires.

Each strand of fencing wire shall be securely fastened in the correct position to each standard with galvanized binding wire. The binding wire for each horizontal fence wire shall pass through a hole or notch in the standard, and the ends of the wire shall be wound at least four times around the fencing wire.

At the end, corner, straining, and gate posts the fencing wire shall be securely wrapped twice around the post and secured against slipping by tying the end tightly around the wire by means of at least six snug, tight twists. In the case of high-tensile wire, two long windings must first be made before the six tight twists to prevent the wire from breaking at the first twist. Where smooth wire is used, the loose end shall be bent back and hooked into the opening between the fencing wire and the first winding.

Splices in the fencing wire will be permitted if made in the following manner with the use of a splice tool: The end of each wire at the splice shall be carried at least 75 mm past the splice tool and wrapped snugly around the other wire for not less than six complete turns, after which the two separate wire ends shall be wound in opposite directions. After the splice tool has been removed, the space left by it in the splice wire shall be closed by pulling together the wire ends. The unused ends of wire shall be cut close to leave a neat splice.

The gaps between gate posts and the adjacent straining posts shall be fenced off with short fencing wires.

C3.3.1.1.7 PA 07 INSTALLING DIAMOND MESH

Where indicated on the Drawings, diamond mesh shall be stretched against the fence and properly tied to the fencing wire. The diamond mesh shall be secured by means of binding wire at 1,2 m centres along the top and bottom wires and at 3 m centres along each of the other fencing wires, unless shown otherwise on the Drawings.

C3.3.1.1.8 PA 08 INSTALLING BARBED-TAPE CONCERTINAS

Barbed-tape concertinas shall be positioned on the fence as shown on the Drawings. The concertinas shall be fastened to the appropriate fencing wires at each standard as well as at 1,0 m maximum intervals between standards.

Rolls of barbed-tape concertinas shall be joined with binding wire at four points, spaced at equidistant intervals around the circumference of the loop. Joints shall be made to coincide with the positions of standards.

C3.3.1.1.9 PA 09 CLOSING OPENINGS UNDER FENCES

At ditches, streams, drainage channels or other hollows where the fence cannot follow the general ground contour, the Contractor shall close the opening under the fence by means of horizontal barbed wires 150 mm apart and stretched between additional straining posts as shown on the Drawings. The opening shall be covered with strips of diamond mesh, 1 000 mm wide, fixed to the barbed wires.

In the case of larger streams, the opening below the lower fencing wire shall be closed by means of loose-hanging wire nets as shown on the Drawings. These nets shall be erected at streams only on the instructions of the Engineer.

C3.3.1.1.10 PA 10 INSTALLING GATES

Gates shall be installed at the positions indicated on the Drawings or pointed out on Site. The gates shall be hung on gate fittings in accordance with the details shown on the Drawings. Gates shall be so erected that they swing in a horizontal plane at right angles to the gate posts and clear of the ground in all positions. Double swing gates shall close to have a gap of not more than 25 mm between them, and other gates shall close to be not more than 25 mm from the gate post.

C3.3.1.1.11 PA 11 GENERAL REQUIREMENTS AND TOLERANCES

The completed fences shall be plumb, taut, true to line and to the ground contour, and with all posts, standards and stays firmly set.

The height of the lower fencing wire above the ground at posts and standards shall not vary by more than 25 mm from that shown on the Drawings. Other fencing wires shall not vary by more than 10 mm from their prescribed relative vertical positions.

Anchoring of a fence to structures shall be done as shown on the Drawings.

The Contractor shall, on completion of each section of fence, remove all cut-offs and other loose wire or mesh so as to leave the fence with a neat and finished appearance.

C3.3.1.1.12 PA 12 MEASUREMENT AND PAYMENT

C3.3.1.1.12.1 PA 12.1 Supply and erection of new fencing material

(a) Barbed wire (grade, size and type of wire indicated)……Unit: m

(b) Smooth wire (grade and size indicated)……..……..Unit: m

(c) Barbed tape concertinas (coil diameter indicated)…….Unit: m

The unit of measurement shall be the metre of each type of fencing wire and barbed-tape concertinas measured between end posts. Binding wire and wire used for the bracing and anchoring of posts shall not be measured for payment.

(d) Diamond mesh (mesh size indicated)……..……Unit: m²

The unit of measurement shall be the square metre of diamond mesh and the quantity shall be calculated on the prescribed width and the length between straining posts or gate posts, or the length of strips for covering openings under fences, or the length used for the covering of gates.

(e) Corner, end, and straining posts, including anchors (type, size and length indicated.
……Unit: number

The unit of measurement shall be the number of posts required to conform to the maximum spacing specified or such lesser spacing as authorised by the Engineer.

(f) Standards (length and type indicated)……..Unit: number

The unit of measurement shall be the number of standards required to conform to the maximum spacing specified or such lesser spacing as authorised by the Engineer.

(g) Droppers (length and type indicated)……Unit: number

The unit of measurement shall be the number of droppers required to conform to the maximum spacing specified or such lesser spacing as authorised by the Engineer.

The tendered rates shall include full compensation for concrete, binding wire, straining wire, bolts, washers and nuts, all excavations, drilling of holes for standards, and the complete erection of the fence as specified and as shown on the Drawings. The tendered rate for posts shall make provision for the construction of the stays of the types shown on the Drawings.

The quantity of material used shall be determined by measuring the quantities of individual items of material installed in the completed fence. No linear measure of completed fence shall be applicable.

C3.3.1.1.12.2 PA 12.2 New gates

(a) Single leaf (size and type indicated)……..Unit: number

(b) Double leaf (size and type indicated)……Unit: number

The unit of measurement shall be the number of new gates erected. A pair of gates shall be measured as one.

The tendered rate shall include full compensation for gate posts, hinges, bolts, concrete, locking mechanism and straining wire, and for the erection of the gates complete as specified and as shown on the Drawings. It shall not include compensation for any fencing wire or mesh used on the gate.

C3.3.1.1.12.3 PA 12.3 Drilling and blasting holes for posts and anchors……..Unit: number

The unit of measurement shall be the number of holes for posts and anchors made by drilling and blasting where excavation by hand-tools or pneumatic tools cannot be done economically.

The tendered rate shall include full compensation for drilling and blasting the holes and for all other expenses in connection with the provision, storage, transportation and use of explosives.

C3.3.1.2 PC DIRECTIONAL DRILLING

C3.3.1.2.1 PC 01 SCOPE

This Section deals with the design, site establishment, services location, drilling, reaming and installation of pipes and sleeve pipes for cables using Trenchless Technology (Horizontal Directional Drilling), surface reinstatement and de-establishment.

C3.3.1.2.2 PC 02 DEFINITIONS

C3.3.1.2.2.1 PC 02.1 DIRECTIONAL DRILLING

A steerable method for the underground installation of pipes or conduits in a shallow arc using a surface launched drilling rig. In particular, the term applies to large scale crossings in which a fluid filled pilot bore is drilled without rotating the drill string, and this is then enlarged by a washover pipe and back reamer to the size required for the product pipe.

Trenchless technology terminology used on this Contract has the meaning given in the definitions used by the International Society for Trenchless Technology (ISTT).

C3.3.1.2.3 PC 03 MATERIALS

C3.3.1.2.3.1 PC 03.1 SLEEVE PIPE MATERIAL

The sleeve pipe material shall be HDPE unless specified otherwise. The HDPE pipe shall comply with the requirements of SANS ISO 4427. The wall thickness shall be determined by the Contractor taking into account the pulling forces applied during installation and the external load on the sleeve pipe.

C3.3.1.2.3.2 PC 03.2 DRILLING FLUID

The selected drilling fluid shall be compatible with the environment. Waste oil and environmentally non bio-degradable polymers shall not be used.

C3.3.1.2.4 PC 04 EQUIPMENT

Drilling rigs and navigation equipment with the capacity to install up to a 200 mm diameter sleeve pipe over a distance varying between 5 m and 50 m shall be used. The pulling force that the selected equipment is capable of exerting shall be a minimum of 1.5 times the weight of the pipe to be installed.

The Contractor shall indicate what rock drilling and reaming equipment will be required. Refer to Clause 11.9.

C3.3.1.2.5 PC 05 CONSTRUCTION

C3.3.1.2.5.1 PC 05.1 GENERAL PROCEDURES

The Contractor shall:

a) Determine the drilling length and equipment pull strength for the type of soil and rock encountered.

b) Provide the method to control line and grade.
   i) Provide and maintain instrumentation that accurately locates the pilot hole.
   ii) Drill the pilot hole along the path within 100 mm tolerances.

iii) Include electronic monitoring of the horizontal and vertical drilling head location. Obtain an accuracy range within 25 mm of the actual position of the pipeline. Record the position readings at a maximum of 3 m intervals.
iv) At completion of the pilot hole drilling, furnish the Engineers representative with tabulations of the horizontal and vertical alignment.

c) When water is encountered:
i) Provide and maintain a dewatering system of sufficient capacity to remove water.
ii) Keep the excavation free of water until the backfill operation is in progress.
iii) Perform dewatering in such a manner that the removal of soils particles is kept to a minimum.

d) Maintain close observation to detect settlement or displacement of surface and adjacent facilities.
i) Notify the Engineer immediately if settlement or displacement is detected.
ii) Act to maintain safe conditions and prevent damage.

C3.3.1.2.5.2 PC 05.2 DRILLING OPERATION

The Contractor shall:

a) Apply Drilling Fluids as follows:
i) Maintain drilling fluid in the bore hole to increase stability of the surrounding soil and reduce drag on the pulled pipe.
ii) Dispose of the drilling fluid and other spoils at location following laws, ordinances, rules, and regulations.
iii) Transport excess fluids and other spoil to an approved disposal site.
iv) Minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface.
v) Provide clean water for drilling.

b) Execute the Pilot Hole Drilling as follows:
i) Angle the entry hole so that curvature of the pilot hole does not exceed the allowable bending radius of the HDPE pipe or drilling rods.
ii) Be able to make a turn of up to 90 degrees and maintain a curvature not to exceed the allowable bending radius of HDPE pipe.
iii) Procedure in the event of alignment adjustment and restarts.
(1) Follow the pipeline alignment on Drawings within the tolerances specified herein. Before adjustments, notify the Engineer for approval.
(2) Notify the Engineer when forward motion of operation is stopped by an obstruction.
(3) Abandon in place with drilling fluid unless the Engineer directs otherwise.
(4) Upon the Engineer's approval, attempt a second installation at approved location or excavate at the point of difficulty and install the HDPE pipe by open trench method.
(5) Exercise caution when discovering and locating unknown services. The exact location of such service shall be confirmed prior to any adjustment or restart of the pilot hole drilling.
(6) Keep the number of boring pits to a minimum, unless otherwise approved by the Engineer. Equipment must be capable of boring in a single bore.

C3.3.1.2.5.3 PC 05.3 INSTALLING HDPE PIPE

The Contractor shall:

a) Provide a swivel to the reaming assembly and pull section of the pipe to minimize tensional stress on the pull section after drilling the pilot hole.

b) Hold the reaming diameter to 1.5 times the outside diameter of the HDPE pipe being installed.

c) Protect the pull section as it proceeds during pull back so that it moves freely and is not damaged.

d) Pull the detection wire along with the HDPE pipe. Extend the wire into the locator station at each end of the HDPE pipe.

e) When connecting to the adjacent pulled or non-pulled section of the HDPE pipe, allow the pull section of the pipe to extend past the termination point. Make the tie-ins the next day after the pullback of the HDPE pipe.

f) Test pit pipe installation to verify horizontal and vertical alignment at the Engineer's direction.

g) Replace portions of the pipeline not in compliance with the Contract Documents at the Engineer's direction.

C3.3.1.2.6 PC 06 SUNDRY ITEMS

C3.3.1.2.6.1 PC 06.1 ENVIRONMENTAL MANAGEMENT

Management and operation of the sites shall comply with the requirements of the Environmental Specifications.

C3.3.1.2.6.2 PC 06.2 OCCUPATIONAL HEALTH AND SAFETY

The Contractor shall prove that the pipe or cable sleeve is clean and watertight.

An air test shall be done on the installed pipe or cable sleeve, witnessed by the Engineer's representative to prove water tightness of the pipe.

C3.3.1.2.7 PC 07 TOLERANCES

C3.3.1.2.7.1 PC 07.1 ALIGNMENT AND GRADE

The deviation from the specified line and level of the sleeve on the agreed bore plan shall not exceed 100 mm in any direction. The specified dimensions of a cable sleeve shall be such that the cable may be laid in the sleeve within the tolerances specified for the cable.

C3.3.1.2.8 PC 08 TESTING

C3.3.1.2.8.1 PC 08.1 AIR TEST

a) Installed pipe or cable sleeve above the water table:

An approved air testing machine shall be used to raise the gauge pressure in the section of the installed pipe or cable sleeve under test first to 3.75 kPa. After a 2-minute stabilization period the pressure shall be reduced to 2.5 kPa. The machine shall then be switched off and the time taken for the pressure to drop from 2.5 kPa to 1.25 kPa shall be recorded. The time taken shall be at least the applicable of the following values:

Nominal diameter of pipe, mm	**Minimum time (in minutes) taken for pressure to drop from 2.5 kPa to 1.25 kPa**
100	2

150	3
200	4
250	4.5
300	6

b) Installed pipe or cable sleeve below the water table:

An approved air testing machine shall be used to raise the gauge pressure in the section of the installed pipe or cable sleeve under test to 2.5 kPa above the static water pressure. After this pressure has been attained and the machine stopped, any change in pressure shall be noted. There shall be no discernible loss for a period of at least 5 minutes.

C3.3.1.2.8.2 PC 08.2 PROOF OF ROUNDNESS AND CLEANLINESS

Two cable draw wires or lines shall be provided in the cable sleeve. One will be used to pull a testing cylinder through the sleeve in the presence of the Engineers representative to proof the roundness of the sleeve and that it is free of obstructions to install the cables.

C3.3.1.2.9 PC 09 DESIGN

HDPE cable sleeves with nominal internal diameter as indicated on the drawings need to be installed under the road or rail servitude using trenchless technology. The Contractor is responsible for the selection of the sleeve wall thickness and HDPE material class that suits the installation profile and drilling rig to be used at each site. The sleeve shall be installed with minimum cover of 2 m unless otherwise specified by the Way Leave requirements.

Prior to the commencement of the installation of the cable sleeve at each site, the following working drawings and method statement describing in detail the proposed method and entire operation shall be submitted for approval by the Engineer:

a) Size, capacity, and arrangement of equipment.

b) Location and size of drilling and receiving pits (Bore plan).

c) Dewatering method and method of removing spoil material.

d) Method of installing detection wire and pipe.

e) Type, location, and method of installing locator station.

f) Method of welding HDPE pipe segments and type of equipment.

g) Removal of weld bead.

h) Type of cutting head.

i) Method of monitoring and controlling line and grade.

j) Detection of surface movement.

k) Drilling fluid if required:
- Product information, material specifications, and handling procedures.
- Material safety data sheet and special precautions required.
- Method of mixing and application.

The Contractor shall refer to the geotechnical information provided in the Contract Documents and the cross sections provided in the Drawing.

C3.3.1.3 PD BUILDING WORK

C3.3.1.3.1 PD 01 SCOPE

This is a Particular Specification and covers the various construction activities associated with the erection of buildings which form part of this Contract.

Building work shall be carried out in accordance with the National Building Regulations, SANS 10400, the applicable clauses of the SANS Standardized Specifications and the information contained in this Specification.

Work appurtenant to the erection of buildings such as earthworks, concrete work, structural steelwork, etc. shall be carried out as specified in the appropriate Standardized Specifications and will be measured and paid for under those Specifications.

C3.3.1.3.2 PD 02 BRICKWORK, PLASTER WORK AND FLOOR SCREEDS

C3.3.1.3.2.1 PD 02.1 MATERIALS

(a) Bricks

Bricks shall comply with SANS 227 and shall be of the class scheduled or shown on the drawings.

Satisfactory proof of the load-bearing capacity of the bricks offered shall be submitted before deliveries are made to the site.

Air bricks shall be well-burnt terracotta and shall be free from cracks and blemishes and lined with copper mosquito gauze.

Three samples of each type of brick shall be submitted to the Engineer for approval. All subsequent deliveries shall be of a standard equal to or better than that of the approved samples.

(b) Cement

Cement shall comply with the requirements of SANS 50197 and shall be stored under cover. The use of Portland blast-furnace cement (PBFC) which complies with the requirements of SANS 50197 will only be allowed if approved by the Engineer.

(c) Aggregate

Fine aggregate shall consist of natural sand, or crushed rock or gravel, and shall be hard, clean and free from adherent coatings or other deleterious matter. Sand for plaster and mortar shall comply with the requirements of SANS 1090, whereas the aggregates for normal and granolithic floor screeds shall comply with the requirements of BS 1199 and BS 1201 respectively.

(d) Water

Water shall be clean and free from clay, silt, oil, acid, alkali, organic or other matter which would impair the required strength and durability of the mortar, plaster, or floor screed.

(e) Wall ties

Wall ties shall be of the galvanized, crimped, single-wire type, 3,5 mm in diameter, and shall comply with the requirements of SANS 28.

(f) Damp-proof sheeting

Damp-proof sheeting shall comply with SANS 248, type FV for fibre felt, or SANS 952, type B for embossed polyethylene sheeting.

C3.3.1.3.2.2 PD 02.2 CONSTRUCTION OF BRICKWORK

(a) Cement mortar

Cement mortar shall, unless otherwise specified, consist of one-part Portland cement to four parts sand (1:4) by volume for normal brickwork and one-part Portland cement to three parts sand (1:3) by volume for reinforced brickwork. The ingredients for cement mortar shall be measured in proper gauge boxes on a boarded platform and thoroughly mixed. Alternatively, mixing may be by means of an approved mechanical batch mixer. Only when the dry ingredients have been thoroughly mixed and a mixture of uniform colour has been obtained may the water be added in sufficient quantity to obtain mortar with the required consistency.

Cement mortar shall be used within two hours of adding water to the mix and shall not be used after two hours or if it has begun to set. Mortar shall be turned over frequently to prevent it from setting until it is used.

(b) Brickwork

Dimensions of all the brickwork shall be set out and built as shown on the drawings. Bricks shall be kept wet before laying and the top of brickwork shall be wetted before any further bricks are laid. Bricks shall be well buttered with mortar before being laid and all joints shall be thoroughly flushed up as the work proceeds. All joints to face brickwork shall be neatly made and key-drawn with a 6 mm key.

Brickwork shall be carried up in a uniform manner with no portion being raised more than 1 m above an adjacent portion. All perpends, quoins, etc., shall be kept strictly true and square and the whole properly bonded together.

Brickwork shall be built in stretcher bond or english bond as shown on the Drawings, and bats shall not be used except where required for the bond. All joints shall be 10 mm wide and four courses shall measure 340 mm.

Brickwork for cavity walls and solid walls built in stretcher bond shall be tied with wall ties placed not more than one metre apart in every third course and shall be staggered vertically. At openings, the ties shall be positioned not more than 300 mm apart along the periphery of the opening and 150 mm from the opening.

Face brickwork shall be kept perfectly clean and rubbing down of the brickwork shall not be allowed. Scaffold boards shall be turned back during heavy rain to avoid splashing. Soiled brickwork shall be cleaned at the Contractor's expense, and the cleaning method shall be approved by the Engineer.

(c) Reinforced brickwork

Brickwork over door and window openings shall be reinforced with steel rods, welded, or expanded mesh, etc. Reinforcement shall be placed in each course of brickwork for a

minimum of four (4) courses or as shown on the drawings. Reinforced brickwork shall continue at least 300 mm on each side of the openings.

Brick lintels shall be built upon rigid temporary supports left in position for not less than seven (7) days after bricklaying. Prestressed concrete lintels may be used where approved by the Engineer.

(d) Key for plaster

Joints of all brickwork receiving plaster shall be raked out, or the brick surfaces shall otherwise be prepared with an acrylic slurry or any other approved bonding agent.

(e) Damp-proofing

A damp-proof course shall be laid over the full width of all the walls at a minimum height of 150 mm above the final ground level or wherever else it may be required, and it shall be lapped for at least 150 mm at angles and joints. A damp-proof course shall also be laid and stepped up under all external sills.

(f) General

Rough and fair cutting shall be performed as required, and the brickwork shall be fitted around any steel work. Face brickwork shall be carefully cut and fitted to suit fittings.

Chases shall be left or formed for edges of concrete floors, staircases, etc. Chases shall also be provided wherever they may be required for pipes, conduits, switch boxes, distribution boards, and the like. Joints shall be raked out for flashings.

C3.3.1.3.2.3 PD 02.3 PLASTER WORK

(a) Plaster coats

A plastered finish shall consist of a single coat, comprising one application of a 1:6 cement sand mixture with a wood or steel-float finish.

(b) Thickness

The total thickness of the plaster finish shall be 13 mm minimum and 20 mm maximum.

(c) Workmanship

All plaster work shall be finished smooth and ready to receive paint. Plaster shall be flush with the faces of all switch and plug boxes, the interiors of which shall be kept free from plaster. Plastered surfaces shall be plumb, and jambs and reveals shall be formed square.

The plasterer shall cut out and make good all cracks, blisters and other defects and leave the plaster work, on completion, in a state which is acceptable to the Engineer.

C3.3.1.3.2.4 PD 02.4 FLOOR SCREEDS

Floor screeds shall have a mix proportion by mass consisting of one (1) part Portland cement and three (3) parts (1:3) fine aggregate. A minimum amount of water is to be used, but it shall be sufficient to allow adequate compaction.

Screeds shall be laid on clean hardened bases in panels not exceeding 14 m² and shall be steel-trowelled to a true and smooth finish. In monolithic construction, the panels shall not exceed 30 m². Joints in screeds shall coincide as nearly as possible with joints in the

bases. The thickness of screeds shall be as shown on the drawings or as directed by the Engineer.

The entire screed surface shall be free from loose or raised particles of aggregate, trowel marks or any irregularities, humps or depressions exceeding 5 mm when measured from a 3 m long straight edge.

Screeds shall be cured for three (3) to seven (7) days as may be directed by the Engineer and shall be protected from damage.

No moisture-sensitive floor finish shall be laid on screeds unless a reliable moisture test shows that the screed is sufficiently dry to receive the covering.

C3.3.1.3.3 PD 03 DOORS AND WINDOWS

C3.3.1.3.3.1 PD 03.1 MATERIALS

(a) General

All steel and iron work shall be delivered clean and free from rust, pitting or other defects. Shop primings shall be applied before delivery and shall consist of a coat of red oxide paint, or any other approved anti-rust paint on all surfaces.

Unless otherwise specified, all materials shall conform at least to the appropriate SANS or BS standards where such standards apply to ironmongery, or steel, cast iron and any other related materials.

(b) Pressed-steel door frames

Pressed-steel door frames shall comply with SANS 1129 and shall be manufactured from 1,6 mm thick mild-steel sheeting, pressed to the required shapes, properly mitred, welded and reinforced, with all welding neatly cleaned off.

Frames shall be of the widths required to suit the thickness of the walls into which they are built and shall be fitted with suitable tie bars and braces at the bottom. Three lugs to be built into the brickwork shall be provided on each jamb.

Rebates in frames and transoms for doors shall be of the widths required to suit the thicknesses of the doors and shall be fitted with a pair of approved steel butt hinges set flush into recesses in the frames. 4,5 mm thick reinforcing plates shall be welded to the backs of the frames at hinge positions.

Heads of frames over double doors shall be drilled where required to form keeps for bolts and shall be fitted with one rubber buffer for each leaf of the door.

Frames for single doors shall be fitted with approved chromium striking plates and an adjustable striking-plate keeper boxed in at the back of the frame by a welded-on sheet-metal box. The frames shall be fitted with a minimum of two rubber buffers.

Frames shall be protected against twisting and damage during transit and erection.

(c) Pressed-steel doors

Pressed-steel doors shall be manufactured from 1,6 mm thick steel plate. The doors shall be of standard design, pressed to shape with 40 mm reveals all round. The doors shall be strengthened with full-length vertical V-shaped or other approved sectional strengthening ribs projecting to the outer face. Two horizontal stiffening rails shall also be welded to the inner face of the doors.

A door shall be hung on a pair of 100 mm long steel butt hinges with loose pins. The leaves of the hinges shall be welded to both the door and the door frame, and a 1,6 mm thick steel plate shall be welded to the inner face of the door to protect the lock.

One leaf of double doors shall be fitted at the top and bottom with approved 150 mm cast brass barrel bolts in an approved manner and the other leaf shall be fitted with a lock, the striking plate of which shall be fixed to the first leaf.
Where indicated on the drawings, doors shall be fitted with louvred ventilation grills of approved design, backed with insect and vermin-proof gauze screening.

(d) Steel window frames

All steel window frames shall comply with SANS 727 and shall be of the types and sizes shown on the drawings.

Standard industrial types of steel window frame shall be constructed from rolled mild-steel industrial sections, 35 mm wide by 3 mm thick, with opening sections constructed from standard residential sections, 25 mm wide by 3 mm thick, welded at angles and properly jointed at intersections.

Window frames shall be formed perfectly flat, truly square, and properly jointed at all angles, and the opening portion shall fit properly on all faces and shall open and close freely.

Glazing bars shall be continuous with jointed intersections, the ends being neatly tenoned into the frame and securely welded in position.

Frames shall be fitted with standard fixing lugs.

Opening sections shall open as indicated on the drawings and shall be fitted with steel hinges with brass pins. Pivots shall be fitted with bronze ring centres.

Side hung or top hung opening sections shall be fitted with brass handles and friction stays. Bottom hung sections shall be fitted with friction pivots and spring catches.

Weather bar drips shall be attached to the fixed frames for the complete width of the window at the head of outward opening sections.

Composite windows shall preferably be delivered to the Site fully assembled, complete with mullions and transoms.

(e) Door-locks and handles

All door-locks shall comply with the requirements of SANS 4 and shall be of approved industrial-type manufacture and pattern. All locks shall be supplied with two keys. Keys shall be distinctly numbered with consecutive numbers and each key shall be stamped with the same number as that of the lock which it controls. No two locks in any one building may have the same key.

External doors shall be fitted with four-lever heavy-duty mortice locks, which shall be master-keyed.

All locks shall be properly installed, and, after completion, striker plates shall be adjusted, and the locks serviced.

Doorhandles shall be of cast zinc of approved manufacture and pattern.
(f) Miscellaneous fittings

All retaining devices for doors and windows as well as fittings such as coat hooks, retaining hooks, etc. shall be of solid brass. All fittings shall be secured by screws or set screws of the same material and finish as the fitting.

Fittings to be fixed to plastered walls, masonry or floors shall be fixed direct by means of patent plastic or fibre plugs fitted into drilled holes.

Doorstops shall be provided at every door and shall be 40 mm diameter rubber stops.
(g) Aluminium windows and doors

Aluminium extrusions shall be of 6063-T6 alloy and temper. Aluminium sheet and strips shall be of 1200-H4 alloy and temper.

Joints in all aluminium members shall be formed in an approved manner so that the joints are practically invisible. Screw heads, pins, rivets, etc shall be concealed as far as possible. 300 Series stainless steel screws and bolts shall be used for jointing and fixing aluminium work.

The surfaces of all aluminium which are in contact with other materials when fixed shall be suitably insulated with a non-absorbent insulating material to prevent corrosion. All aluminium work shall be suitably protected against damage, deterioration or discolouration caused by mortar droppings, paint, etc by taping with removable tape, covering with temporary casings or by covering with motor oil.

Aluminium described as “anodized” shall be treated with Grade 25 coating thickness for exterior use or Grade 15 for interior use as specified, to the required finish. All alloys to be anodized shall be suited to anodizing.

These specifications shall apply to aluminium windows, doors, etc in all respects in so far as they are applicable. Aluminium windows and doors shall be manufactured from extruded aluminium members of 6063T6, 6261-T6 or 6082-T6 alloy and temper.

Ancillary members such as sills, flashings, infill panels and the like formed from flat sheet material shall be of an appropriate alloy selected from 1200, 3004 or 5251 complying with BS 1470 of a temper suitable for the method of forming and a composition suitable for anodizing or painting as required.

Windows, doors, etc shall be of an approved standard system, manufactured by an approved firm experienced in this type of work, and shall meet with the minimum recommended performance requirements as set out by the Association of Architectural Aluminium Manufacturers of South Africa (AAAMSA) in the latest edition of the Selection Guide.

The fittings for all opening sashes shall be substantial and, unless otherwise described, shall be of high quality aluminium alloy finished to match the windows, doors, etc on which they occur. Samples of all fittings shall be supplied to the Principal Agent for approval.

Top, side and bottom hung opening sashes shall be hung on two aluminium hinges with 300 Series stainless steel pins, nylon bushes and stainless-steel washers. Side hung sashes shall have fasteners and sliding stays, top hung sashes shall have peg stays and bottom hung sashes shall have spring catches and concealed arms.

Projected out sashes shall have aluminium fasteners and concealed arms of a non-corrosive material compatible with aluminium.
The frames which are to be built into openings in brickwork shall be fitted with the manufacturer’s standard type fixing lugs, not less than 20 x 3 x 150mm long, screwed to frame and placed one near each corner and intermediately not more than 450mm apart

to sides, top and bottom and where fixed to concrete reveals, wood sub-frames or to preformed openings in brickwork shall have countersunk holes for screws, one near each corner and intermediately not more than 450mm apart to sides, top and bottom.

Where so described, openings and sashes of windows and doors shall be fitted with approved channel section aluminium glazing beads sufficient in size and profile to suit the method of glazing employed, finished to match the windows, doors, etc and neatly mitred. Screws where necessary shall be of aluminium or 300 Series stainless steel and have pan or raised heads finished to match the beads.

Windows, doors, etc described as “anodized” shall be treated with Grade 25 coating thickness. Windows, doors, etc described as “factory painted” shall have an electrostatically applied oven baked polyester paint coating not less than 25 micrometres thick.

Aluminium windows, doors, etc shall include glass as described, fixing in position, sealing and protection against damage, deterioration or discolouration by taping with removable tape or covering with temporary casings or motor oil and removing same on completion.

C3.3.1.3.3.2 PD 03.2 INSTALLATION OF DOORS AND WINDOWS

All built-in door and window frames shall be set straight, plumb, and level, and shall operate to the satisfaction of the Engineer after fixing has been completed.

Fittings shall be either removed, or wrapped and protected from damage, until all rough trades have been completed.

C3.3.1.3.4 PD 04 GLAZING

C3.3.1.3.4.1 PD 04.1 MATERIALS

(a) Glass

Glass shall comply with the requirements of CKS 55. The quality of all window glass shall be such that surface deterioration will not develop after glazing.

All glass shall be free from bubbles, waviness, scratches, stains, or other imperfections.

Unless otherwise specified, sheet glass for glazing shall be flat-drawn clear glass of ordinary glazing quality and of the thicknesses indicated below:

For panes not exceeding 0,75 m² in area 3 mm

For panes exceeding 0,75 m² but not exceeding 1,5 m² in area 4 mm

(b) Putty

All putty shall comply with the requirements of SANS 680.

Putty shall not be too hard or soft or caked when used and shall dry evenly without crazing or cracking.
Defective putty shall be cut out and replaced by the Contractor at his own expense, and any broken glass shall also be so replaced and putty so repainted.

C3.3.1.3.4.2 PD 04.2 GLAZING

Glass shall be cut in panes to suit all glazed openings with sufficient clearance all round to prevent cracking by expansion, contraction, or vibration.

In all cases the glass shall be well bedded and back-puttied and installed as specified in SANS Code of Practice 10137.
All putty shall be carefully trimmed, cleaned off and neatly finished off straight with smooth surfaces and sharp mitres. A paint primer shall be applied as soon as the putty has dried out sufficiently to prevent shrinkage cracks from forming.

The entire glazing operation shall be cleaned before the premises are handed over for occupation.

C3.3.1.3.5 PD 05 CARPENTRY AND JOINERY

C3.3.1.3.5.1 PD 05.1 GENERAL

(a) Materials

All timber used for structural purposes shall be of merchantable grade and shall comply with the requirements of SANS 1783-1 and SANS 1783-2. Structural timber shall be carefully selected and of the best quality, free from large or dead knots, shakes, waney edges or other defects. Purlins and brandering shall comply with the requirements of SABS 1783-4. Finger-jointed structural timber shall comply with the requirements of SANS 10096 and laminated timber with the requirements of SABS 1460.

Hardwoods and softwoods for joinery shall comply with SANS 1099 and SANS 1783-3 respectively and suitable species shall be used for the various purposes.

Unless otherwise specified, all materials shall conform to the appropriate SANS or BS Specification where such standards exist for nails, screws, bolts, adhesives, etc.

(b) Preservative treatment

All structural timber shall be given a preservative treatment suitable for the duty for which the timber is intended in accordance with SANS 10005, and no untreated timber shall be used. The preservative treatment shall not impair the final finish. The timber shall be impregnated throughout. When surface coating is specified, the compounds applied on the surfaces of the timber shall form an unbroken film.

(c) Priming

The jointing surfaces of all joints exposed to the weather and built-in portions of frames shall be thickly primed except where adhesives are specified.

Carpentry and joinery items which are prepared for painting by the manufacturer, shall be knotted and primed before being dispatched to the Site.

Primed surfaces shall be touched up where necessary during the progress of the work or where site adjustments have been made.

C3.3.1.3.5.2 PD 05.2 CARPENTRY WORK

(a) Scope of work

Carpentry work shall be carried out in a manner consistent with good workmanship and in compliance with the drawings.

The carpenter shall perform all cutting away and making good in attendance upon all other trades and he shall provide and maintain temporary coverings required for the protection

of any finished work that might be damaged if left unprotected during the progress of the work.

(b) Dimensions

Unwrought timber shall be as sawn and shall be to the dimensions and within the tolerances specified in the relevant SANS Standard Specifications mentioned in subclause PD 05.1(a).

(c) Jointing

Unless otherwise specified, all joints shall be secured by means of a suitable type and a sufficient number of approved connectors. All joints shall be carefully made in such a way that they will not impair the strength and stiffness of the beams or members.

(d) Timber roof construction

The plates, joists, rafters, purlins, brandering and other pieces used for the construction of the roof and trusses shall be of the dimensions, spacing and construction as shown on the drawings.

All the joints in the framework shall be of the most appropriate type, accurately formed and adequately secured with fasteners as specified.

C3.3.1.3.5.3 PD 05.3 JOINERY WORK

(a) Scope of work

Joinery work shall consist of the manufacture, delivery to the site, and fixing in the buildings, of all joinery shown on the drawings.

Except where a special finish is specified, the Contractor shall have all stairs, landings, doors, shelves, and other joinery work cleaned and scrubbed down and shall leave all his work in a good order to the satisfaction of the Engineer.

(b) Dimensions

All wrought timber shall be sawn, planed, drilled, or otherwise machined or worked to the correct sizes and shapes shown on the drawings.

Reasonable tolerances shall be provided at all connections between joinery works and the building structure to compensate adequately for any irregularities, settlements, or any other movements.

(c) Manufacture

The joiner shall perform all the necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all the other works necessary for correct jointing. He shall also provide all metal plates, screws, nails, and other fixings that may be necessary for doing the specified joinery work properly.

(d) Joints

Where joints are not specifically indicated, they shall be the recognised forms of joints for each position. The joints shall be so made as to comply with Part 2 of BS 1186.

(e) Doors and frames

Door frames, linings, panel doors, framed, ledged and braced doors, flush doors, sliding doors, etc. shall be supplied or made by the joiner and shall be installed, fitted, or hung as detailed on the drawings.

All timber shall be wrought and prepared for oiling, staining, varnishing, or painting.

(f) Skirtings, cornices, etc.

Skirtings, cornices, etc. shall not be installed until after the wall coverings have been applied, the flooring laid and ceilings installed, unless otherwise specified.

(g) In-situ joinery

In-situ joinery work shall not be executed until after all floor, wall and ceiling surfaces have been formed or constructed, unless otherwise instructed.

(h) Ceilings

Ceilings shall consist of plaster board or fibre-cement panels as shown on the drawings and shall be nailed to the brandering or suspended from the roof structure. The panels shall be separated by exposed tees and insulated with a 50 mm thick fibreglass wool blanket where shown on the drawings.

C3.3.1.3.6 PD 06 ROOF SHEETING AND ACCESSORIES

Roof sheeting and accessories shall comply with and will be measured and paid for under SANS 1200 HC.

C3.3.1.3.7 PD 07 ELECTRICAL WORK

The electrical wiring of buildings shall be carried out by registered and licensed electricians in accordance with the requirements of SANS 10142-1 and the regulations of the Employer.

The electrician shall work in close co-operation with the Contractor to ensure that all conduits, switchboards, plug boxes and switch boxes are installed in their correct position.

The work shall be carried out in accordance with the drawings and to the satisfaction of the Engineer and the local authority.

C3.3.1.3.8 PD 08 PLUMBING

C3.3.1.3.8.1 PD 08.1 MATERIALS

(a) General

All materials shall be of the best quality and shall be approved by the Engineer before installation. Cracked, chipped, dented, or faulty items or materials shall be replaced at the Contractor's expense. Glazed ceramic sanitary ware shall comply with the requirements of SANS 497 and all other materials shall comply with the standards as specified, scheduled, or shown on the Drawings.

(b) Water closet (WC) suites

WC suites shall consist of a white glazed vitreous china closet with an S or P trap and seat lugs, a 14 litre low-level matching flat-bottomed flushing cistern placed and fixed on the closet, or a suspended enameled cast-iron cistern with the flush pipe connected to the

flushing rim of the closet with rubber cone joints, and a solid heavy-duty plastic seat with cover, hinges and buffers.

(c) Urinals

Urinals shall be of the type detailed or scheduled, of white glazed vitreous china, wall mounted, with an automatic or a manual flushing system, and chromium-plated fittings.

(d) Wash-hand-basins

Wash-hand-basins shall be of white glazed vitreous china or enameled cast iron, wall mounted on a pair of cast-iron brackets, and fitted with chromium-plated fittings consisting of two taps, outlet and chain, and supplied with a plug and an anti-siphon trap.

(e) Sinks

Sinks shall comply with the requirements of SANS 242 and shall be complete with cabinet, chromium-plated outlet, anti-siphon trap, plug, chain and two bib taps or one mixer tap, all as detailed or as scheduled.

(f) Pipes and tubing

Cast-iron and steel pipes used in plumbing work shall comply with the requirements of SANS 746 and SANS 62 respectively. Copper tubing shall comply with the requirements of SANS 460 and malleable cast-iron fittings with SANS 14.

C3.3.1.3.8.2 PD 08.2 CONSTRUCTION

Plumbing shall be carried out strictly in accordance with the Drawings and with the National Building Regulations, with specific reference to Government Notice R1875 dated 31 August 1979.

Steel pipes and their malleable cast-iron fittings shall be joined with red lead and hemp, lead pipes shall have wiped soldered joints, and cast-iron pipes shall be joined by caulking with hemp and metallic lead.

Soil pipes from WCs shall have an internal diameter of at least 100 mm and shall be fitted with a pan connector and an access bend (or an access junction where a vent pipe is used), and carried through walls and into the ground for connection to the sewer. Vent pipes shall be fitted with approved balloon gratings.

Waste pipes from basins and sinks shall have an internal diameter of at least 32 mm and shall discharge into gulleys. Bends for waste pipes shall incorporate cleaning eyes.

Cisterns, basins and sinks shall be connected to the pipe system with 12 mm diameter copper service pipes, and chromium-plated stopcocks shall be installed for isolation and maintenance purposes.

C3.3.1.3.9 PD 09 PAINTING

C3.3.1.3.9.1 PD 09.1 GENERAL

No paint shall be applied to any surface containing traces of dust, grit, grease, oil, loose rust, mill scale or corrosion products of any kind or to any surface that is not free from moisture. Where necessary, surfaces shall be thoroughly washed to remove all traces of soluble salts and/or corrosive air-borne contaminants prior to painting, and the surfaces shall be dried and painted immediately thereafter.

Welding shall be completed in so far as it is possible before painting commences, but in cases where welding can be done only at a later stage, no paint shall be applied to within 75 mm of the proposed weld position unless otherwise specified. Welds and adjacent parent metal shall be abrasive blasted and/or ground and all contaminants such as flux shall be removed prior to painting.

Surfaces of members which are to rest on concrete or other floors or which will be otherwise inaccessible after erection shall receive the full paint system prior to erection.

Damaged paint areas on metal surfaces shall be cleaned, rust spots removed where applicable and the surrounding paint which is still intact shall be feathered for a distance of 20 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the damaged area.

Damaged galvanised areas shall be cleaned and any rust spots and any flakes of the coating surrounding the damaged area removed. The coating shall then be restored by zinc spraying or soldering, or painting with a zinc-rich paint, as may be approved by the Engineer.

Where the shop coat is allowed to age for a few months before the final painting is done, light sanding or rubbing with steel wool or scrubbing with clean water using a bristle brush shall be carried out.

Steel to be embedded in concrete shall not be painted below 50 mm from the final level of the concrete.

Each priming coat and each undercoat of paint shall be inspected and approved by the Engineer before any subsequent undercoat or finishing coat is applied.

All finishing colours shall be as shown on the drawings, or as directed by the Engineer.

C3.3.1.3.9.2 PD 09.2 MATERIALS

Paints shall comply with the requirements of the appropriate specifications below:

- Painting of Structural Steel - EN ISO 12944
- Painting of Buildings - BS 6150
- Undercoats and Finishing Coats - BS 7664

The Contractor shall furnish the Engineer with the following information and details regarding the paints and decorative materials for the painting system he proposes to use, for written approval:

(i) The name of the manufacturer and trade name

(ii) The brand, type or grade of paint and the appropriate Specification

(iii) Manufacturer's data sheets, colour references, instructions for use, including surface preparation, sealers, primers, undercoats, finishing coats, coat thicknesses and curing periods, which shall all be considered as being part of these Specifications if approved by the Engineer

(iv) Safeguards to protect the applied paint from damage until the work is accepted by the Engineer

(v) The shelf or pot life of materials, if applicable

(vi) An undertaking that the proposed paint system is suitable for its intended use and that the various coats of paint are compatible with one another

Where proprietary brands are used, the manufacturer's priming and all subsequent coats of paint suitable for that particular brand shall be employed in accordance with the manufacturer's instructions.

No other materials of a similar nature and quality or from another manufacturer may be used instead of those approved, unless written permission to do so has been obtained from the Engineer.

All materials shall be brought onto the site in containers sealed by the manufacturer. Paints of a different quality, type, brand or colour shall not be mixed, or thinned and shall not be adulterated in any way, but shall be used as supplied by the manufacturer. Any mixing or tinting required shall be carried out by the manufacturer.

Tinting of paint on the site by the Contractor will only be allowed with the written permission of the manufacturer and the Engineer.

C3.3.1.3.9.3 PD 09.3 INSPECTION AND PRELIMINARY WORK

Before commencing paintwork, the Contractor shall carefully inspect the surfaces to be painted to satisfy himself that the surfaces are in a satisfactory or acceptable condition to receive the paint system specified.

All metal fittings and fastenings shall be removed where applicable before the preparatory processes are commenced. On completion, the metal fittings and fastenings shall be cleaned and refitted in position.

C3.3.1.3.9.4 PD 09.4 WORKMANSHIP AND FINISHES

Paint may be applied by spray, brush or roller depending on the materials used, the surface to be painted, and the manufacturer's instructions.

Every coat of paint, irrespective of the method of application, shall be adequately and permanently keyed or bonded to the base material or previously applied coat, and shall be evenly distributed, continuous, free from sags, runs, brush marks, pin holes or other imperfections, and shall dry to a smooth finish.

An approved water trap and air-regulating valve shall be furnished and installed on all equipment used in spray painting.

Before painting the interiors of buildings they shall be cleaned and the floors shall be washed and kept free from dust during the progress of the interior work.

The Contractor shall protect all nearby surfaces against disfigurement by spatters, splashes and smirches of paint or paint materials. The Contractor shall be responsible for any damage by paint or dirt caused by his operations to vehicles or property or injury to persons and he will be required to provide protective measures to prevent any such damage or injury and make good, where required, at his own expense.

If passing traffic creates dust which may harm or spoil the appearance of external painted surfaces, the Contractor shall sprinkle the adjacent areas with water, at his own cost, for a sufficient distance on each side of the location where painting is being done.

Undercoats shall be tinted by the manufacturer to distinguish between successive coats.

The final coats or finishing coats of paint shall be applied after all the other work in the vicinity has been completed.

The painter shall keep some of the final paint in reserve in the event of his having to make good any patching which may be required as a result of damage or unforeseen circumstances.

Upon completion, the Contractor shall, in the case of buildings, clean all glass, remove all paint spots from walls, floors and fittings, and leave the premises clean and fit for occupation.

All inflammable materials, comprising solvents, thinners, wiping cloths, etc., shall be placed in tightly closed containers and properly disposed of.

C3.3.1.3.9.5 PD 09.5 PAINTING OF PLASTER, CONCRETE OR BRICK SURFACES

(a) Surface preparation

Surfaces for painting shall be prepared by sandpapering, scraping or wire-brushing to remove loose material, dust, laitance, scum or other deleterious materials or high spots. Defective areas shall be cut out where necessary and made good with an approved non-shrink filler. Cracks shall be cut out, suitably keyed, and given a coat of an approved bonding agent before the filler is applied. All patches shall be rubbed down to an even surface. Surfaces shall be washed and allowed to dry.

Surfaces shall be treated with neutralising liquid for walls, and if the surface is coarse or textured, either one full coat of pigmented wall sealer or one full filler coat shall be applied in addition to the neutralising liquid.

(b) Paint application

Prior to the emulsion paint being applied, the surface shall be sealed with an approved clear sealer and primed with an undercoat diluted to 50%. Emulsion paint (PVA or acrylic) shall then be applied in two finishing coats.

Egg-shell finish (alkyd oil-based), oil gloss paint or enamel gloss paint shall be applied as follows: one coat of universal undercoat shall be applied and it shall be followed by one coat of a mixture comprising 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of semi-gloss egg-shell, or oil gloss paint or enamel gloss paint shall then be applied.

C3.3.1.3.9.6 PD 09.6 PAINTING OF WOODWORK

(a) Surface preparation

The surfaces shall be cleaned, sandpapered and rubbed down to a smooth, even face before painting. The moisture content of the timber shall not be more than 20% at the time when the first coat is applied. All cracks, shakes or scars shall be filled flush with a filler approved by the Engineer before painting. The surface shall then be washed with cleaner and allowed to dry.

(b) Primer application

One coat of an approved wood primer shall be applied.

After open-grained timber has been prepared and primed, the grain shall be stopped and filled with synthetic filler and rubbed down with water paper.

All new woodwork shall be properly primed on all surfaces and edges before being fixed in position. All woodwork not previously painted shall be given a prime coat, well brushed in.

(c) Paint application

One coat of universal undercoat shall be applied followed by one coat of a mixture of 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of oil gloss paint or enamel gloss paint or semi-gloss egg-shell (alkyd oil-based) paint shall then be applied.

(d) Varnish finish

Two coats of gloss varnish or egg-shell varnish shall be prepared, stopped and applied.

C3.3.1.3.9.7 PD 09.7 PAINTING OF METAL SURFACES

(a) General

Wherever possible, all painting shall be done at the manufacturer's works, but where this is not feasible, the Engineer may permit the application of the undercoat and finishing coats to be carried out on the Site, in which case a prime coat shall be applied at the manufacturer's works prior to the members being dispatched to the Works.

(b) Surface preparation

The preparation of metal surfaces shall comply with SANS Code of Practice 10064 and shall receive the greatest care to ensure rust-free conditions prior to the paint system being applied.

All surfaces shall be prepared by removing loose paint, rust, plaster, scale, dust, dirt, grease, etc. and by repairing or patching defective paint surfaces before painting or repainting. Damaged shop-primed surfaces shall be thoroughly cleaned of rust and patched with a prime coat.

(c) Paint application

(i) Iron and steel work

All iron and steel work shall be properly primed with a red-lead-based primer where steel work is likely to be exposed to the elements for longer than 30 days. Zinc-chromate primer may be used where overpainting will be completed within 30 days of priming. Metal-etch wash primers may be used under dry conditions where overpainting will be completed within 24 hours of priming. The dry-film thickness of the prime coat shall not be less than 0,300 mm.

After priming, one coat of universal undercoat shall be applied. If necessary, the undercoat shall be tinted to a shade just lighter than the desired finish with approved liquid stainers. The dry-film thickness shall not be less than 0,250 mm.

The two finishing coats shall either be of alkyd resin-based synthetic enamel, gloss or matt oil paint, or as specified elsewhere. The dry-film thickness shall not be less than 0,250 mm per coat.

When mating surfaces are brought together, both surfaces shall have been given the full treatment specified, but where this cannot be done, each surface shall be given a copious coating of primer and the surfaces drawn together while the paint is still wet.

The portion of structural steel members to be buried in soil, and all bases to a height of 500 mm shall be given two coats of an epoxy-tar primer instead of the zinc-chromate primer specified for other surfaces.

The surfaces of steel and cast-iron articles, such as floor gratings, grids and manhole covers, shall, after a thorough brushing to remove loose rust, be painted with two coats of epoxy-tar paint, each at least 0,230 mm thick.

(ii) Galvanized iron and steel

All traces of protective coating shall be removed with galvanized iron cleaner, and two coats of calcium plumbate primer shall be applied. One coat of tinted universal undercoat and two finishing coats of alkyd resin-based synthetic enamel gloss paint shall be applied.

(iii) Non-ferrous metals

Surfaces of aluminium, copper, etc. shall be prepared and cleaned, and one coat of self-etch zinc-chromate wash primer shall be applied. One coat of universal tinted undercoat and two finishing coats of enamel gloss paint shall then be applied. Where non-ferrous metals are not to be painted, the surfaces shall be cleaned, polished and two coats of lacquer applied.

C3.3.1.3.9.8 PD 09.8 PAINTING OF FLOOR SCREEDS

Where chemicals could cause damage to floors, such floors shall be painted with an approved epoxy paint. The type of paint to be used will be shown on the drawings and will depend on the types of chemical that are used.

The preparation of such floor screeds for painting and the subsequent application of paints shall be carried out strictly in accordance with the manufacturer's instructions.

C3.3.1.3.9.9 PD 09.9 PAINT THICKNESS

Unless otherwise specified, all coats of paint, whether prime coat, undercoat or finishing coat, shall have a dry-film thickness of not less than 0,200 mm, irrespective of the method of application.

C3.3.1.3.9.10 PD 09.10 INSPECTION

The Contractor shall provide the necessary equipment to establish whether the primers, undercoats and finishing coats have been applied to the correct thickness according to the correct applications. The Engineer may take samples of the paints during painting operations for testing and quality control.

C3.3.1.3.10 PD 10 MEASUREMENT AND PAYMENT

C3.3.1.3.10.1 PD 10.01 Brickwork:

(a) (Thickness, type, and class indicated) …… Unit: m²

(b) Etc. for other thicknesses, types and classes

The unit of measurement shall be the square metre of each type of brickwork built, calculated from the leading dimensions of the brickwork. Areas of pipes, etc. built into

brickwork shall not be included in the areas measured. At corners and intersections common to more than one brick wall, the areas shall be measured only once.

The tendered rates shall include full compensation for the construction of the brickwork complete as specified, including pointing, the building-in of conduits, beams, lintels, pipe sleeves, doors, windows, the raking-out of joints, damp-proof course, brickforce reinforced as specified, etc.

C3.3.1.3.10.2 PD 10.02 Plaster work:

(a) (Thickness of plaster and finish indicated) ……Unit: m²

(b) Etc. for other thicknesses and finishes

The unit of measurement shall be the square metre of each type of coat completed as specified.

The tendered rates shall include full compensation for the construction of the plaster work, including supplying all materials, mixing, applying, finishing, forming reveals, joints, narrow widths, rounded angles, V-joints, etc. complete as specified.

C3.3.1.3.10.3 PD 10.03 Floor screeds:

(a) (Description and thickness indicated) ……..Unit: m²

(b) Etc. for other thicknesses

The unit of measurement shall be the square metre of floor screed laid, as specified, on floors, steps or areas shown on the drawings or as designated by the Engineer.

The tendered rates shall include full compensation for constructing the floor screeds, including supplying all materials, mixing, laying, finishing, and forming nosings, reedings, skirtings, etc.

C3.3.1.3.10.4 PD 10.04 Doors and windows:

(a) (Type and size indicated) ……Unit: number

(b) Etc. for other types and sizes

The unit of measurement shall be the number of doors and windows installed complete as specified.

The tendered rates shall include full compensation for manufacturing and installing steel doors, powder-coated aluminium windows, and frames complete with hinges, handles, industrial-type locks, barrel bolts, retaining devices, door stops, stays and any other work necessary to complete the work as specified or as shown on the drawings. The tendered rate for windows shall also include full compensation for glazing, window sills as specified, and damp-proof sheeting.

C3.3.1.3.10.5 PD 10.05 Structural timber:

(a) Plates (sizes indicated) ...…….Unit: m

(b) Beams (sizes indicated) ...……Unit: m

(c) Joists (sizes indicated)..……..……...Unit: m

(d) Rafters (sizes indicated) ……..……Unit: m

(e) Purlins (sizes indicated) ……..……Unit: m

(f) Roof trusses complete (drawing number indicated) ……..……Unit: number

(g) Roof truss system complete (drawing number indicated) ……Unit: Sum

The unit of measurement shall be the metre of individual types of timber element or the number of complete trusses installed.

The tendered rates shall include full compensation for supplying all materials and manufacturing, cutting, wasting, jointing and installing the timber as shown on the drawings.

C3.3.1.3.10.6 PD 10.06 Ceilings:

(a) Plaster-board ceiling (type and thickness indicated):

(i) Fixed ceiling……..Unit: m²

(ii) Suspended ceiling……Unit: m²

(b) Fibre-cement ceiling (thickness indicated):

(i) Fixed ceiling……...Unit: m²

(ii) Suspended ceiling……Unit: m²

The unit of measurement shall be the square metre of fixed or suspended ceiling installed complete as scheduled.

The tendered rates shall also include full compensation for the construction of the ceilings, including the exposed tees, insulation blanket and brandering as specified, as well as the suspension system where applicable.

C3.3.1.3.10.7 PD 10.07 Joinery:

(a) Items measured by number:

(i) Doors (type and size indicated)……Unit: number

(ii) Etc. for other items measured by number

(b) Items measured by length:

(i) Skirtings (type and size indicated)……Unit: m

(ii) Etc. for other items measured by length

The units of measurement shall be the metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for supplying all materials, and manufacturing, cutting, wasting, fixing and installing the joinery items.

C3.3.1.3.10.8 PD 10.08 Miscellaneous work:

(a) Paintwork……Unit: sum

(b) Plumbing……Unit: sum

(c) Electrical work……Unit: sum

The tendered sums shall include full compensation for the supply of all materials, for transport, storage, all equipment and labour, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion.

C3.3.1.3.10.9 PD 10.09 Miscellaneous items:

(a) Items measured by number:

(i) (Description of item)……Unit: number
(ii) Etc.

(b) Items measured by length:

(i) (Description of item)……Unit: metre (m)

(ii) Etc.

(c) Items measured by area:

(i) (Description of item)……Unit: square metre (m^2)
(ii) Etc.

The unit of measurement shall be the number, linear metro and square metre as applicable to each item.

The tendered rates shall include full compensation for all labour, plant, equipment, transport, etc., manufacturing or providing and installing each item complete as scheduled and shown on the drawings, and shall include all corrosion protection where applicable.

C3.3.1.4 PZ PATENTED EARTH RETAINING SYSTEMS

C3.3.1.4.1 PZ 01 SCOPE

This section covers the construction of retaining structures by means of proprietary or custom-built precast concrete block retaining systems such as Löffelstein, Enviro-wall, Terrace Blok, etc.

C3.3.1.4.2 PZ 02 MATERIALS

C3.3.1.4.2.1 PZ 02.01 GENERAL

All materials used in constructing the retaining systems, as well as all precast units of proprietary or custom-built retaining systems shall be subject to the approval of the engineer.

When requested by the Engineer, the Contractor shall submit test certificates from an approved independent testing authority to show that the respective materials comply with the specified requirements, or certificates from the patent holders or licensees certifying that the manufactured items comply in all respects with the relevant product SPECIFICATIONS.

C3.3.1.4.2.2 PZ 02.02 CONCRETE BASES FOR EARTH RETAINING SYSTEMS

All materials for concrete bases for earth retaining systems shall comply with the relevant requirements of SANS 2001 CC1.

C3.3.1.4.2.3 PZ 02.03 PRECAST CONCRETE BLOCKS

The precast concrete blocks shall be of the type shown on the drawings or specified in the project specifications, or it shall be an approved alternative type. The blocks shall be uniform of colour and durable and shall not react with soil. All materials for precast concrete blocks shall comply with the relevant requirements of SABS 1200 GE.

C3.3.1.4.2.4 PZ 02.04 BACKFILL MATERIAL

The backfill material shall be approved granular material, unless otherwise specified in the project specifications or on the drawings.

C3.3.1.4.3 PZ 03 CONSTRUCTION

C3.3.1.4.3.1 PZ 03.01 EXCAVATIONS

All excavations for the bases of the earth retaining systems shall be done in accordance with the provisions of SABS 1200 D. The contractor shall not commence with the construction of the bases before the excavations have been properly cleaned by the contractor and inspected and approved by the engineer.

C3.3.1.4.3.2 PZ 03.02 BASES

The bases for the earth retaining systems shall be of the type or types shown on the drawings or specified in the project specifications.

The provisions of SABS 2001 CC1 shall apply to the construction of concrete bases.

The bases shall be constructed in accordance with the dimensions and levels shown on the drawings.

No precast concrete blocks shall be installed until the engineer has inspected and approved in writing the completed bases.

C3.3.1.4.3.3 PZ 03.03 INSTALLING THE PRECAST CONCRETE BLOCKS

The precast concrete blocks shall be installed on the completed bases in accordance with the specifications of the patent holders or the licensees and in accordance with the lines, levels and angles of inclination shown on the drawings, or with the variations ordered in writing by the engineer.

C3.3.1.4.4 PZ 04 PATENT RIGHTS

The contractor shall negotiate direct with the patent holders or licensees in connection with royalties payable for the use of the patented systems. The contractor shall arrange for technical assistance by the patent holders or licensees before and during construction.

C3.3.1.4.5 PZ 05 MEASUREMENT AND PAYMENT

C3.3.1.4.5.1 PZ 05.01 PATENTED EARTH RETAINING SYSTEMS:

(a) Löffelstein precast concrete blocks of type (state type)……Unit: m²

(b) Enviro-wall precast concrete blocks of type (state type)……Unit: m²

(c) Terrace Blok precast concrete blocks of type (state type)……Unit: m²

(d) Etc. for other patented earth retaining systems and other types of blocks……Unit: m²

The unit of measurement shall be the square metre of the front vertical face of the earth retaining system placed in position as shown on the drawings. The front vertical face shall be measured from the top of the base to the top of the earth retaining system.

The tendered rate shall include full compensation for procuring, furnishing, transporting, handling and placing all materials and precast concrete blocks, including the specified backfill material between the blocks, compacted fill and/or drainage material behind the blocks, Bidim b3 material, and any additional costs required for placing the blocks in position complete as specified.

C3.3.1.4.5.2 PZ 05.02 EXCAVATION FOR CONCRETE BASES FOR EARTH RETAINING SYSTEMS:

(a) In soft material……...Unit: m³

(b) Extra over subitem (a) above for excavation in hard material……Unit: m³

(c) Base preparation and compaction to minimum of 90% of modified AASHTO maximum density Unit: m³

Measurement and payment for excavation shall be as specified for item PSD 8.3.3 of SABS 1200 D except that no additional excavation shall be measured were formwork is required.

Payment for base preparation and compaction shall be as specified for item PSDM 8.3.3 of SANS 1200 DM.

C3.3.1.3.5.3 PZ 05.03 CONCRETE BASES FOR EARTH RETAINING SYSTEMS (CLASS OF CONCRETE INDICATED)……Unit: m^3

The unit of measurement shall be the cubic metre of concrete cast in the concrete bases for earth retaining systems, calculated in accordance with the net approved dimensions of the concrete bases.

The tendered rate shall include full compensation for supplying and placing the concrete and constructing the concrete bases, including any formwork which may be necessary, and for all steel reinforcement, complete as specified.

C3.3.2 MECHANICAL

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C3.3.2.1 ZUT 0001 GENERAL MECHANICAL

C3.3.2.1.1 ZUT 0001.1 SCOPE

ZUT 0001 specifies general technical requirements for mechanical engineering projects in which the contractor is responsible for the detailed design.

C3.3.2.1.2 ZUT 0001.2 NORMATIC REFERENCES

The following South African National Standards are referred to in this specification:

- SANS 62
- SANS 200
- SANS 4427
- SANS 719
- SANS 936/7
- SANS 989/992
- SANS 1034
- SANS 1062
- SANS 1123
- SANS 1186
- SANS 1200H
- SANS 1217
- SANS 1465
- SANS 1700
- SANS 1804
- SANS 10044
- SANS 10104
- SANS 10160
- SANS 10108
- SANS 50025
- SANS 60034-5
- SANS 61241

The following British Standards are referred to in this specification:

- BS 970
- BS 1400
- BS 1452
- BS 1490
- BS 2789
- BS 3100
- BS 3790
- BS 4515
- BS 4872
- BS 7854
- BS EN 681
- BS EN 1092
- BS EN ISO 23936

The following ISO standards are referred to in this specification:

- ISO Sa3
- ISO 4184
- ISO 8501
- ISO 10816

C3.3.2.1.3 ZUT 0001.3 MATERIALS

C3.3.2.1.3.1 ZUT 0001.3.1 GENERALLY

All materials used in the manufacture and construction of plant and equipment shall be new, unused and shall be the best of their respective kinds. The Contractor shall ensure that the materials are selected in accordance with the best engineering practice to suit the working conditions and the extremely corrosive environment.

C3.3.2.1.3.2 ZUT 0001.3.2 STEEL

Structural steel shall comply with the requirements of SANS 50025 for grade S 355 JR or for grade S 355 JO and shall be legibly marked with the maker's name or trade mark and identification marks.

C3.3.2.1.3.3 ZUT 0001.3.3 STAINLESS STEEL

The grade of stainless steel to be used shall be as specified. Unless otherwise specified, rolled material shall be supplied with a matt, annealed and pickled or otherwise de-scaled surface finish. For wrought steels, the equivalent BS 970 grade may in each case be used.

A manufacturer's test certificate shall be provided for each batch of stainless-steel giving details of the material analysis and any mechanical tests carried out on the material. Each stainless steel item supplied shall be clearly and permanently marked with the grade of stainless steel and cross referenced to the applicable test certificate.

Where grades EN Grade 1.4401 (316) and EN Grade 1.4301 (304) are specified, these shall be taken synonymously with the low carbon grades for welding.

C3.3.2.1.3.4 ZUT 0001.3.4 3CR12

This is the titanium stabilised, 12 % chrome steel as produced by Columbus Stainless, South Africa. 3CR12 shall always be supplied with an annealed and pickled finish. 3CR12, in cases where it is to be coated, shall be suitably abrasive blasted to ensure adherence of the prime coat.

C3.3.2.1.3.5 ZUT 0001.3.5 PLASTICS

Thermoplastics and fibre reinforced polymers shall be UV resistant, have adequate tensile strength and high impact strength and generally suit the application.
PVC is regarded as too brittle and shall not be used unless called for in this Specification or approved in writing by the Engineer before supply.

C3.3.2.1.4 ZUT 0001.4 CASTINGS

Castings shall comply with the relevant South African or international standard for the material used, including the following:

Grey Cast Iron	SANS 1034; BS 1452
S. G. Iron	SANS 936/7; BS 2789
Steel (General Purpose)	SANS 1465; BS 3100
Aluminium	SANS 989/992; BS 1490
Stainless Steel	DIN 17 445
Copper and Copper Alloy	SANS 200; BS 1400

Castings shall be clean and sound and shall be neatly fettled and dressed. Surfaces shall be smooth and irregularities caused by mould washaways, and the presence of porosity, inclusions and sharp edges will not be tolerated. Areas under bolt heads, nuts and washers, shall be

machined or spot faced to ensure a flat and smooth pressure bearing area, and sufficient space shall be provided for the use of ring or socket spanners.
All pressure retaining castings shall be hydrostatically tested to not less than 1,5 times the maximum working pressure after machining and shall be pressure tight.

No repairs shall be undertaken to castings without the written permission of the Engineer. Cast iron castings shall not be welded.

Castings shall be heat treated to provide optimum corrosion resistance and toughness combined with reasonable machinability. In particular stainless steel castings shall be heat treated so as to ensure that all carbides are in solution, to ensure optimum grain size, and to provide maximum corrosion resistance.

The Contractor shall provide a test certificate for each casting or batch of castings, except for those made of grey cast iron, giving details of the material analysis, the heat treatment and any mechanical tests carried out.

C3.3.2.1.5 ZUT 0001.5 FABRICATION OF STEELS

C3.3.2.1.5.1 ZUT 0001.5.1 GENERAL

Steelwork shall generally be constructed, fabricated and erected in accordance with the applicable requirements of SANS 1200 H.

Welding shall comply with the clause “Welding”.

Sharp edges, pits, inclusions, weld spatter, undercuts, indentations or other surface defects are not acceptable.

Edges shall be rounded to a radius of at least 2 mm.

Designs shall avoid inaccessible pockets and hollows.

Sharp edges on items fabricated from thin sheets will not be acceptable and sharp edges shall preferably be avoided by good design.

Inspection of fabrications shall generally be done after fabrication is complete.

C3.3.2.1.5.2 ZUT 0001.5.2 CARBON STEELS

Structural steelwork shall be of grade S 355 JR or of grade S 355 JO in accordance with SANS 50025.

The requirements of the Hot Dip Galvaniser’s Association of South Africa shall be complied with if the item is to be hot-dip galvanised. Designs shall provide proper access for safe and proper entry of the molten zinc into open spaces so that subsequent drilling at the galvaniser’s yard is avoided.

Surfaces to be coated shall be accessible by blast and spray equipment. Inaccessible pockets, such as bad weld profile as well as hollow structures, are unacceptable and the angle of impact of blast material and sprayed coatings shall not be less than 45 degrees. Edges shall be rounded for safety reasons and also to be suitable for the coating system to be applied.

C3.3.2.1.5.3 ZUT 0001.5.3 AUSTENITIC STAINLESS STEELS

Fabrication of austenitic stainless steels shall comply with the recommendations in "The Stainless Steel User Manual" issued by Columbus Stainless. Compliance with publications from equivalent authorities will be acceptable.

Stainless steel fabricators shall use permanently dedicated storage and fabrication areas and shall use machines, tools and handling equipment which are suited and permanently dedicated to this type of material.
Fabrications shall be pickled and passivated over their full surface to achieve an even colour. If grinding is required before pickling, the final grinding shall be done with a fine disc in order to remove coarse grinding marks.

C3.3.2.1.5.4 ZUT 0001.5.4 3CR12

Fabrication of 3CR12 shall comply with the requirements for austenitic stainless steels except that the recommendations in "The 3CR12 Fabrication Guide" issued by Columbus Stainless shall be used. Compliance with publications from equivalent authorities will be acceptable.

C3.3.2.1.5.5 ZUT 0001.5.5 DUPLEX AND HIGHLY ALLOYED STAINLESS STEELS

Fabrication of duplex, super austenitic and other highly alloyed stainless steels shall follow the metal producer's own guidelines.

Welding of duplex stainless steel pipework shall be in accordance with BS 4515 Part 2 or equivalent.

C3.3.2.1.6 ZUT 0001.6 WELDING

C3.3.2.1.6.1 ZUT 0001.6.1 STANDARDS

Standards complying with good modern practice, and acceptable to the Engineer, shall be adopted and the recommendations of the SAIW are acceptable in this respect.
Welders shall be experienced artisans approved in accordance with BS 4872 or equivalent.

C3.3.2.1.6.2 ZUT 0001.6.2 CONTINUOUS WELDING AND ELIMINATION OF CREVICES

Welding shall be continuous on all sides of any joint. Designs which do not allow this shall be re-designed.

Crevices, including those arising from welding on one side only, shall be eliminated. This requirement applies to the welding of all metals and welding procedure shall be designed to prevent unacceptable deformation.

Welds which are only accessible from one side shall be prepared so that the root run provides an acceptable profile and prevents the formation of crevices. Pipework shall be designed so that such welds can be inspected and, where applicable, pickled and passivated.

In special cases only, non-continuous welding might be approved in writing by the Engineer. The resulting crevices shall be sealed with a two part solvent free epoxy which can be applied at thicknesses of up to 600 µm and above such as Sigmaline 523 or Corrocoat Zip E or Sigmacover 1000 or equivalent.

C3.3.2.1.6.3 ZUT 0001.6.3 WELD APPEARANCE

Welding shall be free of blowholes, projections, pinholes, splatter and undercuts and all welding flux, weld spatter and other sharp imperfections shall be removed. Weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground.

C3.3.2.1.6.4 ZUT 0001.6.4 SITE WELDING

Site welding shall be kept to a minimum and shall only be undertaken with the approval of the Engineer.

C3.3.2.1.6.5 ZUT 0001.6.5 WELDING OF STAINLESS STEEL AND 3CR12 – ADDITIONAL REQUIREMENTS

Fabrication of austenitic stainless steels and 3CR12 shall comply with the recommendations in "The Stainless Steel User Manual", "The 3CR12 Fabrication Guide" and the general welding requirements in “Pocket Guide – Stainless Steels” issued by Columbus Stainless. Compliance with publications from equivalent authorities will be acceptable.

Stainless steels to be welded shall be of the low carbon grade; e.g. 1.4306 rather than 1.4301 and 1.4404 rather than 1.4401.

The welding rods used shall be the most suitable for the metal and purpose.

Only welders experienced with welding stainless materials shall be used.

Welds which are accessible from only one side shall be executed in a manner to prevent heat tint or shall be post-weld treated in order to remove all traces of heat tint.

Type 309 stainless steel welding rods shall be used for welding 3CR12 unless otherwise approved in writing. 3CR12 shall be welded as recommended in "The 3CR12 Fabrication Guide" issued by Columbus Stainless.

All possible steps shall be taken to ensure maximum corrosion resistance and strength of the welds and welded material. Special care shall be taken to avoid prolonged heating. Welds shall be passivated. Discolouration and steel contamination must be removed by pickling or electro cleaning as approved by the Engineer but should rather be avoided by taking the appropriate measures.

C3.3.2.1.6.6 ZUT 0001.6.6 INSPECTIONS

The Contractor shall arrange for all fabrications to be inspected by the Engineer prior to transport from the fabrication workshop.

C3.3.2.1.7 ZUT 0001.7 INSTALLATION

C3.3.2.1.7.1 ZUT 0001.7.1 GENERAL

The Works shall comply with the following:

a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.

c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.

d) The use of more than three shims in the alignment of equipment will not be permitted. Machined spacers shall be prepared where necessary. Shims and spacers shall be of a corrosion resistant material such as stainless steel.

e) Corrosion protection requirements shall be carefully attended to and the requirements of ZUT 0003 must be noted. All mating faces must be coated before and sealed after assembly.

f) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.

g) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable formable packing, Denso tape or equivalent, or with a suitable mastic or sealant.

C3.3.2.1.7.2 ZUT 0001.7.2 ALIGNMENT OF SHAFTS

Shafts for drives with an output above 150 kW shall be aligned to the driven shaft as follows:

a) Final alignment shall be done after installation and before commissioning and shall be checked in the presence of and to the approval of the Engineer. Alignment shall be sufficiently accurate to ensure that no initial pre-load is placed on the shaft coupling.

b) Each motor shall be aligned to its pump by alignment specialists using laser aligning equipment with real time computer display.

c) The use of pourable epoxy resin chocks (Epocast 36, Chockfast or equivalent) shall be acceptable. If pourable chocks are used, the baseframe feet do not have to be machined but each machine foot shall be provided with a screw for vertical alignment. The chock thickness shall not be less than 20 mm.

C3.3.2.1.8 ZUT 0001.8 CIVIL AND BUILDING WORKS

C3.3.2.1.8.1 ZUT 0001.8.1 GENERAL DUTIES

The Contractor shall be responsible for grouting pipework required to pass through walls, for all equipment grouting work, anchoring of equipment and closing of apertures associated with equipment to be provided in terms of this Contract.

The Contractor's Documents shall indicate the civil and building details required to accommodate the equipment installation; subject to and in accordance with any details shown on the drawings provided by the Employer. These details shall include plinths, foundation blocks, rebates, pockets, sleeve ducts, holes, thrust blocks, anchor fasteners and openings/box-outs for pipework passing through walls.

The Contractor shall inspect and check the related structures constructed by others for accuracy and suitability of construction and for conformance with the Contractor's documents before commencing installation and construction. No payments shall be allowed for additional costs to the Contractor resulting from a failure to check such works timeously or a failure to provide the related information in Contractor's Documents timeously.

C3.3.2.1.8.2 ZUT 0001.8.2 CIVIL CONTRACTOR'S WORK

The main civil and building works will be completed by others and will be mostly completed when the Contractor is granted access to the Site.

C3.3.2.1.8.3 ZUT 0001.8.3 PUDDLE PIPES

The Contractor shall install puddle pipes required by the design into concrete structures unless otherwise specified. For this purpose, the Contractor shall provide the details of box-outs required in the structure to the Engineer. Puddle flanges shall be of the same dimensions as standard flanges and the box-out shall be designed accordingly and with allowance for civil tolerances of + 40 mm.

The structure will be constructed by others and, if required, it will be tested for water tightness by the Engineer before handover to the Contractor by temporary closure of the box-outs.

Upon receiving access to the Site, the Contractor shall install the pipework and shall grout the puddle pipes into the structure using a suitable non-shrink grout to the approval of the Engineer. The Contractor shall provide a water tight installation and shall be responsible for rectifying any leakage at the puddle pipe.

C3.3.2.1.8.4 ZUT 0001.8.4 BASEFRAMES, PIPE SUPPORTS, ETC.

The design requirements for base frames and pipework supports are specified elsewhere in ZUT 0001.

The Contractor shall be responsible for grouting of base frames, pipe supports, plinths, etc. required for installation of the equipment and this includes any metallic structure which is mounted onto a concrete surface.

The method proposed for anchoring base frames, pipe supports, etc. to concrete shall be submitted to the Engineer for approval and shall incorporate the details of the grout proposed. The material used for grouting shall be a non-shrink, cementitious grout such as ABE Duragrout 1000, or equivalent. ABE Epidermix 324, or equivalent, is acceptable if an epoxy grout is required.

The design and grouting shall eliminate collection points for water or dirt.

If called for by the Engineer, the initial grouting shall be overseen by the grout supplier's technical representative.

Grout shall be applied only after each anchor fastener has been tested for integrity.

C3.3.2.1.9 ZUT 0001.9 PIPEWORK SUPPORTS

Supports for steel pipework and for plastic pipework shall comply with ZUT 7024.

C3.3.2.1.10 ZUT 0001.10 STEEL PIPEWORK; DN 100 AND LARGER

C3.3.2.1.10.1 ZUT 0001.10.1 GENERAL

This clause applies to carbon steel pipework and to stainless steel pipework.

Steel pipework > DN 100 shall comply generally with ZUT 7001: Design and Manufacture of Medium Pressure Steel Specials.

The remainder of this clause specifies additional requirements for pipework associated with equipment installations.

C3.3.2.1.10.2 ZUT 0001.10.2 PIPEWORK CONSTRUCTION AND CONFIGURATION

Pipework shall be joined using bolted flanges.

Stainless steel and 3CR12 pipes shall be to ASTM A312, ANSI B36.19 or ANSI B36.10 or equivalent.

Pipes and fittings shall be neatly installed, straight to line and level and adequately supported. Pipework shall be supported above floor level on supports, racks or wall mounted and shall not be installed directly on the floor.

Pipework shall be configured and shall be provided with couplings and/or bends to allow easy dismantling and disassembly of all pipework without damage to the pipework or pipe supports.

Provision shall be made for draining all sections of pipework.

Provision shall be made for venting high points of pipework.
Valves shall be mounted in horizontal pipework unless this is not feasible.

Pipework shall be correctly anchored to withstand thrust.

If the physical configuration does not provide axial restraint of pipework couplings, then these couplings shall be provided with thrust restraints.

Bends shall preferably be of the long radius type. 90 degree “lobster back bends” shall have a minimum of five segments.

Each flange shall be perpendicular to the segment to which it is welded.

Convergences shall preferably be of swept tee formation rather than tee pieces.

C3.3.2.1.10.3 ZUT 0001.10.3 PUMP SUCTION PIPEWORK

Two mechanical couplings or one rubber tyre type coupling shall be provided on each pump’s suction pipework.

Pump suction pipework shall comply with good hydraulic design.

The suction manifold/pump leg bifurcation shall be of swept tee formation if the speed of flow within the leg at that point is one metres per second or higher. If this flow speed within the leg at that point is lower than one metre per second, the bifurcation may be of a normal tee formation.

The pipework on the suction side of pumps shall be sized to ensure that the flow speed is no higher than 1,5 m/s.

High points shall be avoided in positions where the flow speed is below one metres per second. Suction pipework shall be level or shall slope upwards toward the pump.

Air leaks shall be prevented.

Flow straighteners shall not be used if there is a probability that the straightener will capture solids.

C3.3.2.1.10.4 ZUT 0001.10.4 PUMP DISCHARGE PIPEWORK

Two mechanical couplings or one rubber tyre type coupling shall be provided on each pump’s discharge pipework.

C3.3.2.1.10.5 ZUT 0001.10.5 REDUCERS

Reducers shall have a maximum angle of divergence of 10º unless otherwise shown on the drawings.
Reducers shall not have more than two longitudinal weld seams.

The taper shall not be welded directly to the flange; i.e. a short cylindrical length of pipe shall be provided between the taper and each flange.

C3.3.2.1.10.6 ZUT 0001.10.6 NOZZLES/SOCKETS

Nozzles shall be provided for the installation of gauges, transmitters, drain pipes, cooling water take offs, air release valves, etc. These shall be designed so that the pipework corrosion prevention system can be applied to all wetted surfaces without compromise. Nozzles shall consist of a flanged, welded tee off of at least 100 mm diameter, coated internally and provided with a

non-corrosive blank flange, e.g. EN Grade 1.4401 (316) stainless steel. The blank flange shall be provided with tapped holes, or similar, suitable for the installation.

Carbon steel pipework may be provided with small diameter, EN Grade 1.4401 (316) stainless steel sockets nozzles/nipples which are welded into the pipework. These shall be designed so that the pipework corrosion prevention system can be applied correctly to the carbon steel surfaces and shall overlap onto the stainless steel surfaces.

Nozzles/sockets on the suction side of pumps shall be designed and positioned to provide minimum interference with the flow path.

C3.3.2.1.10.7 ZUT 0001.10.7 SLUDGE PIPEWORK

Sludge pipework shall be provided with a rodding eye or similar arrangement at each bend in order to provide access to the inside of the pipe without dismantling the pipework.

C3.3.2.1.10.8 ZUT 0001.10.8 PIPEWORK FLANGES

Flanges shall comply with SANS 1123 or BS EN 1092 unless required to match existing flanges.

Raised face flanges shall be provided for pipework of PN 25 and higher.

Flange drilling shall be "off centre" unless required to match an existing flange which is drilled otherwise.

The jointing material used on flange joints shall be of a suitable rubber or compressed mineral fibre at least 3 mm thick complying respectively with BS EN 681 or BS EN ISO 23936, as applicable. Gaskets shall be full face. Properly designed O-ring seals are also acceptable.

C3.3.2.1.10.9 ZUT 0001.10.9 PUDDLE PIPEWORK

Puddle pipes to be permanently cast into concrete shall be of EN Grade 1.4401 (316), or of EN Grade 1.4462 (2205 duplex), or of cast iron.

Puddle pipes shall be a straight length, flanged both ends and with a puddle flange. Adequate clearance shall be provided between the wall surface and the flanges for inserting flange bolts and for the handwheel/actuator of the isolation valve but the length shall be kept as short as feasible.

The puddle flange shall be of the same diameter of a normal flange and shall be positioned in the central plane of the wall. It shall be of the same material as the pipe unless otherwise specified. Puddle flanges shall have a plate thickness of at least half the thickness of the standard flange.

The surfaces not directly protected by encasement in concrete shall receive the full corrosion protection system. The coating shall extend about 50 mm into the concrete but the area in contact with the concrete shall otherwise be uncoated. The uncoated area shall be abrasive blasted to promote bonding.
Puddle pipes shall be cast into structures only after the Engineer has approved the Contractor's proposed method statement for the grouting process.

Refer, also, to the clause "Civil and Building Works".

C3.3.2.1.10.10 ZUT 0001.10.10 PIPE COUPLINGS, ALIGNMENT AND FLEXIBILITY

Pipe couplings shall be provided where misalignment or dismantling must be allowed for and also for possible pipe movement from settlement or other cause. The coupling shall have the same or a higher pressure rating than the pipework in which it is installed.

Where the type of coupling is not indicated on the drawing, pipe couplings may be of the mechanical type (VJ coupling or flange adaptor), of the stainless-steel bellows type or of the rubber bellows type.

Mechanical couplings shall be of the rubber ring compression type (i.e. VJ type flange adaptors or VJ type couplings) and shall be provided **in pairs** in order to accommodate axial misalignment and/or settlement. Where a restraint is required, this shall incorporate three tie bars or more. Stainless steel and 3CR12 pipework shall be provided with stainless steel couplings or, where approved by the Engineer, cast iron couplings protected with fusion bonded epoxy. Carbon steel pipework shall be provided with carbon steel or cast iron couplings protected by fusion bonded epoxy. All fasteners, including the studs welded to flanges of flange adaptors, shall be of stainless steel.

Suitably rated **rubber bellows type couplings** with metal backing flanges are acceptable for pipe diameters of DN 300 and below. The bellows shall be provided with two backing flanges drilled to match their mating flanges. Bellows for low carbon steel pipework shall be provided with hot-dip galvanised flanges (i.e. not zinc plated). Bellows for 3CR12 or stainless steel pipework shall be provided with matching flange material.

Stainless steel bellows type pipe couplings shall be of EN Grade 1.4401 (316), or better, and shall incorporate stainless steel fasteners. Flanges shall be of stainless steel.

C3.3.2.1.10.11 ZUT 0001.10.11 PIPEWORK FOR FLOW METER CHAMBER

A flange adaptor shall be provided on the upstream flange of a flow meter and a flange adaptor shall be provided on the downstream flange.

The pipework shall also make allowance for one isolation valve downstream of the flow meter.

C3.3.2.1.10.12 ZUT 0001.10.12 PUMP SUCTION BELL-MOUTHS

Pump suction pipework which draws from open sumps shall be provided with bell mouth inlets. The bell mouth shall have an integral flange and shall be bolted to a flange on the suction pipework.

The bell mouth shall be provided with an elliptical (i.e. not segmented) profile.

The bell mouth may be of glass reinforced plastic, EN Grade 1.4401 (316) stainless steel or of cast iron.

C3.3.2.1.10.13 ZUT 0001.10.13 FABRICATION OF PIPEWORK

Fabrication shall comply with the clauses “Fabrication of Steels” and “Welding”. Welding shall achieve full penetration without crevices and both internal and external weld surfaces shall have a neat profile. An internal root run shall be provided where required to achieve a neat profile.

The internal surface of pipework shall be accessible for inspection and this might require that bends, tees and bifurcations shall be short and shall not be welded to a straight pipe rather than being flanged.

C3.3.2.1.10.14 ZUT 0001.10.14 FABRICATION OF DUPLEX STAINLESS STEEL PIPES

Duplex stainless steel pipes shall be fabricated in an automated production pipe facility using mechanised welding procedures; i.e. they shall not be fabricated by the Contractor (or the Contractor’s sub-contractor) from plate.

C3.3.2.1.10.15 ZUT 0001.10.15 CORROSION PROTECTION OF PIPEWORK

Corrosion protection shall comply with ZUT 0003.

C3.3.2.1.10.16 ZUT 0001.10.16 SITE WORKS

The Contractor shall make allowance for the misalignment of other pipework to which the Contractor's pipework is to be connected in accordance with the Conditions of Contract.

C3.3.2.1.10.17 ZUT 0001.10.17 INSPECTION AND TESTING REQUIREMENTS

Where dispute arises regarding acceptance of welds, the requirements of SANS 10044 Part 3 shall be complied with.

The Contractor shall make all arrangements and carry transport and accommodation costs for the Engineer to inspect the pipework after fabrication but before any corrosion protection.

The Contractor shall perform the following (in the presence of the Engineer unless otherwise agreed):

a) Pre-manufacturing approval of quality control documentation.
b) 100 % dye penetrant testing of all welds.
c) 10 % of welds to be X-rayed (this percentage will reduce if welds are found to be in order during initial testing). On discovery of defective welds the Engineer may call for radiographic examination until it is shown that the necessary standard is being maintained. Repairs of welded joints will be permitted and the repair procedure and performance of repairs shall be in accordance with Section 10 of API Specification 5L.
d) Visual inspection of pipework.
e) Paint thickness measurements.
f) Pipelines which are not fully visible and/or below ground shall be pressure tested to 1,5 times maximum working pressure for at least 15 minutes without pressure loss. This shall be done before covering up the pipeline and shall be witnessed by the Engineer.
g) Provide inspection reports.

C3.3.2.1.10.18 ZUT 0001.10.18 FLOW VELOCITY IN PIPEWORK

Where the pipe diameter is not specified, the design flow velocities for grit free water (water, effluent, centrate and supernatant) and for high solids water (wastewater and sludge) shall be as follows:

DESIGN FLOW VELOCITY [m/s]				
	flow = 0 - 2,5 ℓ/s	*flow = 2,5 - 15 ℓ/s*	*flow = 15 - 100 ℓ/s*	*flow = 100 - 500 ℓ/s*
grit free	< 0,75	< 1,25	< 1,5	< 2
high solids	0,8 – 1,5	0,8 – 1,5	1 – 1,75	1 - 2

C3.3.2.1.11 ZUT 0001.11 STEEL PIPEWORK (< DN 100)

Steel pipework smaller than DN 100 shall comply generally with the clause above but may be of screwed rather than of flanged construction.

C3.3.2.1.12 ZUT 0001.12 PLASTIC PIPEWORK

Polyethylene or Polypropylene pipes shall comply with SANS 4427 and shall carry the SABS mark.

PVC pipework is not acceptable for applications involving vibration or shock, including hydraulic shock.

An operating life of 50 years shall be designed for and appropriate de-rating factors shall be applied to suit the application. The class of pipe selected shall be not less than 1,5 times the actual maximum operating pressure.

Plastic pipework installed externally shall be provided with protection against ultraviolet light.

Tappings, for example for gauges, shall be provided with welded, external doubler plates. The plates shall have a thickness at least equal to the wall thickness of the pipe.

C3.3.2.1.13 ZUT 0001.13 CAST IRON PIPEWORK

Cast iron pipes and fittings shall comply with BS 2035 (Class D) and shall be pressure tested in accordance with Clause 12 of that Standard. The requirements of the Standard's Clause 6 regarding freedom from defects and casting appearance and Clauses 8, 9 and 10 regarding casting accuracy will be strictly applied.

Cast iron pipework shall comply with the requirements of the clause “Castings".

C3.3.2.1.14 ZUT 0001.14 ELECTRIC MOTORS

C3.3.2.1.14.1 ZUT 0001.14.1 ELECTRIC MOTORS BELOW 30 KW

C3.3.2.1.14.1.1 ZUT 0001.14.1.1 General

Cage induction motors below 30 kW shall be rated for operation on a 3-phase, 4-wire, 400/230 volt, 50 Hz, AC supply.

Motors shall be standard squirrel cage motors with IC 0141 cooling, shall be suitable for a damp environment and shall comply with SANS 1804.

Bearings shall be of the oil or grease lubricated roller and/or ball type. Re-greaseable bearings shall be provided with grease nipples (with extension tubes where access is restricted) and sealed to suit external use but with relief from over-greasing. L-10 design life shall not be less than 100 000 hours.

Terminal boxes shall be top mounted wherever possible and arranged for cable entry from either side. The two ends of each stator winding shall be "brought out" to the terminal box.
A stainless-steel rating plate shall be secured to the frame. This shall include the lubrication details.

Motors may have nominal speeds above 1 500 rpm.

Ingress protection shall be to at least IP 55.

C3.3.2.1.14.1.2 ZUT 0001.14.1.2 Performance Requirements

Motors shall provide rated power output at an ambient temperature of up to 40 ºC and at an altitude of at least 1 500 masl.

The rated power of the motor shall be selected to be not less than 20 % in excess of the designed power requirement of the driven equipment. The Engineer might waive this requirement if the motor forms part of a factory packaged unit or another technical reason.

C3.3.2.1.14.1.3 ZUT 0001.14.1.3 Operation and Control

Protection against both starting overload and running overload shall be designed and provided so that it is specific to the application.

C3.3.2.1.14.1.4 ZUT 0001.14.1.4 Hazardous Locations

When required to suit a hazardous location in terms of SANS 10108 or in terms of this Specification, suitable motors complying with SANS 60034-5 or SANS 61241, as appropriate, shall be supplied. The relevant SANS certificates, clearly indicating the location classification in which the machine may be operated, shall be submitted to the Engineer before delivery of the motors. Each motor shall be clearly and permanently marked with the applicable certificate number.

C3.3.2.1.14.1.5 ZUT 0001.14.1.5 VFD Driven Motors

Unless of the submersible or immersible type, VFD driven motors shall be cooled by a separate, 50 Hz motor driven "piggy-back" fan (this requirement will be waived if the Contractor can provide documentation to confirm that the drive and motor design can operate in the application, with conventional shaft-mounted fan, without overheating).

Motors shall incorporate protection against damage to the bearings from induced currents.

C3.3.2.1.14.1.6 ZUT 0001.14.1.6 Corrosion Protection

Motors shall be provided with the motor manufacturer's highest grade of corrosion protection coating available.

Fan cowls shall be of cast iron, stainless steel or plastic; i.e. shall not be of carbon steel.

C3.3.2.1.14.1.7 ZUT 0001.14.1.7 Safety

Rotating parts shall be guarded as required by legislation.

C3.3.2.1.14.2 ZUT 0001.14.2 ELECTRIC MOTORS OF 30 kW AND ABOVE

C3.3.2.1.14.2.1 ZUT 0001.14.2.1 General Requirements

Cage and slipring induction motors of 30 kW and above shall comply with this clause.

400 Volt motors shall be TEFC with an ingress protection of at least IP 55 and with rolling element bearings.
Motors with a rating above 1 000 kW shall be of CACA configuration with oil lubricated sleeve bearings.

Motors shall be suitable for both "continuous running duty", Duty Class S1, and "intermittent periodic duty", Duty Class S3. Windings shall be insulated with Class F material (100 ºC rise capability) with Class B temperature rise (80 ºC). The motors shall be suitable for 6 starts per hour, two of which shall be consecutive.
The type of motor (and starter if applicable) to be supplied is determined by the requirements of the application specified and by any starting limitations specified. In the absence of such specifications, a standard squirrel cage motor shall be provided.

Wound rotor motors shall have a separate enclosure for the slip-ring assembly to ensure that dust does not enter the motor. The rings shall preferably be of stainless steel. The enclosure shall have the same ingress protection as the main motor enclosure but shall have covers for direct access to the assembly.

If a special motor is required to obtain special starting characteristics and/or variable speed, a full technical specification of the motor must be supplied and such specification shall be for equipment to a standard at least equal to this specification and shall incorporate all aspects of electrical protection.

Motors shall be structurally suitable for DOL starting. This includes motors which are VFD driven.

Motors above 30 kg shall be provided with lifting eyes or lugs.

An earth terminal shall be provided on the frame. Access shall be provided to the winding neutral point.

Protection against both starting and running overload shall be designed and provided so that it is specific to the application.

All monitored motor parameters; e.g. bearing temperature, winding temperature, current, etc.; shall be indicated and shall be provided on the SCADA or HMI mimics, if applicable.

Motors shall be of the reduced noise level type unless otherwise specified.

Motors shall be adequately protected against corrosive environments and shall be provided with the motor manufacturer's highest grade of coating available.
Motors of size 75 kW and above shall be fitted with "pocket" heaters. The heater shall be mounted at the bottom of the motor frame and shall be replaceable without dismantling the motor. These shall be arranged to switch on when the motor stops operating and switch off when it starts operating.
A stainless steel rating plate shall be secured to the frame. This shall include the lubrication details.

Vibration levels shall meet the requirements of grade B in IEC 60034-14.

When motors are transported, care shall be taken to prevent damage to bearing elements. The shaft shall either be secured against relative movement and/or the motor base shall be mounted on suitable anti-vibration mounts during transport.

C3.3.2.1.14.2.2 ZUT 0001.14.2.2 Performance Requirements

Motors shall be provided and shall perform in accordance with the requirements of the specified mechanical equipment.
Motors shall provide rated power output at an ambient temperature of up to 40 ºC and at an altitude of at least 1 500 masl.

The rated power of the motor shall be selected to be not less than 15 % in excess of the designed power requirement of the driven equipment (the Engineer might override this requirement if the motor forms part of a factory packaged unit or another technical reason).

Motors shall reach full operating speed within 5 seconds unless driven by electronic soft start or variable speed drive.

C3.3.2.1.14.2.3 ZUT 0001.14.2.3 400 Volt Motors

Motors shall be rated for operation on a 3-phase, 4-wire, 400/230 volt, 50 Hz, AC supply and shall comply with SANS 1804.

Except as otherwise specified or as required by the design of the installation, motors shall be standard squirrel cage or slip-ring motors with IP55 enclosure and IC 0141 cooling and shall be suitable for a damp environment.

Motor frames shall be of the totally enclosed fan cooled type with cast iron stator frames and cast iron end covers. The frame and end covers shall be properly machined and each cover shall locate on a spigotted register to ensure concentricity and parallelism.

Terminal boxes shall be top mounted wherever possible and arranged for cable entry from either side.

C3.3.2.1.14.2.4 ZUT 0001.14.2.4 3,3 kV, 6,6 kV, 11 kV and 15 kV Motors

Motors shall be rated for operation on a 3-phase, 4-wire, 50 Hz, AC supply.

C3.3.2.1.14.2.5 ZUT 0001.14.2.5 TEFC Motors

The fan cowl shall be of cast iron, plastic or stainless steel; i.e. carbon steel cowls are not acceptable.

An internal cooling circuit fan shall be provided for frame sizes 355 and larger.

If it is required that the motor shall produce low sound output, the fan cowl shall be provided with internal damping.

C3.3.2.1.14.2.6 ZUT 0001.14.2.6 CACA Motors

CACA motors shall have IP 55 ingress protection rating unless otherwise specified.

The heat exchanger shall be provided with lifting eyes or lugs.
Fans shall have cooling air inlet silencers and shall have outlet silencers.
Rotors shall be dynamically balanced.

The drive end bearing shall be earthed to prevent shaft currents.

Ports shall be provided for air gap measurement at the drive end and at the non-drive end.

Vertical jacking shall be provided at each holding down point.

At least one internal cooling circuit fan shall be provided for frame sizes 355 and larger.

C3.3.2.1.14.2.7 ZUT 0001.14.2.7 Hazardous Locations

When required to suit a hazardous location in terms of SANS 10108 or in terms of this Specification, suitable motors complying with SANS 60034-5 or SANS 61241, as appropriate, shall be supplied.

The relevant SANS certificates, clearly indicating the location classification in which the machine may be operated, shall be submitted to the Engineer before delivery of the motors.

Each motor shall be clearly and permanently marked with the applicable certificate number.

C3.3.2.1.14.2.8 ZUT 0001.14.2.8 Electronic Variable Speed Drive

Motors which will be driven by electronic variable speed drives shall be designed for the application and their design shall be submitted to the Engineer for approval. The design shall consider and deal with harmonic currents and with protection against bearing damage.

Unless of the submersible or immersible type, VFD driven motors shall be cooled by a separate, 50 Hz motor driven "piggy-back" fan.

Motors shall incorporate an insulated bearing and shall incorporate an earthing brush at the drive end.

C3.3.2.1.14.2.9 ZUT 0001.14.2.9 Bearings

Bearings shall comply with the clause “Bearings”.

Each bearing shall be mounted in a cartridge housing which is securely attached to the end covers.

Grease lubricated rolling element bearings shall be re-greaseable during motor operation. They shall be provided with stainless steel grease nipples (with stainless steel extension tubes where

access is restricted) and shall be suited for external applications. A port for relief against over-greasing shall be provided.

Bearings on the non-drive end shall be insulated. Drive end bearings shall preferably be earthed.

Bearings for motors of 300 kW and above shall be provided with temperature measurement, indication and alarm.

C3.3.2.1.14.2.10 ZUT 0001.14.2.10 Motor Speed

(This sub clause does not apply to high speed motors with special bearings)

For motors with ratings between 30 kW and 132 kW (both inclusive), preference shall be given to nominal speeds of 1 500 rpm or lower.

Motors with ratings above 132 kW shall have a nominal speed of 1 500 rpm or below.

C3.3.2.1.14.2.11 ZUT 0001.14.2.11 Instrumentation

Motors of 30 kW and up to (but not including) 150 kW shall be provided with thermistors embedded in the windings of each phase. The thermistor tails shall be "brought out" to separate terminals mounted near the motor winding terminal block.

Motors rated at 150 kW and above, both fixed and variable speed, shall be provided with PT 100 type RTDs. Two RTDs shall be provided per phase winding. All six shall be incorporated into the control system; three to provide monitoring and three to provide high temperature trip functions.

C3.3.2.1.14.2.12 ZUT 0001.14.2.12 Safety

Rotating parts shall be guarded as required by legislation.

C3.3.2.1.15 ZUT 0001.15 BASEFRAMES

C3.3.2.1.15.1 ZUT 0001.15.1 GENERAL

The Contractor shall provide the baseframe, anchor fasteners and chemical anchor for securing the fasteners.
Equipment and drivers shall be mounted on either a baseframe or on soleplates and shall not be mounted directly onto a concrete base.

Driven equipment and their drivers shall be mounted on common cast iron or fabricated steel base frames of rigid construction. This requirement applies to both direct coupled and belt driven machines.

In applications where base frames are not practical, machined soleplates, suitably fixed and grouted within the concrete plinths, shall be provided.

C3.3.2.1.15.2 ZUT 0001.15.2 DESIGN REQUIREMENTS

Base frames shall prevent pooling of water and shall be grout filled or shall be provided with drain holes in all side members.

The baseframe shall incorporate machined mounting pads at the support and fixing positions of each item of plant and equipment to be mounted on the baseframe. Machining shall be done after fabrication, stress relieving (if applicable) and hot-dip galvanizing are complete. The thickness of the mounting pads shall be not less than 1,25 times the diameter of the holding down bolts. The pads shall not be provided with threaded holes for machine screws but shall be drilled for inserting through bolts and adequate provision shall made for reaching the nut with a suitable spanner. In

the period between machining and installation of the equipment, the machined surface shall be protected against corrosion by a removable coating. After installation, a non-hardening compound, Tectyl or equivalent, shall be applied to exposed machined surfaces and to the crevice formed at the foot of the equipment. A pourable resin based chocking system is acceptable but not preferred. The above design may be suitably modified if the Contractor uses a pourable resin based chocking system. Such chocks shall be at least 15 mm thick.

At least two diagonally opposed jacking screws shall be provided for belt tensioning in the case of belt driven units. Direct coupled motors above 10 kW shall be provided with jacking screws for horizontal alignment and direct coupled motors above 150 kW shall be provided with jacking screws for vertical alignment as well. Jacking screws shall be of EN Grade 1.4401 (316), or better. A jacking point shall consist of a suitable hot rolled steel section welded to the baseframe and with a captured machine nut to accept the jacking screw. Drilled and tapped flat plate is not acceptable for jacking points.

C3.3.2.1.15.3 ZUT 0001.15.3 FABRICATION

Fabrication of baseplates shall comply with the clause “Fabrication of Steels” and welding shall comply with the clause “Welding”.

Base frames shall be manufactured of either:

- hot rolled steel sections.
- bent plate (with the overall length not more than 200 X plate thickness).

If the Engineer agrees to an organic coating system in lieu of hot-dip galvanising, practical requirements for providing accessibility for surface preparation and coating shall be taken into consideration and hidden surfaces shall not be permitted. Inaccessible pockets and hollow spaces which cannot be accessed by blast and spray equipment shall be avoided or shall be welded closed.

Inspections of carbon steel fabrications will generally be done after fabrication is complete.

C3.3.2.1.15.4 ZUT 0001.15.4 MATERIALS

Base frames shall be fabricated from steels complying with SANS 50025 for grade S 355 JR or for grade S 355 JO.

C3.3.2.1.15.5 ZUT 0001.15.5 CORROSION PROTECTION

Steel base frames shall be hot-dip galvanized in accordance with ZUT 0003.

Designs shall provide proper access for safe and proper entry of the zinc into open spaces so that subsequent drilling at the galvaniser’s yard is avoided.

C3.3.2.1.15.6 ZUT 0001.15.6 ANCHOR FASTENERS

Anchor fasteners shall be of EN Grade 1.4401 (316), or better. Fasteners shall comply with the clause “Fasteners”.

A minimum of six anchors shall be provided for pumps with an inlet of DN 150 and smaller. Eight or more anchors shall be provided for pumps with an inlet larger than DN 150.

Anchor fasteners shall be sized in accordance with the table below.

Pump Inlet	Fastener Size (Minimum)

DN 50	M10
DN 100	M12
DN 200	M12
DN300	M16
DN 400	M20
DN 500	M24
DN 600	M30

Anchor fasteners shall be provided with both a lock washer and a flat washer.

C3.3.2.1.15.7 ZUT 0001.15.7 INSTALLATION

Not more than three shims may be used at any point and these must be made of a corrosion resistant material.

Concrete surfaces under base frames shall be scabbled before the baseframe is placed and shall be blown clean using compressed air immediately before grouting.

Base frames shall be designed and grouted to eliminate collection points for water or dirt. Except where otherwise approved in writing by the Engineer, all base frames on concrete plinths shall be fully grouted in. Grouting holes must be provided on base frames having a continuous top plate. Tapped holes and fixing setscrew protrusions shall be suitably protected. The material used for grouting shall be a non-shrink, cementitious grout (ABE Duragrout 1000, or equivalent). ABE Epidermix 324, or equivalent, is acceptable if an epoxy grout is required. The initial grouting shall be overseen by the grout supplier's technical representative.

Preliminary alignment of equipment mounted on base frames shall be done at the factory to ensure that the baseframe has been correctly manufactured, but final alignment shall always be done on Site after installation and grouting have been completed. Alignment shall be accurate and to the approval of the Engineer and a final alignment check witnessed by the Engineer must be carried out by the Contractor prior to start up.

C3.3.2.1.15.8 ZUT 0001.15.8 INSPECTIONS

The Contractor shall arrange for the Engineer to inspect the fabrication of the baseframe before it is hot-dip galvanised.

C3.3.2.2 ZUT 0002 OPERATING AND MAINTENCNACE MANUALS

C3.3.2.2.1 ZUT 0002.1 SCOPE

ZUT 0002 specifies the standard requirements for the Operating and Maintenance Manual for the Contract.

C3.3.2.2.2 ZUT 0002.2 SUBMISSION OF MANUAL

The Contractor shall submit the Manual to the Engineer for approval. If the Manual does not comply with this specification, the Contractor shall correct it and re-submit it for approval. At each submission, the Contractor shall provide a duplicate copy for the Employer.

Three (3) copies of the final version of the Manual, as approved by the Engineer, shall be provided prior to the start of the Commissioning phase.

C3.3.2.2.3 ZUT 0002.3 GENERAL REQUIREMENTS

The Manual shall comply with the following:

a) The Manual shall be for the complete Works.

b) The Manual shall be in English and shall be practically and neatly presented.

c) One Manual shall contain original documents and this set shall be marked "Original". The other 2 Manuals shall contain all the information in the original and shall be marked "Copy 2" to “Copy 3".

d) Binders shall have hard, plastic protected covers utilising four-ring, spring-clip holders. Each binder shall not be more than two-thirds full. A title label shall be affixed to the spine of each binder. This shall indicate Contract number, title, Contractor's name, Site/Plant name, volume number and contents.

e) Sections and sub-sections shall be titled, uniquely numbered, and provided with separator sheets.

f) Manufacturer’s printed matter shall be marked to identify the model provided.

g) Drawings shall be to a scale which makes details clear. Large drawings shall be held in plastic envelopes in the Manual. A4 and A3 drawings may be bound as normal pages. Drawings shall also be provided on electronic data storage in AutoCAD, or equivalent, format.

h) Cross-referencing within the Manual is acceptable if this will avoid duplication.

i) The complete Manual shall be electronically submitted in PDF format complete with index for easy search.

C3.3.2.2.4 ZUT 0002.4 FORMAT AND CONTENTS

The Manual shall comply in general with the format below but shall be modified to suit the Works:

NO	HEADING	CONTENT
1	**General**	
1.1	Contents List	Contents list for complete Manual.
1.2	Description of the Works	Description of the equipment installation with layout drawings and process flow diagrams. Process description and performance parameters for the Works.

1.3	Equipment List	List of the make, model, operating range and hazardous zoning of every item of mechanical, electrical, instrumentation and control equipment.
1.4	Drawing List	List of the Contractor's drawings.
2	**Operation**	
2.1	Operating System	Description of the operating system containing: **S**tart-up, adjustment, operating and shut-down procedures for manual and automatic operation - **E**mergency operating procedures - **P**rocess verification - **S**ettings, setpoints, protection, alarms and trips. This document shall be suitable for using as a Training Manual.
2.2	Commissioning	Commissioning results.
3	**Maintenance Schedule**	
	Maintenance and Lubrication	Schedule of routine maintenance for all **mechanical**, **electrical**, **instrumentation** and **control** equipment, broken down in daily, weekly, monthly, annual periods, etc. The schedule shall be all-inclusive but may refer to manufacturer's standard manuals in other parts of the Manual. The schedule shall include **all** lubrication periods, lubricants and capacities.
4	**Mechanical Equipment**	
4.1	Mechanical Equipment Item 1 (e.g. Pumps)	- The make, model, serial number, description, size, design range, performance data, motor and drive details and supplier's details of the item. - Dimensioned drawing. - A photograph of the nameplate. - Manufacturer's operating and maintenance manual. - Operating curves, test results, etc.
4.2	Equipment Item 2 (e.g. Mixers)	Ditto
4.3	etc.	Ditto
5	**Electrical Equipment**	
5.1	Elec. Equip. Item 1 (e.g. MCC Panels)	As for 4.1 above; *PLUS:* **C**ontrol and electrical details, including logic sequence, circuit diagrams and software, as applicable - **E**lectrical reticulation drawings - **E**quipment overall dimensions - **W**iring diagrams - **S**witchboard layout drawings - **S**LDs.
5.2	Elec. Equip. (e.g. VFCs)	ditto
5.3	etc.	ditto
6	**Instrumentation Equipment**	
6.1	Instrumentation Equip. Item 1 (e.g. Magflo)	As for 4.1 above; *PLUS:* **C**ircuit diagrams of instrumentation systems and of individual instruments - **I**nstallation arrangement - **N**ormal operating range - **C**alibration procedures.
6.2	Equip. Item 2 (e.g. level)	ditto
7	**Control**	
7.1	Identifying Information	Make and model of PLCs, transmitters, HMIs, computers, etc.; copied from the Equipment List.
7.2	I/O List	Cross-referenced listing of all I/Os used.
7.3	SCADA	Colour prints of SCADA mimic screens, control faceplates, sequences and trend screens. Schedule of alarm messages and TAG lists. File structures, lists and naming conventions.

7.4	Program	An annotated program listing. CDs containing all software. Loop and logic diagrams for each PLC. System control diagram and logic sequence chart.
7.5	Documents	Schedule of cable terminals. Copy of SCADA hardware diagnostic mimic.
8	**Documents**	
8.1	Drawings	All as-built Contractor's drawings, including MFDs, P&IDs, electrical panel construction drawings, etc.
8.2	Cable Schedule	Cable schedule for power, data, control and instrumentation cables. This shall include the cable construction, conductor material, insulation, protection, voltage rating, start and finish points, route length, duty, load, voltage drop, core area, no. of cores, no. of cores used and gland size. For cable voltages above 400 Volts, the schedule shall also include the purchase details, specification and date of manufacture.
8.3	Other	**L**ist of spares provided in terms of this Contract - **C**ertificate of electrical compliance - **C**orrosion protection systems used - **C**oating supplier's data sheets and coating repair procedures.

C3.3.2.2.5 ZUT 0002.5 MEASUREMENT AND PAYMENT

C3.3.2.2.5.1 ZUT 0002.5.1 Supply and Deliver

Payment for all Operation and Maintenance Manuals will be made under this Section. The lump sum shall be inclusive of all cost associated with the input required during preparation, checking, printing copying, binding etc. The extent of the services to be provided by the Contractor is covered in the Sections of the Specification.

C3.3.2.3 ZUT 0003 GENERAL CORROSION PROTECTION FOR PIPELINES, WATER AND WASTEWATER WORKS

C3.3.2.3.1 ZUT 0003.1 SCOPE

This Specification covers the painting and corrosion protection of plant, equipment in pump stations and water and wastewater treatment works and pipelines exposed to environments with variable corrosive tendencies.

Interpretations and variations of this Specification are set out in the Amendments of this Specification.

C3.3.2.3.2 ZUT 0003.2 NORMATIVE REFERENCES

C3.3.2.3.2.1 ZUT 0003.2.1 SUPPORTING SPECIFICATIONS

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification;
b) SANS 1200 Series of Standardized Specifications:
    i) SANS 1200 L: Medium-pressure pipelines
c) Specification ZUT 7001 : Design and manufacture of medium-pressure steel specials

Equipment, materials and operational methods shall comply with the latest edition of the relevant SANS, ISO, AS, BS, DIN or equivalent American Standard as shown in Annexure A.

C3.3.2.3.3 ZUT 0003.3 DEFINITIONS AND ABBREVIATIONS

C3.3.2.3.3.1 ZUT 0003.3.1 DEFINITIONS

In this Specification the following shall have the meaning given:

a) **Coat**: A single uniform film of corrosion protection material applied to a substrate for corrosion protection purposes.
b) **Layer**: A uniform protective film of corrosion protection material applied to plant, equipment and piping in a specified manner consisting out of multiple coats.
c) **System**: A corrosion protection coating or lining consisting of multiple coats and/or layers, the type of coat, the number of coats and their thickness, the method of application and the requirements of the complete system.
d) **Coating**: A system on the outside of plant, equipment and pipework. However, certain international specifications referred to in this specification (e.g. AWWA specifications) use the term ‘coating’ to refer also to internal pipe protection and where these specifications are being referred to their terminology is used.
e) **Lining**: A system on the inside of plant, equipment and piping.
f) **Dis-bonded area**: An area of coating or lining that initially did adhere to the steel substrate after application, but which subsequently became loose from the substrate as a result of mechanical, chemical or other action.
g) **Un-bonded area**: An area of coating or lining which at no stage adhered to the steel substrate.
h) **Water path**: The distance along the surface of a material embedded in concrete but exposed to water measured from the concrete surface.
i) **Holiday**: A discontinuity in a coating or lining which exhibits electrical conductivity when exposed to a specific voltage.
j) **Abrasive blast cleaning**: The process of projecting a stream of abrasive particles at high velocity towards a surface for the purpose of removing contaminants from that surface and to produce a textured surface which will increase the surface area and thus increase adhesion of the coating.
k) **Dry film thickness (DFT)**: The thickness of a coating or lining after it is hard dry.

l) **Electrical insulation defect (EID)**: Defects in a coating or lining that impair the protective properties of the coating or lining and that are detected instrumentally by either:
   i) a low-voltage, wet-sponge detector, or
   ii) a high-voltage, sparking detector,
   iii) operated in each case within the parameters specified.

   Note: EID's include such defects as steel projections from the substrate, conductive particles embedded in the coatings or linings, voids and those defects commonly known as pinholes and holidays.

m) **Fusion bonded epoxy (FBE)**: A thermoset epoxy powder coat. (The powder is normally applied by electrostatic spray to a preheated surface. The powder normally melts, fuses and cures at a temperature of 220ºC to 250ºC.)

n) **Inspector**: A person authorised by the Engineer to act as his representative in examining the work and materials and drawing such samples and carrying out such tests as may be necessary to ensure compliance with the specification.

o) **Lot**: A number of similar or related items submitted for inspection at one time by the Contractor and of such size that the inspector can reasonably be expected to examine adequately in not more than one working day.

p) **Paint**: A liquid material that, when applied as a thin film to a suitably prepared surface by an appropriate method, undergoes a physical or chemical change (or both) that converts it to a solid coating or lining bonded to the surface to which it is applied.

q) **Pinhole**: An electric insulation defect detected by the use of a wet sponge detector (see EID).

r) **Pot life**: The period, after the contents of the packs of a two-pack paint have been mixed together, during which the paint remains suitable for use without the addition of further solvent.

s) **Powder coat**: A material in the form of a dry, free flowing powder that, when applied to a suitably prepared steel surface by an appropriate method, can be fused by application of heat and subsequent cooling to form a continuous coating or lining that is bonded to the surface. A powder coat is classified as thermoplastic, when the applied coat may be re melted by heating, or thermoset, when it cannot be re melted by heat. Low or medium density polyethylene powder is thermoplastic whilst FBE is a thermoset material.

t) **Significant surface**: The part of the article covered or to be covered by the coating or lining and for which the coating or lining is essential for serviceability and/or appearance.

u) **Steel**: This term embraces carbon steels, 3CR12 and all grades of stainless steels.

v) **Water break free**: A surface which, when wetted all over with plain potable water, maintains a continuously wet surface and the water does not break up into islands surrounded by unwetted surfaces.

w) **Wet film thickness (WFT)**: The thickness of a coating or lining immediately after application and before any volatile matter has evaporated.

x) **Quality control**: The operational techniques and activities that are employed by the Contractor to sustain the required quality of a product, process or service.

y) **SAHDGA**: South African Hot Dip Galvanisers Association.

z) **Sa**: Followed by a number refers to a photographic illustration of the standard of blast cleaning required, as shown in ISO 8501-1

aa) **St**: Followed by a number refers to a photographic illustration of the standard of mechanical cleaning required, as shown in ISO 8501 1.

C3.3.2.3.3.2 ZUT 0003.3.2 ABBREVIATIONS

The following abbreviations shall have the meaning assigned to them:

µm	:	Micrometre
3Cr12	:	Corrosion resistant steel
3LPE	:	Three layer high density polyethylene
ABS	:	Acrylnitrile-butadiene-styrene
Al	:	Aluminium
CI	:	Cast iron
CS	:	Cast steel
DCA	:	Die cast aluminium
DFT	:	Dry film thickness
FBE	:	Fusion-bonded Epoxy

FBP	:	Fusion-bonded Polyester
FBPE	:	Fusion-bonded Polyethylene
GRP	:	Glass fibre reinforced Polyester
HDG	:	Hot-dip galvanized
HDPE	:	High Density Polyethylene
MIO	:	Micaceous Iron Oxide
MS	:	Mild steel
PC	:	Polycarbonate
PVC	:	Polyvinylchloride
QCP	:	Quality Control Plan
SG	:	Spheroidal graphite cast iron
SS	:	Stainless steel – grades 304, 304L, 316 and 316L
UV	:	Ultra Violet

C3.3.2.3.4 ZUT 0003.4 REQUIREMENTS

C3.3.2.3.4.1 ZUT 0003.4.1 CONTRACTOR'S OBLIGATION

The requirements, material, surface preparation and corrosion protection systems prescribed in this Specification is regarded as a minimum requirement for the specific application. No deviation from this Specification shall be allowed without the written approval of the Engineer.

The Contractor is responsible for the design of the corrosion protection system and shall provide the Engineer with details of the material selection, surface preparation method and corrosion protection system he intends using as part of his design, including the Manufacturer's Instructions for each product and shall only proceed with the purchase of the corrosion protection materials/paints upon receipt of written approval from the Engineer.

The corrosion protection material selection, surface preparation method and corrosion protection system shall be approved by the material manufacturer/supplier. The Contractor shall obtain a written assurance from the chosen material manufacturer/supplier that the proposed materials, surface preparation method and corrosion protection system comply with the specified requirements and are suitable for the intended purposes under the specified Environmental Conditions (refer to Clause 4.3). The Contractor shall also obtain the Manufacturer's Instructions (refer to Clause 4.2). The written assurance and Manufacturer's Instructions shall be submitted to the Engineer for approval before commencement of the work.

Plant, equipment and pipes shall be manufactured and corrosion protected in accordance with the requirements specified in the Specification and Drawings. In the event that no corrosion protection is specified for any Plant, equipment or pipes within the Specifications or Drawings, this Specifications shall be used to agree the specific application.

C3.3.2.3.4.2 ZUT 0003.4.2 MANUFACTURER'S INSTRUCTIONS

The manufacturer's instructions shall be regarded as the recommendations supplied by the manufacturer in the form of the latest edition of printed data sheets, or given in writing on the manufacturer's letterhead.

The following details shall be made available to the Engineer and the applicator:

- Brand and type of corrosion protection material;
- Mixing and thinning instructions;
- Recommended type and quantity of solvent required for thinning during application;
- Pot life of mixed product;
- Minimum and maximum recommended dry film thickness per coat;
- Minimum and maximum recommended dry film thickness per layer;
- Recommended time intervals between coats;
- Recommended minimum and maximum steel surface temperatures during application;

- Time for complete drying and curing on applicable surfaces;
- Substrate surface preparation requirements;
- Recommended primers for substrate;
- Recommended method of coating and lining application;
- Repair procedures for damaged coatings and/or linings and field joints on pipelines;
- Toxicity if in contact with water, and
- All relevant information the Supplier wishes to submit on his product.

Verbal instructions by the manufacturer's representative will not be accepted unless confirmed in writing by the Contractor.

C3.3.2.3.4.3 ZUT 0003.4.3 ENVIRONMENTAL CONDITIONS

Environmental conditions shall be classified according to SANS 1200 HC: Part 3. The corrosion protection system design and applied by the Contractor shall be suitable for the Environmental Conditions specified.

Unless otherwise specified in the Amendment of this Specification the Environmental Conditions shall be classified as follows:

- Mildly-corrosive: Dry, indoor/internal, above ground and ventilated conditions, not within 5km from the coastline or polluted industrial area. Relative humidity below 70%.
- Severely corrosive: Submerged, splash-zone, underground, very moist conditions, or within 5km from coastline or polluted industrial area, or in wastewater works, or close to electrical power lines. Relative humidity above 85%.
- Medium Corrosive: All other conditions not included in the abovementioned definitions.

Notwithstanding the abovementioned information the Contractor shall satisfy himself of the environmental conditions on site and design the final corrosion protection systems accordingly.

C3.3.2.3.4.4 ZUT 0003.4.4 WORKMANSHIP

A high standard of workmanship is required. Only experienced personnel shall be used to carry out corrosion protection work. All work shall be carried out under the constant supervision of a qualified supervisor.

Similarly all repair work at Site shall be done by competent personnel under the supervision of a qualified supervisor.

C3.3.2.3.4.5 ZUT 0003.4.5 COMPATIBILITY OF MATERIALS

C3.3.2.3.4.5.1 ZUT 0003.4.5.1 Design Precautions

All equipment shall be designed to suppress corrosion in an exposed environment with special reference to galvanic corrosion.
The Contractor shall ensure that metals or alloys are compatible or are adequately protected if, in the galvanic series, there is more than a 0,3 volt difference in the galvanic potential.

C3.3.2.3.4.5.2 ZUT 0003.4.5.2 Galvanic Corrosion Prevention

The Contractor shall ensure that the following steps are taken to minimise corrosion:

1) If dissimilar metals are used: Coat all surfaces of the whole assembly including the more noble member of the galvanic series.

2) If the noble member of the assembly cannot be entirely covered:
   a) Keep the anode/cathode ratio as large as possible in the particular component.
   b) Use electrical insulators between two metals. Insulation must be complete; a bolt requires a sleeve as well as washers of an insulating material.

3) Joints and crevices between metals shall be sealed.

4) Where fastening is unavoidable, the fasteners shall be more noble (cathodic) than the base material. Fasteners shall be coated where possible and/or adequately electrically insulated between fasteners and the base material.

C3.3.2.3.4.6 ZUT 0003.4.6 HANDLING OF CLEAN ITEMS

After cleaning, surface shall not be contaminated in any way. Operators shall wear clean gloves and all surfaces shall be clean and free from oil, grease, grit, dirt and other contamination.

C3.3.2.3.4.7 ZUT 0003.4.7 MACHINED AND MATCHING SERVICES

Mating surfaces of joints shall be coated with primer (where specified) or first coat only. The coating or lining shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joints shall be fully coated.

C3.3.2.3.4.8 ZUT 0003.4.8 SPECIAL AREAS

Areas that are inaccessible after assembly shall be prepared and fully coated with the specified system to the specified requirements before assembly. The coats shall be fully cured before assembly.

Steel edges to be welded after coating shall not be coated for a distance of 50 mm from the welding edge. The unlined strip of grit blasted surface shall be temporarily protected with a coat of (red or a different colour to the lining/coating) weldable primer between coating and/or lining application and installation.

Friction grip areas shall be left un-coated unless otherwise specified.

C3.3.2.3.4.9 ZUT 0003.4.9 SUPPORTS

During coating and/or lining application, the items shall be so supported to prevent damage to the wet coatings or linings until the coatings or linings have hardened adequately. Items shall remain supported during curing, storing and handling.

C3.3.2.3.4.10 ZUT 0003.4.10 WATER RETENTION AREAS

Pockets, recesses and crevices in which water and dirt may collect shall be avoided. Water retention areas shall be properly drained by holes as large as possible.

Surfaces of corrodible metals, such as the insides of tanks or hollow sections that cannot be protected by any method (e.g. painting or dipping), shall be avoided, or where not possible, be fully sealed against ingress of air and moisture.

C3.3.2.3.4.11 ZUT 0003.4.11 STRIPE COATS AND CREVICES

All complex surfaces including metal edges, up stands, welds, bolts and nuts shall be adequately coated to ensure complete corrosion protection. Additional stripe coats shall be applied after initial priming, if required or ordered by the Engineer.

Special attention shall be given to crevices and edges to ensure complete coverage and uniform paint thickness.

C3.3.2.3.4.12 ZUT 0003.4.12 REPAIR OF DAMAGED COATS

Repair procedures shall be approved by the Engineer and repairs will be subject to inspections as set out in Clause 11.2. Where the damage is extensive the particular remedial procedures for each such instance shall be agreed with the Engineer in writing.

All repairs shall comply with the requirements of the repair-product Manufacturer's Instructions. The Engineer may at his discretion request that repaired areas undergo adhesion tests.

Any damage occurring during transit from the Contractor's premises to the Site shall be the responsibility of the Contractor. The Contractor shall repair any damage occurring on Site during handling, assembly, storage, transport and erection.

A repaired area shall be tested in accordance with Sub-Clauses 8.4 and 8.12 of SANS 1217 for compliance with the relevant requirements for thickness and electrical insulation defects respectively.

Any item showing electrical insulation defects exceeding an average of five per square metre (a cluster of pinholes within a radius of 25 mm being regarded as a single defective area), or flaking or other signs of loss of adhesion, shall not be repaired. The item shall be blast cleaned and re-coated in accordance with the relevant requirements of this Specification.

Paint surfaces which become streaky because paint has run, will be rejected.

Touching up of damage to the final paint coat will NOT be permitted. If final paint coat is damaged the item shall completely repainted with the finishing coat in accordance with the specifications.

C3.3.2.3.4.12.1 ZUT 0003.4.12.1 Repair Methods for Minor Defects

The repair of areas showing electrical insulation defects or low film thickness shall, if approved by the Engineer, be carried out as follows:

- Degrease in accordance with Clause 7.4.1.
- Thoroughly abrade the area, including an adjacent surrounding area of at least 25 mm wide, with a medium grade 220 abrasive paper.
- Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769 and Clause 7.2.
- Wipe the abraded paint surface with methyl ethyl ketone and allow to dry.
- Apply as many coats of repair material as necessary to achieve the specified electrical insulation thickness and finish as to conform to the adjoining corrosion protection system's requirements.
- Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

C3.3.2.3.4.12.2 ZUT 0003.4.12.2 Repair Methods for Major Defects

The repair of areas showing damage down to the steel surface shall, if approved by the Engineer, be carried out as follows:

- Degrease in accordance with Clause 7.4.1.
- Blast-clean area to Sa 3 (ISO 8501-1).
- Feather the surrounding paint for a distance of 25 mm beyond the damaged areas with a medium grade 220 abrasive paper.
- Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769 and Clause 7.2.
- Wipe only the abraded paint surface with methyl ethyl ketone and allow to dry.

- Apply as many coats of repair material as necessary to conform to the specified adjoining corrosion protection system's requirements.
- Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

C3.3.2.3.4.13 ZUT 0003.4.13 QUALITY CONTROL

C3.3.2.3.4.13.1 ZUT 0003.4.13.1 Responsibility for Quality

The Contractor shall accept full responsibility for the quality of his workmanship and material used, irrespective of any quality surveillance that may be carried out by the Engineer or his assistants.

The Contractor and all approved Subcontractor(s) shall:

a) Be responsible for compliance with all the Clauses of this Specification and shall carry out all inspections and tests called for in this Specification in the presence of the Engineer or his assistant. The cost of these inspections and tests shall be included in the Rates; and
b) Abide by the approved Project Quality Plan (PQP) throughout all the intended stages of testing during manufacture, cleaning, preparation and application as well as hold points for independent quality surveillance.

C3.3.2.3.4.13.2 ZUT 0003.4.13.2 Contractor Qualification

The Contractor and Subcontractor(s) shall satisfy the Engineer that they have the management, facilities and equipment, skilled staff, a quality control procedure and required test methods and standards to carry out the quality control committed to in the approved PQP during manufacture and corrosion protection application.

In this regard, the Contractor and his Subcontractors shall be subject to quality audits.

C3.3.2.3.4.13.3 ZUT 0003.4.13.3 Submission for approval

The Contractor shall submit the following to the Engineer, including data sheets where applicable, for approval:

C3.3.2.3.4.13.3.1 ZUT 0003.4.13.3.1 Corrosion Protection

- A programme;
- The Quality Control Plan (QCP) for corrosion protection indicating hold points;
- Process Method Statement;
- Blast material;
- Proposed corrosion protection systems; and
- Proposed pickling and passivating products.

C3.3.2.3.4.13.3.2 ZUT 0003.4.13.3.2 Manufacture and Corrosion Protection Programmes

The manufacture and corrosion protection programmes shall state the time and place when the following will be conducted:

- Inspection of material;
- Hydrostatic testing of uncoated castings, pipes and fittings;
- Manufacture of components;
- Fettling or dressing;
- Degreasing;
- Water soluble salts test;
- Blast cleaning and application of the first coat;
- Application of intermediate and final coats; and
- The commencement of Site repairs.

C3.3.2.3.4.13.3.4 ZUT 0003.4.13.3.4 Inspection by the Engineer and Notice of Inspection

Inspection of Plant shall be carried out by the Engineer, his appointed representative or a nominated and Approved Inspection Authority at the manufacturer's and corrosion applicator's works.
The Engineer shall be notified at least seven days in advance, or as otherwise agreed, of impending inspections or when cleaning and first coat application are to be carried out as well as for witnessing the points in terms of the agreed Quality Control Plans (QCP's).

The Engineer's inspection shall in no way relieve the Contractor or his Subcontractors of any of their obligations with respect to design, manufacture and supply Plant of superior quality and workmanship in accordance with the Specification.

C3.3.2.3.4.13.3.5 ZUT 0003.4.13.3.5 Substandard Quality Control

All material, certification and records of the Contractor will be subject to examination by the Engineer.

This shall include the checking and testing of the Plant. If any deviation to the approved QCP or product quality is found, additional testing and quality surveillance shall be carried out at no additional cost to the Employer.

If the additional testing confirms inaccurate quality control by the Contractor, all work on that particular Plant item shall be stopped and shall only proceed after remedial action has been implemented to the satisfaction of the Engineer.

C3.3.2.3.4.14 ZUT 0003.4.14 HEALTH & SAFETY REQUIREMENTS

C3.3.2.3.4.14.1 ZUT 0003.4.14.1 Control of Major Classes of Risk

1) Health risks, these include:
   a) Gases/vapours;
   b) Volatile liquids in the paint; and
   c) Powders/dust.

2) Fire or explosion risks, these include:
   a) Fire risk during storage/transport; and
   b) Explosion hazard during application.

C3.3.2.3.4.14.2 ZUT 0003.4.14.2 General Aspects of Explosion Hazards

The essential precaution to be taken is, inter alia that sufficient ventilation air shall be provided to maintain the ratio of vapour/air to no more than 10% of the lower explosive limit.

C3.3.2.3.4.14.3 ZUT 0003.4.14.3 General Aspects of Toxic Hazard

Measures shall be taken by the Contractor to ensure that the following are prevented:

- Inhalation of dust/fumes;
- Skin contact with paint;
- Ingestion of paint; and
- Eye contact/penetration of paint.

Operators shall be provided with the necessary Personal Protective Equipment (PPE), such as masks/hoods, barrier creams and protective clothing to minimize the chances of the above occurring.

Emergency procedure shall be in place and First Aid kit provided to deal adequately with any of the above occurrences.

The Contractor shall ensure that in terms of Clause 6(2) of the Construction Regulations of the OH&S Act 85 of 1993, an assistant construction supervisor is specifically appointed for the application or repairs of linings inside enclosed or semi-enclosed areas e.g. pipe linings, prior to the execution of any such work.

C3.3.2.3.4.15 ZUT 0003.4.15 SPECIFIC REQUIREMENTS FOR PIPES AND SPECIALS

C3.3.2.3.4.15.1 ZUT 0003.4.15.1 Cut Back of Coated Pipes

The blast cleaned surface shall be stopped off or cut back by suitable masking which shall not contaminate the cleaned surface. Cut-backs shall comply with the requirements as set out in Table 4.1 below:

Table 4.1: Cut-back of Coatings

PIPE END	CUT-BACK (mm)	COMMENT
Pipe ends prepared for field butt welding	100	All coatings to be mitred or feathered to prevent air entrapment in the joint coating system
Pipe ends prepared for flexible joint couplings	Various	The coating shall be cut back a sufficient distance to accommodate a standard coupling for the particular diameter of pipe
"Bell and spigot" pipe ends prepared for first welding	100	The cut back shall be measured from either side of the (field) external fillet weld position when the spigot is fully inserted into the "bell"

C3.3.2.3.4.15.1.1 ZUT 0003.4.15.1.1 Protection of Pipe Ends on Pipes with Cut-Back

Before delivery cut backs of each pipe for field welds shall be coated with an approved rust inhibitor. This inhibitor shall provide corrosion protection for up to 6 months and shall enable good cutting and welding properties (Sigmaweld 120, Plascon etching primer or equivalent approved). Plain ended pipes (to be joined by flexible couplings) are to be coated with an approved rust inhibitor for a distance of 100mm from the pipe ends on the inside and the outside of each pipe. Careful attention must be paid to ensuring the pipe ends are also completely covered. The inhibitor used must be compatible with both the lining and the coating.

C3.3.2.3.4.15.2 ZUT 0003.4.15.2 Pipe Ends

C3.3.2.3.4.15.2.1 ZUT 0003.4.15.2.1 Extension of Lining

For flanged pipes or specials and pipes or specials intended for joining with flexible couplings or for Site welding by means of double sleeve weld-on couplings, the lining shall extend to the ends of pipes and specials including edges and shall overlap by at least 300 mm on the outside of the pipe. Coatings shall overlap surfaces on the outside by at least 25 mm.

C3.3.2.3.4.15.2.1 ZUT 0003.4.15.2.1 Butt Weld Edges

For pipes and specials intended for Site butt-welding, lining and coating shall extend up to a distance of 50 mm from pipe ends. The unlined circumferential strip of grit blasted surface shall be temporarily protected between the Works and Site with a coat of weldable primer (of a different colour to the lining/coating).

C3.3.2.3.4.15.3 ZUT 0003.4.15.3 Field Joints

No welding whatsoever shall be performed on any pipe or special on which the lining or coating has been completed, unless otherwise approved by the Engineer in writing.

The materials used for the repairs to field joints, linings and coatings shall be the same as that used for the pipes, unless otherwise approved by the Engineer in writing.

The linings and coatings of butt welded steel pipes or continuously welded steel cylinder type prestressed concrete pipes, shall be made continuous over joints as soon as possible after approval and acceptance by the Engineer of the welded joint. At no time shall field joints, lining and coating repairs/remedial work lag more than 250 metres behind the last pipe laid.

Flexible couplings shall be provided with external protection as soon as the pipeline has been hydrostatically tested and electrically bonded, where applicable.

C3.3.2.3.4.15.4 ZUT 0003.4.15.4 Supports

When pipes are installed or mounted on concrete supports, rubber insertion shall be used to insulate the pipe from the support. The thickness of the rubber insertion shall not be less than 10 mm and protrude not less than 20 mm all round.

C3.3.2.3.4.15.5 ZUT 0003.4.15.5 Sealing

Pipes that enter or exit concrete shall be sealed on their circumference with a continuous polyurethane or polysulphide flexible sealer, in a 25 mm square recess, approved by the Engineer.

C3.3.2.3.4.15.6 ZUT 0003.4.15.6 Spare Pipes

Corrosion protection of spare pipes shall where applicable be supplied with a top coat of Re-coatable Polyurethane to a DFT of 30 – 50 µm, colour white or silver, for storage and above ground installation.

C3.3.2.3.5 ZUT 0003.5 MATERIALS

The material requirements for each corrosion protections system is specified in the relevant clauses of Clause 10 and shall be read in conjunction with this clause.

C3.3.2.3.5.1 ZUT 0003.5.1 GENERAL

All materials in a corrosion protection system shall be purchased from the same manufacturer unless approved by the Engineer.

Materials offered and subsequently approved shall not be changed without written approval of the Engineer.

All corrosion protection materials shall be delivered in the manufacturer's original containers clearly marked with the following:

- Manufacturer's name;
- Product Brand and Reference Number;
- Batch Number which may incorporate the date of manufacture;
- Abbreviated instructions for storage and use of material, which shall include mixing ratios of the components of multi-component materials, minimum and maximum temperature of application and the method of application; and
- The SANS mark where applicable.

Any conflict between the manufacturer's data sheet and the specification shall be referred to the Engineer for adjudication.

C3.3.2.3.5.2 ZUT 0003.5.2 TOXICITY OF LINING MATERIAL

Materials used for the lining of equipment that will be in contact with water shall be non-toxic and shall not impart any odour, taste, or colour to the water.

C3.3.2.3.5.3 ZUT 0003.5.3 STORAGE

All corrosion protection materials shall be kept in an approved dry and enclosed store. The temperature shall not drop below 0°C nor exceed 40°C.
Usage of materials shall be on a first in, first out basis and no materials shall be used that have exceeded the shelf life recommended by the manufacturer.

C3.3.2.3.6 ZUT 0003.6 PLANT/EQUIPMENT

C3.3.2.3.6.1 ZUT 0003.6.1 HANDLING AND TRANSPORTATION

The plant and equipment used by the Contractor for handling of pipes, valves, pumps and other equipment, for the purpose of corrosion protection shall be such that no pipe shell, valve or pump casing or any other piece of equipment is over stressed during any operations covered by this Specification.

C3.3.2.3.6.2 ZUT 0003.6.2 SURFACE PREPARATION EQUIPMENT

The Contractor shall provide all the equipment required for abrasive blast cleaning, preparation and cleaning of all surfaces to be coated.

C3.3.2.3.6.3 ZUT 0003.6.3 COMPRESSOR

Compressors used for abrasive blast cleaning shall be fitted with an after cooler and oil and water traps such that the air delivered at the nozzle is completely free from oil and water. The volume displacement of the compressors shall be adequate for the number and bore of blast nozzles, the spray equipment and flame spray equipment that may be necessary to carry out the specified coating operations.

C3.3.2.3.6.4 ZUT 0003.6.4 APPLICATION EQUIPMENT

The Contractor shall provide all the equipment required for airless spray painting, two component hot airless spray painting, electrostatic powder coating, fluidised bed powder coating, or any other approved method of applying the corrosion protection system in the shop or required for site application and repairs to coats. All equipment shall be thoroughly cleaned on completion of each day's work and maintained in clean working order.

C3.3.2.3.6.5 ZUT 0003.6.5 INSPECTION OF EQUIPMENT

All facilities and equipment shall be subject to inspection by the Engineer or the independent inspectorate and defects in the equipment shall be rectified when so required.

C3.3.2.3.6.6 ZUT 0003.6.6 INSPECTION EQUIPMENT

The Contractor shall supply all facilities and equipment for inspecting and testing the specified preparation and corrosion protection of all items supplied under the Contract. Recent calibration certificates shall be available for all equipment requiring calibration. This equipment shall be made available to the Engineer or his independent inspectorate for the purpose of testing the specified corrosion protection systems and verifying the accuracy of the test equipment.

C3.3.2.3.7 ZUT 0003.7 PREPARATION OF SURFACES TO BE COATED

The surfaces of all items to be coated and/or lined, irrespective of the corrosion protection system used, shall be prepared in accordance with the relevant following requirements.

C3.3.2.3.7.1 ZUT 0003.7.1 STANDARDS

Reference is made to the latest issues of the following Standards:

SANS 1344 Medium duty solvent detergent.

SANS 10064 The preparation of steel surfaces for coating.

ISO 8501-1 Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un- coated steel substrates and of steel substrates after overall removal of previous coatings.

ISO 8504-2 Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.

SANS 5770 Cleanliness of blast-cleaned steel surfaces for painting (freedom of soluble salts).

SANS 5772 Profile of blast-cleaned steel surfaces for painting (profile gauge).

SANS 5769 Cleanliness of blast-cleaned steel surfaces for painting (freedom from dust and debris).

ISO 11125 Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.

ISO 11127 Preparation of steel substrates before application of paints – Non-metallic blast–cleaning abrasives.

C3.3.2.3.7.2 ZUT 0003.7.2 SURFACE CONDITION

Before surface preparation all items to receive a coating or lining shall be in rust condition A to C of Swedish Standard SIS 05 5900. Items in rust condition D will be rejected.

Prepared surfaces shall conform to Table 7.1 below. If only surface cleanliness to ISO 8501-1 is specified in the Specifications then the corresponding values of Table 7.1 for degreasing, surface profile and soluble salts shall apply.

Table 7.1: Surface Condition

Cleanliness to ISO 8501-1 (min)

(SIS 055900)	**Sa 3**	**Sa 2½**	**St 2**
Residual dust and debris (SANS 5769)	0.3%	0.5%	0.5%
Oil, grease and perspiration	Nil	Nil	Nil
Surface Profile(min)	30 µm	30 µm	n/a
Layers up to 200 µm (max)	50 µm	50 µm	
Surface Profile (min)	50 µm	50 µm	n/a
Layers > 200 and up to 300 µm (max)	80 µm	80 µm	
Surface Profile (min)	60 µm	60 µm	n/a

Layers > 300 and up to 500 µm (max)	100 µm	100 µm	
Water soluble salts:			
Maximum at any point.	100 mg/m²	400 mg/m²	500 mg/m²
Average of any 250 cm of Pipe length.	100 mg/m²	100 mg/m²	100 mg/m²

Note: The maximum surface profile shall be less than ⅓ of the coat thickness.

Unless otherwise specified in the Amendments to this Specifications the surface condition shall conform to the following requirements:

- Sa 3 for the environmental condition classified as severely corrosive,
- St 2 for Tape Wrapping, and
- for all other environmental conditions, the surface condition shall be Sa 2½.

C3.3.2.3.7.3 ZUT 0003.7.3 PREPARATION OF ITEMS

Prior to the application of any coat, each item shall comply with the following:

- Weld splatter shall have been removed by chipping or grinding to a smooth surface flush with the surrounding steel.
- Weld seams shall have a smooth contour, free from sharp edges, protrusions and undercuts.
- Sharp edges and protrusions shall have been removed by grinding to a smooth radius. The radius shall be a minimum of 3 mm for steel of thickness 6 mm or greater, or a minimum of 50% of the steel thickness for steel of thickness less than 6 mm.
- Laminations, scabs or occluded scale shall be ground out. If such grinding penetrates deeper than 3.5% of the metal thickness, the area shall be repaired by welding or the metal shall be rejected at the discretion of the Engineer.
- Articles for hot-dip galvanizing shall not have any overlapping joints. Closed sections shall be suitably vented.

C3.3.2.3.7.4 ZUT 0003.7.4 CLEANING OF ITEMS

C3.3.2.3.7.4.1 ZUT 0003.7.4.1 Degreasing

All surfaces to be coated shall be tested for oil and grease contamination by the water break free test.

In the event that degreasing is required, items shall be degreased by the use of a water based solvent degreaser such as that complying with SANS 1244 or, for use in enclosed systems, with SANS 1365.

Items shall be thoroughly washed with clean potable water to remove all residues. The items shall then be allowed to dry. The washed surfaces shall be tested after degreasing to show that no oil, grease and chemical contamination are present.

Care shall be taken to avoid entrapment of cleaning agents in recesses or other retention areas.

C3.3.2.3.7.4.2 ZUT 0003.7.4.2 Blast Cleaning

Blast-cleaning shall be done in accordance with the code of practice SANS 10064. Any abrasive used for blast cleaning shall composed of clean, non-recycled, sound hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter, water soluble salts and foreign metals.

The surface of the items to be coated or lined shall be blast cleaned by centrifugal or air blast cleaning methods, then vacuum cleaned or blown off to achieve the following requirements:

- The surface condition shall be in accordance with Swedish Standard SIS 05 5900 (or ISO 8501-1) as stipulated in Clause 4.2 and specified in the Amendments and Additions of the Specification, when tested in accordance with SANS Method 767.or SANS Method 772.
- Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the above requirements. If grinding penetrates the steel to a depth greater than 3.5% of the nominal wall thickness, the item will be rejected.
- The time interval between abrasive blast cleaning and paint application shall not exceed those given in Clause 9.2.6.2.

C3.3.2.3.7.4.3 ZUT 0003.7.4.3 Mechanical Surface Preparation

Cleaning by hand or by means of power tools (e.g. wire brushing) shall be carried out in accordance with the methods described in SANS 10064 to the standards specified in the Amendments of this Specifications and as shown in SIS 055900 and Clause 7.2.

C3.3.2.3.7.5 ZUT 0003.7.4.3 PICKLING AND PASSIVATION

Where specified the following areas shall be pickled and passivated:

- All un-coated areas;
- Ground and sheared edges; and
- Heat affected zones caused by welding or cutting.

Where possible, pickling and passivation shall be done by the dipping process.

Proprietary pickling and passivation chemicals (as supplied by approved suppliers) shall only be used in accordance with the manufacturer's recommendations. Pickling formulations made up of 15 to 20% nitric acid (HNO3) and 1 to 2% hydrofluoric acid (HF) by volume with potable water are considered suitable. Care shall be taken not to exceed the maximum contact time recommended. After pickling and passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. Repeat the process, if necessary to remove all discolouration. Surfaces shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer.

C3.3.2.3.8 ZUT 0003.8 SURFACE PREPARATION METHODS

The requirements as specified below shall be read in conjunction with the requirements of Clause 7: Preparation of Surfaces to be Coated. Each preparation method specified below shall also conform to the relevant requirements of Clause 7 and its sub-clauses. Where in in conflict with Clause 7 and its sub- clauses the requirements hereunder shall take precedence.

Unless otherwise specified in the Amendments of this Specifications and subject to the approval of the Engineer, the surfaces of all items to be coated and/or lined shall be prepared in accordance with one or more of the following Methods.

C3.3.2.3.8.1 ZUT 0003.8.1 METHOD 1: MILD STEEL

Components manufactured from mild steel shall be degreased and blast clean before the corrosion protection system is applied. Oil and grease contamination, when present, shall be removed to a water break free surface by degreasing (Refer to Clause 7.4.1) before blast cleaning (refer to Clause 7.4.2).

Steel items less than 2 mm thick may distort when blast cleaned. Sheet steel items less than 2 mm in thickness shall be degreased, acid pickled and phosphated with an approved proprietary 7 or 9 stage process to produce a fine grain zinc phosphate surface complying with SANS 10064 Table 2 Lightweight or by a proprietary process approved by the Engineer for the standard of cleaning specified.

All surfaces of steel 2 mm or more in thickness shall be abrasive blast cleaned in accordance with SANS 10064 Section 4.3 and cleaned to achieve the requirements given in Table 4.1 for the standard of abrasive blast cleaning specified.

C3.3.2.3.8.2 ZUT 0003.8.2 METHOD 2: CAST IRON AND CAST ALLOYS

Cast iron shall be abrasive blast cleaned until all sand particles, residual burnt-on sand and casting skin have been completely removed. Cast iron surfaces shall be abrasive blast cleaned in accordance with SANS 10064 Section 4.3 to achieve the requirements given in Clause 7.2 for the standard of abrasive blast cleaning specified.
Blowholes and omegas in cast surfaces shall be opened up where necessary and filled with a two component solvent free epoxy filler. When the filler has set hard, the surface shall be abraded to be flush with the surrounding metal.

C3.3.2.3.8.3 ZUT 0003.8.3 METHOD 3: STAINLESS AND CORROSION-RESISTANT STEEL

Components manufactured from stainless or corrosion-resistant steel shall be supplied in the fully passivated condition. Sheared edges, welds or surfaces subjected to any form of heat treatment or contamination with iron or mild steel, shall be pickled and passivated in terms of Clause 7.5.

Surfaces shall thereafter be thoroughly degreased in terms of Clause 7.4.1, then rinsed with potable water to obtain a water-break-free surface.

When it is required to paint stainless steel exceeding 2 mm thickness, the surface shall be blast cleaned in accordance with the parameters given in Clause 7.2, using non-metallic abrasives such as iron slag, copper slag or platinum slag. The use of steel shot, steel grit or cast-iron grit is strictly prohibited. Any contamination with iron or mild steel is prohibited.

Where blasting is impractical, the surface shall be cleaned with detergent solution and roughened manually using non-metallic abrasive pads, followed by washing with clean potable water to a water-break- free surface. If a water-break-free surface is not obtained, detergent cleaning shall be repeated until the surface is water-break-free. Allow the surface to dry before coating.

C3.3.2.3.8.4 ZUT 0003.8.4 METHOD 4: ALUMINIUM

Generally, aluminium surfaces will be anodized or powder coated and will require no further treatment. Where painting is required, the aluminium surface shall be thoroughly degreased then rinsed with clean potable water. If the surface is not water break free, repeat the degreasing process until a water-break-free surface is obtained. Allow to dry completely, then apply a thin coat (8 to 13 micrometres dry film thickness) of wash primer which complies with SABS 723, mixed and applied in accordance with the manufacturer's instructions. Note that the “wash primer” is an adhesion promoter and does not replace the primer specified in the paint system.

C3.3.2.3.8.5 ZUT 0003.8.5 METHOD 5: HOT-DIP GALVANIZED SURFACES

Hot-dip galvanized surfaces shall be thoroughly degreased by scrubbing with water rinsable solvent degreaser, followed by thorough washing with clean, potable water. If the water breaks up into islands of non-wetted surface, the degreasing shall be repeated until a water break free surface is obtained. Small areas may be abraded with a nonmetallic abrasive paper prior to painting. Large surfaces may be sweep blast cleaned, using ultra fine abrasive (particle size 0,2 to 0,8 mm) and a nozzle pressure not exceeding 300 kPa. A uniform matt surface shall be obtained. Loss of zinc thickness shall not exceed 10 µm. Cracking and flaking of the galvanized layer is indicative of excessive blast cleaning by using too coarse abrasive or too high blast pressure. Such surfaces will be rejected. The article shall then be stripped and re-galvanized.

C3.3.2.3.8.6 ZUT 0003.8.6 METHOD 6: PAINTED SURFACES

C3.3.2.3.8.6.1 ZUT 0003.8.6.1 Primer Only

Where the surface has been contaminated it shall be washed and dried to remove dust and deposits before overcoating.
The succeeding coats shall be compatible with the primer. Where the type of primer is unknown, a test patch shall be applied. There shall be not loss of adhesion or other defects of the primer or between primer and undercoat. If defects or adhesion loss occur, the primer shall be completely removed, feather blasted and replaced by a primer which is compatible with the specified system.

C3.3.2.3.8.6.2 ZUT 0003.8.6.2 Recoatable Materials

Surfaces painted with recoatable paints shall be abraded with abrasive paper grade 220 to a uniform matt finish, washed and dried to remove dust and deposits before overcoating.

C3.3.2.3.8.6.3 ZUT 0003.8.6.3 Fully Cured Non-Recoatable Materials

Surfaces painted with fully cured non-recoatable paints that have exceeded their overcoating time shall be thoroughly abraded with abrasive paper grade 220 to a uniform matt finish, washed and dried before overcoating. The edges of any damage shall be smoothly feathered into the sound paint. Repairs to damaged areas shall extend 25 mm beyond the damage.

C3.3.2.3.8.6.4 ZUT 0003.8.6.4 Two Component Paints within their Overcoating Time

Surfaces painted with two component paints where the paint is still within the overcoating time specified by the manufacturer shall be recoated without special surface preparation. Where the surface has become contaminated, it shall be cleaned.

C3.3.2.3.8.7 ZUT 0003.8.7 METHOD 7: PLASTIC SURFACES SUCH AS PVC AND GRP

Where the surface has been contaminated it shall be washed and dried to remove dust and deposits before overcoating.

C3.3.2.3.8.8 ZUT 0003.8.8 METHOD 8: CONCRETE AND PLASTER SURFACES

Concrete and plaster surfaces to be painted shall be clean, dry and free from laitance, dust or similar friable surface layers and from mould oil or similar contaminants that will interfere with the adhesion of the coating or lining.

Mould oil shall be removed by the use of a water-based detergent followed by high pressure water washing. When all contaminants have been removed, the surface shall be allowed to dry either to a damp condition or to a completely dry condition, depending on the coating or lining to be applied.

For immersion or other heavy duty applications, laitance shall be totally removed by water blast cleaning, with abrasive injection, or by mechanical scabbling of the surface, or by acid pickling, followed by very thorough washing with potable water.

Off shutter concrete usually shows surface blowholes or omegas. Omegas shall be drilled or chipped open to the full hole diameter. Blowholes and opened omegas shall be filled with a suitable filler such as acrylic or solvent-free epoxy. The use of gypsum or cellulose-based fillers is not permitted for underwater or humid conditions. Shutter kicks and similar projections shall be removed by grinding to a smooth surface.

For coatings or linings of low water permeability, such as solvent-borne epoxies, vinyls and chlorinated rubber, the moisture content of the concrete or plaster shall be not more than an indicated 5% when tested with an approved electrical conductivity meter, designed for use on

concrete or plaster (such as the Delmhorst meter). The pins of the meter shall penetrate the concrete or plaster to a depth of not less than 5 mm.

The first coat of the coating or lining system may require thinning with the manufacturer's recommended solvent to assist in penetration.

C3.3.2.3.9 ZUT 0003.9 APPLICATION OF CORROSION PROTECTION SYSTEM

All coatings and/or linings, irrespective of the surface preparation method or corrosion protection system used, shall be applied in accordance with the relevant following requirements.

C3.3.2.3.9.1 ZUT 0003.9.1 CONDITIONS DURING APPLICATION

If in the opinion of the Engineer adverse weather conditions are such as to interfere with the successful application of an efficient corrosion protective system, he shall order a stoppage of work. The Contractor will be deemed to have accepted this risk and made provision for it in his rates.

C3.3.2.3.9.1.1 ZUT 0003.9.1.1 Dusty Conditions

Coats shall not be applied in dusty or contaminated conditions.

C3.3.2.3.9.1.2 ZUT 0003.9.1.2 Surface Temperature

Coats shall not be applied if the surface temperature of the base metal is less than 3°C above dew point or outside the range 5 - 40°C, unless otherwise recommended in the manufacturer's instructions.

C3.3.2.3.9.1.3 ZUT 0003.9.1.3 Ambient Temperature

Coats shall not be applied when the ambient temperature is less than the minimum or greater than the maximum recommended by the manufacturer's instructions of the corrosion protection material.

C3.3.2.3.9.1.4 ZUT 0003.9.1.4 Relative Humidity and Time Interval

The time interval between abrasive blast cleaning and paint application shall not exceed those given in Table 9.1

Table 9.1 - Maximum time interval - Between blast cleaning and coating

Ambient Relative Humidity	Maximum Time (hours)
Below 50%	6
50% - 70%	4
70% - 85%	2
Over 85%	Coating not permitted - Reblast and coat when rel. humidity below 85%

Should immediate lining/coating not be possible, or should any atmospheric oxidisation take place between the completion of blast cleaning and commencement of lining/coating, such oxidisation shall be removed by flash blasting to restore the specified surface finish.

C3.3.2.3.9.2 ZUT 0003.9.2 PAINTS

C3.3.2.3.9.2.1 ZUT 0003.9.2.1 Application method

The recommendations of the paint manufacturer as per the manufacturer's instruction (refer to Clause 4.2) as shown on his data sheets or given in writing on his letterhead and approved by the Engineer shall be followed.

Apart from touch up, all liquid paints applied in the shop shall be applied by means of airless spray machines. Before use all paints shall be thoroughly stirred so as to be completely homogeneous. Two component paints shall be thoroughly mixed in the correct proportions as specified in the manufacturer's data sheet.

Painting on site shall be carried out to the Engineer's written approval. Significant surfaces to be painted on site shall be those specified in the Specification or shown on the drawings. Site application methods shall comply with the paint manufacturer's recommendations.

C3.3.2.3.9.2.2 ZUT 0003.9.2.2 Colour

Successive coats shall have distinctively different shades to facilitate coverage of each coat. Unless otherwise specified in the Amendments to this Specification, or directed by the Engineer, the final paint colour shall be that given in Appendix B of this specification and shall be a commercial match to the appropriate colour in SANS 1091 - National Colour Standards for Paint.

C3.3.2.3.9.2.3 ZUT 0003.9.2.3 Wet film thickness

The Contractor shall regularly and frequently monitor wet film thickness and shall calculate the dry film thickness from the volume solids of the paint.

C3.3.2.3.9.2.4 ZUT 0003.9.2.4 Mixing

The Contractor shall ensure that all paints are mixed in accordance with the requirements of BS 5493.
All paint components, particularly two- or multi-component materials, shall be thoroughly mixed until a homogeneous mixture is achieved.

C3.3.2.3.9.2.5 ZUT 0003.9.2.5 Degree of Cure

The degree of cure of paint will vary with time, temperature and ventilation and shall be assessed by solvent wiping in accordance with the method given in SANS 1217 (Methyl Ethyl Ketone Resistance Test).

C3.3.2.3.9.2.6 ZUT 0003.9.2.6 Overcoating

C3.3.2.3.9.2.6.1 ZUT 0003.9.2.6.1 Compatibility of Coats

All primer, intermediate, finishing coats and layers shall be mutually compatible and recoatable paints shall be used where applicable. There shall be not loss of adhesion between the consecutive coats or other defects.

C3.3.2.3.9.2.6.2 ZUT 0003.9.2.6.2 Overcoating intervals

The minimum and maximum overcoating intervals provided in the manufacturer's data instructions shall be strictly observed. Times and dates of application shall be recorded for each separate item and coat in the quality control records.

Since overcoating times are frequently quoted at 20 °C or 25 °C, longer overcoating times shall be allowed at lower temperatures. As a rough guide, increase time by 50% for a 5° decrease (or by 100% for a 10° decrease) in the ambient temperature below the temperature quoted in the data sheet.

C3.3.2.3.9.2.6.3 ZUT 0003.9.2.6.3 Thickness of Consecutive Coats

Generally a corrosion protection system will be build-up with multiple coats. The thickness of all coats, primer, intermediate or finish coats shall be strictly according to the manufacturer's instructions. For solvent-based paints it is imperative that the applicator does not exceed the maximum film thickness per coat applied to prevent entrapment of the solvent and the formation of pinholes.

C3.3.2.3.9.3 ZUT 0003.9.3 POWDER COATS

Powder shall be applied in the shop by electrostatic spray or by fluidised bed as applicable. Items for powder coating shall after surface preparation, be pre heated to the required temperature, usually in the range 200 to 250ºC, coated by electrostatic spray or by fluidised bed, then post cured if necessary to obtain complete fusion and cure. For surfaces to be immersed the applied coating shall be tested for defects by high voltage spark testing. No defects will be permitted. Thermoset materials such as FBE shall be fully cured.

C3.3.2.3.9.4 ZUT 0003.9.4 HOT-DIP GALVANIZING

Hot-dip galvanizing shall be carried out in accordance with SANS 121. The coating of lining thickness shall comply with the values specified for General Applications or Heavy Duty Applications as specified in the Clause 10.8.

Galvanized surfaces which are to be painted shall NOT be passivated by the galvanizer.

Repairs to damaged galvanizing shall be carried out in accordance with the procedures specified in SANS 121 by hot metallic zinc spraying unless the use of an appropriate solder is approved. Conventional solder shall NOT be used. Solder composition shall have been approved in writing by the SANS (Metallurgy Division) or by the SAHDGA.

C3.3.2.3.9.5 ZUT 0003.9.5 CEMENT MORTAR LINING

C3.3.2.3.9.5.1 ZUT 0003.9.5.1 Mixing of mortar

Components of the mix shall be accurately weighed. Each batch shall be identical. Mixing shall be carried out in a suitable mechanical mixer. Aggregate and cement shall be measured in correct proportions, then dry mixed in the mixer. When homogeneous, water shall be added from a measuring vessel to achieve the correct consistency but shall not exceed the amount stated previously. When correctly mixed, the material shall be used as soon as possible and not later than 1 hour after the first addition of water. Re tempering of the mix by further addition of water or other material shall not be permitted.

From a random batch of each days production prepare three 150 mm test cubes, in accordance with SANS 5863. After 28 days curing, the compressive strength shall not be less than 30 MPa.

C3.3.2.3.9.5.2 ZUT 0003.9.5.2 Placing of cement mortar

Cement mortar shall be placed to the specified thickness by spin casting (preferred method) or by mechanical drag trowel. In either case, sufficient centrifugal force shall be used to ensure optimum bonding to the pipe wall and optimum compaction of the cement mortar, with minimum segregation of different sizes of aggregate. The finished lining shall be smooth and uniform. Hand application is not permitted except on specials or by prior agreement of the Engineer.

C3.3.2.3.9.5.3 ZUT 0003.9.5.3 Curing of lining

After completion of placing, spinning, troweling an end finish, the lining shall not be disturbed until set. The pipe ends shall be closed with waterproof end covers or caps and the pipe shall be left

undisturbed for at least 40 hours. After 48 hours the lining shall be sprayed with a fine mist of water and the covers and caps replaced or shall be steam cured by an approved method. The lining shall be kept wet for not less than 7 days. Pipes shall not be transported within 21 days from the date of applying the lining.

During placing of the cement mortar and the whole of the curing period, the pipes shall be kept constantly in the shade or under cover. Pipes shall not be exposed to direct sunlight.

C3.3.2.3.9.6 ZUT 0003.9.6 PLASTIC TAPE WRAPPING

Pipes shall be helically wrapped on site with minimum 25 mm overlap, using a tape wrapping machine to ensure uniform tension. Wrinkling, bubbling or other visible defects are not permitted. The tape manufacturer shall approve the tape wrapping procedure and equipment and the application shall comply with SANS 10129.

C3.3.2.3.9.7 ZUT 0003.9.7 DUPLEX OR MULTI-LAYER SYSTEMS

Duplex or Multi-layer systems consist of more than one corrosion protection system applied consecutively

e.g. a Hot-Dip Galvanizing and Polyurethane system.

The specifications for each of the corrosion protection systems shall be strictly followed. Special attention shall be given to adhesion between the systems.

C3.3.2.3.9.8 ZUT 0003.9.8 FINISHING ON SITE

Repairs, finish painting and cleaning on the site are regarded as inherent parts of the installation. On completion of erection, all pipework, control gear and indicating gear shall be thoroughly cleaned.
After erection, paint work shall be washed down, using nylon brushes and detergent to remove all adhering contamination. It shall then be washed with clean water to remove all traces of detergent and allowed to dry. The finishing coat shall then be applied as specified in the Amendments to this Specification.

All surfaces which cannot be painted after erection shall be painted as specified before erection. The painting system so applied shall be allowed to become fully hard dry (for at least two weeks for epoxy type paints) before erection.

For coatings such as epoxies, having a limited overcoating interval as specified in the manufacturer's data sheets, the surface shall be washed and thoroughly abraded to a matt finish before application of the finishing coats in accordance with the manufacturer's instructions.

C3.3.2.3.9.9 ZUT 0003.9.9 TOLERANCES

C3.3.2.3.9.9.1 ZUT 0003.9.9.1 Individual Coats Film Thickness

At least 90% of all thicknesses measured shall comply with the minimum thickness of the system specification. Up to 10% of all readings may be below the specific minimum thickness, but no reading shall be less than 70% of the specified minimum thickness.

C3.3.2.3.9.9.2 ZUT 0003.9.9.2 Total Dry Film Thickness

Not more than 10% of readings shall be less than the minimum specified and no reading shall be less than 90% of the specified minimum. For severely corrosive conditions no reading shall exceed the mean specified thickness by greater than 60% of the minimum.

C3.3.2.3.10 ZUT 0003.10 CORROSION PROTECTION SYSTEMS

The requirements as specified below shall be read in conjunction with the requirements of Clause 9: Application of Corrosion Protection Systems. Each system specified below shall also conform to the relevant requirements of Clause 9 and its sub-clauses. Where in in conflict with Clause 9 and its sub- clauses the requirements hereunder shall take precedence.

C3.3.2.3.10.1 ZUT 0003.10.1 RECOMMENDED CORROSION PROTECTION SYSTEM

Unless otherwise specified in the Amendments to this Specification and subject to the approval by the Engineer, Plant, equipment and pipework in pump stations and water and wastewater treatment works and pipelines shall be corrosion protected with one or more of the corrosion protection systems described in the following paragraphs of this Specification.

C3.3.2.3.10.2 ZUT 0003.10.2 SYSTEM 1: ALKYD RESIN BASED

Alkyd systems are intended for use in environments of low corrosivity, where a good decorative finish is required. Materials shall therefore be applied with due cognizance of appearance and protection. Defects such as runs, sags, curtaining, shriveling, or wrinkling will not be permitted.

C3.3.2.3.10.2.1 ZUT 0003.10.2.1 Standards

Reference is made to the latest issues of the following Standard Specifications:
SANS 630: Decorative high gloss enamel paints.
SANS 681: Undercoats for paints
SANS 1319: Zinc phosphate primer for steel

C3.3.2.3.10.2.2 ZUT 0003.10.2.2 Material

Alkyd zinc phosphate primer for steel shall comply with the requirements of SANS 1319. General purpose alkyd undercoat shall comply with the requirements of SANS 681 Type 2. Alkyd enamel shall comply with the requirements of SANS 630.

C3.3.2.3.10.2.3 ZUT 0003.10.2.3 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall confirm to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table 7.1 and the applicable Method as specified in Clause 8.

C3.3.2.3.10.2.4 ZUT 0003.10.2.4 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in Clause 4.12.

C3.3.2.3.10.2.5 ZUT 0003.10.2.5 Testing

Testing shall conform to the requirements of Clause 11.1 and SANS 1217.

C3.3.2.3.10.3 ZUT 0003.10.3 SYSTEM 2: VINYL RESIN BASED

Vinyl copolymer (PVC) paints are a single component vinyl resin-based paints have excellent resistance to water, chemicals, dilute acids and hypochlorites. Their resistance to heat is poor and they must never be used on surfaces continually subjected to a temperature of 70 °C or higher.

They are not resistant to solvents and should not be used where there may be contact with oils, grease, kerosene, petrol etc.

The main advantage of vinyls is their easy maintainability. Whereas epoxies are difficult to recoat after about one month's exposure, vinyls may be recoated after any period of time.

Vinyls are recommended for use above water and for interior and exterior use where and could be subject to chemical fumes, as in chlorination rooms.

C3.3.2.3.10.3.1 ZUT 0003.10.3.1 Material

Vinyl copolymer (PVC) paints shall have a solids content of 50% by mass and 32% by volume with a viscosity of 4,5 poise +_ 0,5 poise. The paint shall be stabilised against UV radiation.

C3.3.2.3.10.3.2 ZUT 0003.10.3.2 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall confirm to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table 7.1.

C3.3.2.3.10.3.3 ZUT 0003.10.3.3 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in Clause 4.12.

C3.3.2.3.10.3.4 ZUT 0003.10.3.4 Testing

Testing shall conform to the requirements of Clause 11.1 and SANS 1217.

C3.3.2.3.10.4 ZUT 0003.10.4 SYSTEM 3: TERMAL SPRAY METAL

Not Used.

C3.3.2.3.10.5 ZUT 0003.10.5 SYSTEM 4: POWDER COATS

Not Used.

C3.3.2.3.10.6 ZUT 0003.10.6 SYSTEM 5: TWO PACK EPOXY

This corrosion protection system is suitable for large steel items subject to medium corrosive and severely corrosive environmental conditions such as valves, pipes, etc.

C3.3.2.3.10.6.1 ZUT 0003.10.6.1 Standards

Reference is made to the latest issues of the following Standard Specifications:
SANS 1217: Internal and external organic coating protection for buried steel pipelines.
ISO 2808: Determination of film thickness.
BSS 5493: Protective coating of iron and steel structures against corrosion.

C3.3.2.3.10.6.2 ZUT 0003.10.6.2 Material

The material used for two component (two pack) high build polyamide epoxies shall be based on epoxy- polyamide resins and shall comply with the requirements of SABS 1217. Epoxies shall be of the high build, modified aluminium epoxy mastic type, containing at least 90% solids.

Solvent free epoxies in accordance with SANS 1217 Type 1C is preferred. Type 1A - solvent-borne chemically cured paint material (Solvent base epoxies) will only be approved by the Engineer for

specific application conditions. Solvent base epoxies shall complying with the requirements of SANS 1217 Type 1A and 1B.

The epoxies shall be nontoxic and non-tainting when it will be in contact with potable water.

C3.3.2.3.10.6.3 ZUT 0003.10.6.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements Clause 7.2.

C3.3.2.3.10.6.4 ZUT 0003.10.6.4 Application

C3.3.2.3.10.6.4.1 ZUT 0003.10.6.4.1 Dry Film Thicknesses

Dry film thicknesses shall be at least 250 µm unless otherwise specified in the Amendments of this Specification.

C3.3.2.3.10.6.4.2 ZUT 0003.10.6.4.2 Mixing

In the case of two-pack materials, each component containing pigments shall be thoroughly mixed. The two components shall then be mixed in the proportions supplied by the manufacturer until the mixture is completely homogeneous. For two pack materials, the use of part of the contents (split packs) is strictly forbidden.

In the case of solvent based Epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period, as recommended by the manufacturer, before use.

During application, paint materials shall be agitated regularly to keep the solids in suspension.

The preparation time, induction time and pot life of these materials shall be closely adhered to.

C3.3.2.3.10.6.4.3 ZUT 0003.10.6.4.3 Curing

Adequate ventilation (and heating if required), shall be provided for the proper curing of the epoxy coating or lining in all circumstances with special reference remedial work, repairs and to field joints of pipelines.

C3.3.2.3.10.6.5 ZUT 0003.10.6.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in terms of Clause 4.12.

C3.3.2.3.10.6.6 ZUT 0003.10.6.6 Testing

Testing shall conform to the requirements of Clause 11.1 and SANS 1217.

C3.3.2.3.10.6.7 ZUT 0003.10.6.7 Pipe Field Joints for Epoxy Linings

The internal corrosion protection System of welded field joints, for pipes with epoxy linings, shall be the same as that used for the adjacent pipes.
The surface preparation of the field joint area shall be the same as for the repair of major defects as specified in Clause 4.12.2.

C3.3.2.3.10.7 ZUT 0003.10.7 SYSTEM 6: FUSION BONDED EPOXY (HEAVY DUTY)

This corrosion protection system is suitable for large steel items subject to medium corrosive and severely corrosive environmental conditions such as valves, pipes, etc.

C3.3.2.3.10.7.1 ZUT 0003.10.7.1 Standards

Reference is made to the latest issues of the following Standards:
SANS 1217: Internal and external organic coating protection for buried steel pipelines.
ISO 12944: Paints and varnishes – Corrosion protection of steel structures by protective paint systems.

C3.3.2.3.10.7.2 ZUT 0003.10.7.2 Material

Material used shall conform to SANS 1217, Type 2, powder coating.

C3.3.2.3.10.7.3 ZUT 0003.10.7.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements Clause 7.2.

C3.3.2.3.10.7.4 ZUT 0003.10.7.4 Application

C3.3.2.3.10.7.4.1 ZUT 0003.10.7.4.1 Dry Film Thicknesses

Dry film thicknesses shall be at least 250 µm unless otherwise specified in the Amendments of this Specification

C3.3.2.3.10.7.4.2 ZUT 0003.10.7.4.2 Coat Application

Items shall be heated to a temperature of 200°C (only applicable to heavy items) and coated with Fusion- bonded Epoxy by means of an electrostatic powder gun.

The normal procedures pertaining to powder application shall apply.
On completion of the coating or lining, items shall be cured for 60 minutes at 200°C (mean temperature).

C3.3.2.3.10.7.5 ZUT 0003.10.7.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and conform to the requirements of Clause 4.12. with an approved repair kit.

C3.3.2.3.10.7.6 ZUT 0003.10.7.6 Testing

Testing shall conform to the requirements of Clause 11.1 and SANS 1217.

C3.3.2.3.10.8 ZUT 0003.10.8 SYSTEM 7: HOT-DIP GALVANIZING (HEAVY DUTY)

This corrosion protection system is suitable for steel items subject to mildly corrosive and medium corrosive environmental conditions such as handrails, covers, small diameter pipework, etc.

C3.3.2.3.10.8.1 ZUT 0003.10.8.1 Standards

Reference is made to the latest issues of the following Standards:
SANS 14713: Protection against corrosion of iron and steel in structures - guidelines.
SANS 32: Internal/external protective coatings for steel tubes.
SANS 121: Hot-dip galvanized coatings on fabricated iron and steel articles.
SANS 5772: Profile of blast-cleaned steel surfaces for painting.
SANS 2063: Metallic and other inorganic coatings – Thermal spraying.
ISO 2808: Determination of film thickness.
SANS10374-1: The suitability of hot-dip galvanized steel piping for the transportation of water.

SANS 1344: Medium duty solvent detergent.
ISO 752: Zinc ingots.
EN 1179: Zinc and zinc alloys – primary zinc.
SANS 9000: Model for quality assurance in production and installation.

C3.3.2.3.10.8.2 ZUT 0003.10.8.2 Material

Impurities in the molten zinc, as defined in ISO 752 and EN 1179, shall not exceed a total of 1.5%.

Steel to be hot-dip galvanized shall be as listed below. In both cases material certification shall be supplied:

- For aesthetic appearance:
  - Aluminium killed steel, or
  - Silicon-killed steel with a Silicon content not exceeding 0.04% and a Phosphorus content not exceeding 0.02%.

- For general corrosion protection:
  - Aluminium killed steel, or
  - Silicon killed steel with a Silicon content not exceeding 0.25% and a Phosphorus content not exceeding 0.02%.

The condition of articles to be hot-dip galvanized shall comply with “Annexure C” of SANS 121.

The condition of tubes to be hot-dip galvanized on a continuous line shall comply with “Annexure A” of SANS 32.

C3.3.2.3.10.8.3 ZUT 0003.10.8.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements Clause 7.2.

C3.3.2.3.10.8.4 ZUT 0003.10.8.4 Application

Galvanizing shall only be done by members of the Hot Dip Galvanizers Association of Southern Africa (HDGASA) in accordance with SANS 9000 and for tubes shall be in accordance with SANS 121 and SANS 32.

C3.3.2.3.10.8.5 ZUT 0003.10.8.5 Special Requirements

C3.3.2.3.10.8.5.1 ZUT 0003.10.8.5.1 Steel Specials

Steel Specials shall be in accordance with Clause 6 of SANS 121.

1) Surface
Surfaces shall be free from nodules, blisters, roughness and sharp points. Un-coated areas, flux residues, lumps and zinc ash will not be permitted.

Notwithstanding Clause 6.1 of SANS 121, in the case of handrails etc. a high quality surface finish is required and a bright smooth surface shall be achieved. Double dipping shall not be allowed.

2) Thickness
The thickness of hot-dip galvanizing shall comply with the requirements of the Table 10.1 below.

Table 10.1: Minimum Coat Thickness on Items that are not Centrifuged

	HEAVY DUTY	LIGHT DUTY

ARTICLES AND ITS THICKNESS	Thickness µm (min)	Local Thickness µm (min)	Mean Thickness µm (min)
Steel ≥ 6 mm	105	70	85
3.0 mm ≤ Steel < 6.0 mm	80	55	70
1.5 mm ≤ Steel < 3.0 mm	65	45	55
Steel < 1.5 mm	55	35	45
Castings ≥ 6.0 mm	105	70	80
Castings ≤ 6.0 mm	-	60	70

Heavy duty coats are required except in the following cases:

- Where a high surface finish is required; and
- Where otherwise specified in the Amendments of this Specification.

C3.3.2.3.10.8.5.2 ZUT 0003.10.8.5.2 Steel Tubes

Steel tubes shall be in accordance with Clause 7 of SANS 32.

1) Surface
The surface of the coat shall be continuous, smooth and free from flux residues.

2) Thickness
The thickness shall comply with the requirements of the coat quality A1, in accordance with Clause 8, Table 1 of SANS 32, as specified below.

Table 10.2: Minimum Local Coat Thickness Requirements for Coat Quality A1

REQUIREMENTS	QUALITY A1
Minimum local coat thickness on the inside surface except at the weld bead	55 µm
Minimum local coat thickness on the inside surface at the weld bead	28 µm
Minimum local coat thickness on the outside surface	55 µm

3) Adhesion
The coat shall show no evidence of flaking or cracking when tested in accordance with Clause 11.4 of SANS 32.

4) Qualities
Coat qualities shall be A1 for water installations – see Sub-Clause 8.2 of SANS 32.

The surface of the coat on the inside shall be as smooth as can be achieved by steam blowing.

C3.3.2.3.10.8.6 ZUT 0003.10.8.6 Testing

This clause and its sub-clauses shall be read in conjunction with Clause 4.13 and Clause 11.1 of this Specification.

C3.3.2.3.10.8.6.1 ZUT 0003.10.8.6.1 Steel Items

1) Visual Examination
Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.

2) Thickness
Thicknesses shall be in accordance with Clause 10.8.5 and shall be tested in accordance with Sub-Clause 6.2 of SANS 121.

C3.3.2.3.10.8.6.2 ZUT 0003.10.8.6.2 Steel Tubes

1) Visual Examination
Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.

2) Thickness
Shall be tested in accordance with Sub-Clause 11.3 of SANS EN 10240.

3) Adhesion
Shall be tested in accordance with Sub-Clause 11.4 of SANS EN 10240.

C3.3.2.3.10.8.6.3 ZUT 0003.10.8.6.3 Chemical Analysis

Items shall be tested in accordance with Sub-Clause 11.5 of SANS EN 10240.

C3.3.2.3.10.8.7 ZUT 0003.10.8.7 Repair of Damaged Coats

C3.3.2.3.10.8.7.1 ZUT 0003.10.8.7.1 Steel Items

The total un-coated areas for renovation by the galvanizer shall not exceed 0.5% of the total surface area of a component. Each un-coated area for renovation shall not exceed 400 mm². If un-coated areas are larger, the item containing such areas shall be re-galvanized.

The repair method shall be approved by the Engineer before repairs are initiated.

Repairs shall be by zinc thermal spray in accordance with SANS 2063 or three component zinc solvent free Epoxy repair system. The repair shall include removal of any scale, cleaning and any necessary pre- treatment to ensure adhesion – refer to Clause 7

The coat thickness on the renovated areas shall be a minimum of 30 µm more than the local coat thickness specified in Clause 10.8.5 for the relevant hot-dip galvanized coat unless otherwise specified by the Engineer. The coat on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

C3.3.2.3.10.8.7.2 ZUT 0003.10.8.7.2 Steel Tubes

Repairs shall not be allowed on internal surfaces of tubes. Where repairs are required, tubes shall be re- galvanized. Repairs on external surfaces shall be in accordance with Clause 10.8.7.1.

C3.3.2.3.10.9 ZUT 0003.10.9 SYSTEM 8: ELASTOPLASTIC POLYURETHANE

This part of the Specification applies to two component solvent free elastoplastic polyurethane. This system shall only be used in limited approved applications.

C3.3.2.3.10.9.1 ZUT 0003.10.9.1 Standards

Reference is made to the latest issues of the following Standards:

SANS1217: Internal and external organic coating protection for buried steel pipelines.

C3.3.2.3.10.9.2 ZUT 0003.10.9.2 Material

The paint material shall be a solvent free two-component polyurethane hybrid based on a polyester type polyol and aromatic isocyanate. The cured paint shall comply with the following requirements:

- Tensile strength at 3 mm thickness - ASTM D 638 - not less than 15 MPa.
- Adhesion to primed steel - SANS Method 776 - not less than 10 MPa.
- Impact resistance (direct) - ASTM G 14 - not less than 9 Joules.
- Dielectric Strength - not less than 10 kV/mm.
- Elongation at break - not less than 25%.
- Compressibility - not less than 25 MPa.
- Surface hardness of 5 mm thick sample - not less than 60 nor greater than 80 Shore 'D'.
- Water Vapour Permeability - not greater than 0.5 g/24 h/m²/mm².
- Cathodic disbonding - when tested in accordance with ASTM GB Method A, for 60 days, the dis- bonded area shall not exceed 500 mm².

C3.3.2.3.10.9.2.1 ZUT 0003.10.9.2.1 Adhesive

Adhesive shall be a two component polyurethane adhesive designed to maximise adhesion between used polyurethane and freshly mixed polyurethane.

C3.3.2.3.10.9.3 ZUT 0003.10.9.3 Application

C3.3.2.3.10.9.3.1 ZUT 0003.10.9.3.1 Dry Film Thicknesses

Dry film thicknesses shall be at least as follows unless otherwise specified in the Amendments of this Specification

- Overcoating as duplex system
  - The dry film thickness shall be 40 µm minimum.
- For corrosive/abrasive environmental conditions:
  - The dry film thickness shall be 1.0 mm minimum.
- For highly corrosive/abrasive environmental conditions:
  - The dry film thickness shall be 3.0 mm minimum.

C3.3.2.3.10.9.4 ZUT 0003.10.9.4 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and conform to the requirements of Clause 4.12.

C3.3.2.3.10.9.5 ZUT 0003.10.9.5 Testing

Testing shall conform to the requirements of Clause 11.1 and SANS 1217.

C3.3.2.3.10.10 ZUT 0003.10.10 SYSTEM 9: TAPE WRAPPING

The tape wrapping system is intended to be used in areas where special protection is required due to handling of items e.g. pipelines at road crossings etc. or where it is highly likely that the paint system can be damaged e.g. at specials and addition precaution is required to protect the pipeline. It is also often used to repair field joints of pipelines. It is suitable for severely corrosive environments.

C3.3.2.3.10.10.1 ZUT 0003.10.10.1 Standards

Reference is made to the latest issues of the following Standards:
SANS 1117: Plastic wrappings for the protection of steel pipelines. SANS 10129:Plastics tape wrapping of steel pipelines.

C3.3.2.3.10.10.2 ZUT 0003.10.10.2 Material

Polyethylene pressure-sensitive tape or polyethylene laminated to an elastomeric layer of butyl rubber tapes shall conform to SANS 1117, types A, B or C.

C3.3.2.3.10.10.3 ZUT 0003.10.10.3 Application

1) General

Steel pipes, fittings and specials, protected by means of tapes, shall be wrapped in accordance with SANS 10129 as amended and supplemented by this Specification. All pipes shall be wrapped outside the trench in accordance with acceptable factory applications. Tape wrapping may be carried out in an "over the trench" operation for pipe diameters up to 450 mm.

2) Surface Preparation

Steel pipe surface preparation shall conform to Clause 3.2 of SANS 10129.

3) Priming

Immediately after surface preparation but not later than 4 hours after cleaning, provided the pipe surfaces are kept dry and free from dust, a primer shall be applied according to Clause 4.2.1 of SANS 10129.

4) Normal Wrapping

Tape wrapping shall be applied with sufficient pre-tensioning immediately after priming, in accordance with Clause 4.2.2 of SANS 10129, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects at temperatures up to 65°C.

For normal wrapping, tape shall be applied in two layers with a minimum overlap of 50 mm on both the inner and outer wraps.

Tape joints and repairs shall be done in accordance with Clause 4.2.3 of SANS 10129.

Hand wrapping shall only be allowed for short lengths that are inaccessible to a wrapping machine, specials, joints, small diameter pipes and small repairs – refer Clause 10.10.6

5) Armouring

Where armour wrapping is specified, two layers of tape wrapping shall first be applied with sufficient pre- tensioning immediately after priming, in accordance with Clause 4.2.2 of SANS 10129, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects even at temperatures up to 65°C.

The first layer of wrap shall overlap by half the tape width plus 25 mm and the second wrap shall overlap by not less than 50 mm.

The above-mentioned layers of tape shall be armoured by the application of a third layer of pressure- sensitive polyethylene tape with a carrier thickness of 750 micrometres and a minimum overlap of 50%.

Armoured wrappings shall generally be applied at the following positions:

- All road crossings through sleeves and culverts;
- All railway crossings through sleeves or culverts; and
- Wherever the Engineer may consider that special conditions warrant such measures.

6) Wrapping of Specials

In the case of specials or pipe lengths where length and/or shape preclude the application of a protective wrapping system by any means, the protection shall be carried out either by bitumen-fibre glass or epoxy corrosion protection system in accordance with the requirements of the applicable corrosion protection system. In the case of access, scour, air valve and farmers off-take tees the special shall be deemed to incorporate at least two (2) diameter lengths either side of the main tee barrel.

7) Armour Wrapping of Coated Pipes

Where armour wrapping of coated pipes is specified, a single layer of pressure-sensitive polyethylene tape with a carrier thickness of 750 micrometres and a minimum overlap of 50% shall be applied.

C3.3.2.3.10.10.4 ZUT 0003.10.10.4 Tolerances

1) Pressure Sensitive Tape Wrapping

The minimum thickness of the inner low-density polyethylene tape carrier component shall be 300 µm and the maximum thickness of the outer high-density tape carrier shall be 1000 µm. Total minimum polyethylene thickness of 1450 µm.

The adhesive part of the inner layer shall be a minimum thickness of 1.5 times the polyethylene tape carrier thickness. For the outer layer the adhesive layer shall be at least equal to the thickness of the polyethylene tape carrier thickness.

2) Butyl Rubber Laminates

The minimum thickness of the completed wrapping shall be 750 µm. The inner layer shall be a butyl rubber laminate of 450 µm minimum thickness of which the butyl rubber film shall not be less than 200 µm thick and the polyethylene film shall not be less than 200 µm thick.

The outer layer shall be high density pressure tape of 300 µm minimum thickness.

C3.3.2.3.10.10.5 ZUT 0003.10.10.5 Testing

This clause and its sub-clauses shall be read in conjunction with Clause 4.13 and Clause 11.1 of this Specification.

1) Visual Inspection

The wrapping shall have a smooth appearance, free from wrinkles, blisters, bridging across weld beads, frayed edges, cracks, dis-bonding and any signs of physical damage.

2) Non-Destructive Testing

i) Electrical Insulation Defect (Holiday) Testing

The entire wrapping of the pipeline shall be tested to ASTM G62 with an approved Holiday Detector equipped with a rolling ring detector around the pipe by the Contractor to the Engineer's satisfaction. The ring shall be in close contact with the surface of the wrapping along the pipe circumference. The test shall be carried out immediately prior to lowering the pipe into the trench. The wrapping on specials or short pipe lengths shall be tested with an approved Holiday Detector fitted with a copper bristle brush detector of suitable form. The wrapping shall exhibit no Holidays when tested with an effective voltage of 12 kV at a nominal pulse frequency of not less than 30 Hz.

The Engineer may instruct any length of pipe or any number of specials to be re-tested using a Holiday Detector with a copper bristle brush detector.

ii) Insulation Test

The Engineer shall carry out a conductance test on the wrapping over any section of pipeline between valves when the pipeline has been wrapped and installed in the trench with padding and back filling completed. The test shall be conducted as per NACE TM0102with the valves temporarily removed from the line, at the Contractor's expense, to ensure complete isolation of the pipeline section under test or between gaps left for tie-ins.

The length of the section of pipeline under test shall be carefully measured and the conductance over the section tested shall not exceed 180 micro-Siemens per square metre of pipe surface under all conditions of test. If the results of the test for the section of pipeline tested are not satisfactory, two sections immediately adjacent to the testing section will be tested. If the results on one or both of these sections tested are not satisfactory, all sections of wrapped pipeline shall be tested.

3) Destructive Testing

The Engineer may from time to time collect samples of 10 m of each type of tape and one litre of primer for testing, for compliance with the Specification, by any independent laboratory appointed by the Engineer. The supply of samples shall be for the Contractor's account. The Engineer reserves the right to reject the whole batch of materials from which unsatisfactory samples were obtained.

4) Repair of Damaged Coats

The Contractor shall be required to locate areas of faulty protection on all sections on which unsatisfactory results are obtained and to affect the necessary repairs. The cost of this work and all additional materials provided or supplied, including the reinstatement of the trench and the retest shall be for the Contractor's account.

C3.3.2.3.10.10.6 ZUT 0003.10.10.6 Repair Methods

Where damage to the wrapping on a pipeline has occurred and where there are creases, wrinkles and folds in the wrapping, proceed as follows:

1) Small Damaged Areas

If the width of the tape being used exceeds by at least 100 mm the length of the section affected, cut the area of damaged wrapping away to bare metal leaving no raised edges or protrusions.

Clean and prime the exposed area in accordance with Clauses 10.10.3.2 and 10.10.3.3 and apply a patch of tape, ensuring an overlap of not less than 50 mm on all sides onto the surrounding wrap. Apply by hand-wrapping with a 55% overlap, a further layer of tape commencing two turns before and continuing for two turns beyond the patch.

2) Large Damaged Areas

Where the extent of damaged or faulty wrapping is such that the tape cannot span the affected area and provide a 50 mm overlap on all sides it must be completely removed from the pipe over the affected section. The area shall be cleaned and primed in accordance with Clauses 10.10.3.2 and 10.10.3.3. The pipe must be re-wrapped with a 55% overlap, commencing two turns before and finishing two turns beyond the bared section.

3) Damage on Double Wrap

Where damage or a defect has occurred in a section that has been double wrapped and in the case of small Holidays, the outer wrap shall be removed for a distance equal to three (3) times the width of the inner wrap tape on each side of the damaged area.

The appropriate procedure given in Clauses 10.10.6 shall be used to affect the repair of the inner wrap.
The outer wrap shall be re-instated in accordance with Clause 10.10.3.5.

4) Outer Wrap Damage

Where damage extends through an outer wrap / rockshield (see Section 6 of SANS 10129), this shall be carefully removed for a distance equal to three (3) times the width of the inner wrap tape on each side of the damaged area without damaging the inner wrapping.

The repair shall be carried out by the appropriate method given in Clauses 10.10.6 and the outer wrap / rockshield re-instated in accordance with Clause 10.10.3.5.

C3.3.2.3.10.11 ZUT 0003.10.11 SYSTEM 10: PETROLATUM WRAPPING

Profiling mastic and mastic blankets are used for corrosion protection of couplings and flanges in chambers with high humidity and buried in soil.

C3.3.2.3.10.11.1 ZUT 0003.10.11.1 Standards

Reference is made to the latest issues of the following Standards:

SANS ISO 8501-1: Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after removal of previous coatings.
SANS 0129: Plastics tape wrapping of steel pipelines.
SANS ISO 9000: Model for quality assurance in production and installation.

C3.3.2.3.10.11.2 ZUT 0003.10.11.2 Surface Preparation

Mechanically clean and wire brush the joint to remove all loose rust, scale, old coating or lining and foreign matter to St 2 (ISO 8501-1).

Areas subjected to chemical attack, salt spray, fungus or bacteria shall be neutralized, rinsed with clean potable water and mechanically cleaned as specified above.

C3.3.2.3.10.11.3 ZUT 0003.10.11.3 Priming

Brush priming solution well over the entire joint area, leaving a thin film (at a nominal coverage rate of 0.8 m²/litre). Apply a liberal amount around the bolt threads, narrow cavities and crevices.

Paste shall be used where excessive surface corrosion has occurred and under high humidity or submerged conditions.

C3.3.2.3.10.11.4 ZUT 0003.10.11.4 Application

Use profiling mastic and/or strips to fill all voids, crevices and sharp or irregular contours.

Apply mastic tape circumferentially over the area to be coated with a 25 mm overlap on either side of the mastic with a 75 mm end overlap.

Pre-formed petrolatum mastic blanket system (10 mm thick), supported by a coated tape backing, is available to provide a quick and easy method to apply this system.

Eliminate all air pockets, wrinkles and creases.

C3.3.2.3.10.11.5 ZUT 0003.10.11.5 Top Coat

1) Buried Conditions

Two complete turns of the polyethylene sheeting shall be applied circumferentially. The ends are secured to the pipe barrels with 48 mm wide bands of PVC adhesive tape, which is also applied to the outside diameter of the bolted joint.

2) High Humidity Conditions

Overcoat with a synthetic coat mixed with a cementitious filler to give a tough, flexible coat. The base coat may be over-coated with water based Acrylics or Epoxies.

NOTE:

- Detail of application shall be in accordance with the manufacturer's data sheets and approved by the Engineer.

C3.3.2.3.10.12 ZUT 0003.10.12 SYSTEM 11: POLYOLEFIN-BITUMEN WRAPPING

Not Used.

C3.3.2.3.10.13 ZUT 0003.10.13 SYSTEM PC1: SOLVENT FREE POLYURETHANE COATING ®

This corrosion protection system covers the application of Solvent Free Polyurethane as a coating to steel pipes. Generally the coating is to be applied in accordance with ANSI/AWWA C222-99 'Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings'. Where in conflict with ANSI/AWWA C222-99, the amendments hereunder shall take precedence.

C3.3.2.3.10.13.1 ZUT 0003.10.13.1 Section Numbers of ANSI/AWWA C222-99

The section (clause) and sub-section numbers in this clause refer to the same numbered sections and subsections in ANSI/AWWA C222-99.

1) ANSI Section 4.2 Test Requirements

Replace 'Table 1 Requirements' with the new Table 1 below.

New Table 1: Physical and Performance Requirements

Property	Polyurethane Coating Material	Test Method Sub-Section
Adhesion, MPa min (laboratory)	15 MPa	ASTM D 4541

Impact resistance Kg m, min	1.6 kg m	ASTM D 2794 Intrusion
Water absorption %, max	max 3%	ASTM D 570 long term
Dielectric strength kV/mm thick min	7.5 kV/mm thick min	SANS 1217 clause 8.10
Resistance to abrasion, mg max	max 100/1000 rev	ASTM D 4090 CS17 1 kg 1000 cycles
Cathodic disbondment	max 12 mm radius	ASTM G 95 at 23 deg C
Durometer Hardness	min 65 Shore D	ASTM D2240
Chemical Resistance 10% sulphuric acid 30% NaCl 30% NaOH Diesel fuel	 max 5% in mass, length or width max 5% in mass, length or width max 5% in mass, length or width max 5% in mass, length or width	ASTM D543

2) ANSI Section 4.3 Coating Thickness

ANSI Sub-Section 4.3.1
The minimum dry film thickness of coating is to be 2000 microns within a tolerance of -100 microns and +1000 microns.

3) ANSI Section 4.4 Surface Preparation

The requirements of section 4.4 of ANSI/AWWA C222-99 will apply and will take precedence over Clause 3.2 above.

4) ANSI Section 4.7 Welded Field Joints

ANSI Sub-Section 4.7
The hold backs (cut-backs) are to comply with Clause 4.15.1 of this Specification.

5) ANSI Section 5.3 Coating Tests

ANSI Sub-Section 5.3.1
The basis of acceptance of proposed coating material shall be as per method (1).

6) ANSI Section 5.5 Coated Pipe Inspection

ANSI Sub-Section 5.5.4
Electrical continuity inspection shall be conducted on all pipes as per Clause 8.10 'Dielectric strength' of SABS 1217 Ed. 1.3.

7) ANSI Sub-Section 5.5.3

The adhesion is to be tested in accordance with ANSI/ASTM D4541.

8) ANSI Section 6.5 Affidavit of Compliance

The manufacturer is to submit with his/her first request for payment an affidavit that all material and work has been conducted in accordance with the requirements of this standard.

C3.3.2.3.10.14 ZUT 0003.10.14 SYSTEM PC2: FUSION-BONDED MEDIUM DENSITY POLYETHYLENE

This coating system shall comply with the Australian Standard Specification AS 4321-1955 entitled "Fusionbonded medium density polyethylene coating and lining for pipes and fittings" except as modified hereunder.

C3.3.2.3.10.14.1 ZUT 0003.10.14.1 Modifications to Specification AS 4321-1955

1) Preparation of Surface

Delete Clause 5.1 of AS 4321-1955 and replace with Section 3 "SURFACE PREPARATION FOR PIPES TO BE COATED AND LINED" of this specification.

2) Repairs

Delete the last sentence of Clause 8.1 of AS4321-1995 and replace with "Damaged areas that pass the continuity test need not be repaired provided that the coating or lining thickness is equal to or greater than the thickness specified in Table 1 of AS 4321-1995. Generally no more than 3 repairs will be allowed per 9m length of pipe and the area of a single repair is not to exceed 0.01 square m. If the area of a single repair does exceed 0.01 square m the pipe will be rejected. Repairs may be undertaken in accordance with Clause 8 of AS 4321 for the following methods of repair:- Fusion bond; Heat shrink sleeve or Hot gas welding. A wrapping system may also be used if applied as detailed hereunder.

i) Repairs with Tape

When repairs are permissible the repairs shall be made using a repair system comprising (1) a polymer bitumen primer (Denso Primer D or equivalent approved), (2) an inner seal of modified rubber bitumen sealing tape (Denso Mastic Sealing Tape or equivalent approved) and (3) an outer protective layer of acrylic coated/modified bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape. The outer protective tape is to be wrapped around the entire pipe.

a) Pinholes

At each pinhole detected by the electrical test, the surrounding area shall be abraded to at least a minimum area of 175mm by 175mm around the hole. The abrasion shall be carried out (with clean emery paper of 80 to 100 mesh) around the repair so as to provide a suitable rough surface profile without causing the removal or excessive amounts of coating material. The repair area is to be feathered into the surrounding sound coating. Debris and other deleterious matter are to be removed by means of a clean rag moistened with Cleaning Solvent. The primer is applied and once it has dried the prepared surface is covered with a patch of modified rubber bitumen sealing tape (Denso Mastic Sealing Tape or equivalent approved) of size 150mm by 150mm. The bond is to be free of air bubbles and smoothed out by hand or using an aluminium fluted roller. Finally, acrylic bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape.

b) Larger Damaged Areas

The edges of the damaged coating must be chamfered back to remove all potential void areas. The primer and modified bitumen rubber are applied as for pinholes but the modified bitumen rubber tape is pre-cut and applied with 55% overlap Finally acrylic bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape. Weld beads are repaired with suitable lengths of the above size tapes. When covering weld beads, the centre portion of the

square must make contact first. Smooth the tape out with an outward direction to remove all entrapped air."

3) Storage, Handling, Transport and Marking

Add to Clause 11 of AS4321-1955: Clause 1.5 of this specification entitled "Plant and Rigging for the handling and delivery of Pipe and Specials".

C3.3.2.3.10.15 ZUT 0003.10.15 SYSTEM PC3: THREE LAYER SYSTEM

The three layer corrosion protection system consists of a powdered epoxy primer, a polymeric adhesive and a polyethylene outer sheath which shall be applied in accordance with Canadian Standards Association Specification (CSA) Z245.20-06/Z245.21-06.

The application is to be in accordance with, inter alia, the following sections of the Canadian specifications listed below.

C3.3.2.3.10.15.1 ZUT 0003.10.15.1 Z245.20 External Fusion Bond Epoxy Coating for Steel Pipe

a) General Requirements
b) Materials
The following Fusion Bonded Epoxy primers are approved for use.
Akzo Nobel PCL 331
Jotun CORRO-COAT EP-F 1003HW
Should the Supplier wish to use any other make of primer, samples must be left with the Employer or his/her agent for testing. Delays in approval will not be accepted as a reason for late delivery.
c) Coating Application
d) Inspection and Testing
e) Repair of Coated Pipes
f) Markings
g) Handling and Storage
h) Test Reports and Certificates of Compliance
i) Test Procedures

C3.3.2.3.10.15.2 ZUT 0003.10.15.2 Z245.21 External Polyethylene Coating for Pipes

a) General Requirements
The Polyethylene outer sheath is to comply with System B1
b) Materials
The following adhesives are approved for use:-
Borealis Borcoat ME0420
Industrie Polieco M.P.B. SRL COESIVE L8.92.8
The following HDPE Outer Sheath materials are approved for use:-
Borealis Borcoat HE3450
Industrie Polieco M.P.B. SRL HDPE 2050
Should the Supplier wish to use any other make of adhesive or outer sheath materials, samples must be left with the Employer or his/her agent for testing. Delays in approval will not be accepted as a reason for late delivery.
c) Coating Application
d) Inspection and Testing
e) Repair of Coated Pipes
f) Markings
g) Handling and Storage
h) Test Reports and Certificates of Compliance
i) Test Procedure

C3.3.2.3.10.16 ZUT 0003.10.16 SYSTEM PC4: BITUMEN FIBRE COATING

Not Used.

C3.3.2.3.10.17 ZUT 0003.10.17 SYSTEM PL1: CEMENT MORTAR LINING

This corrosion protection system covers the application of Cement Mortar as a steel pipe lining. The pipes will be used to convey potable water.

C3.3.2.3.10.17.1 ZUT 0003.10.17.1 Standards

Reference is made to the latest issues of the following Standards: AS1281-2001: Cement mortar lining of steel pipes and fittings

C3.3.2.3.10.17.2 ZUT 0003.10.17.2 Material

All materials for the cement mortar lining of pipes shall be in accordance with AS1281-2001.

C3.3.2.3.10.17.3 ZUT 0003.10.17.3 Application

Some of the pipes are likely to be stored on site for periods in excess of 3 months before being laid.

C3.3.2.3.10.17.4 ZUT 0003.10.17.4 Testing

The Quality Control Plan and Procedure referred to in Clause 4.13 above will detail the means of demonstrating compliance with AS 1281-2001 and will be based on Appendix B of AS 1281-2001.

C3.3.2.3.10.18 ZUT 0003.10.18 SYSTEM PL2: SOLVENT-FREE EPOXY LINING

This system is specific design to be used as a lining system for pipelines conveying potable water and raw water.

C3.3.2.3.10.18.1 ZUT 0003.10.18.1 General

This corrosion protection system covers the application of Solvent Free Liquid-epoxy as a steel pipe lining. Generally the lining is to be applied in accordance with ANSI/AWWA C210-97 'Liquid-epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines'. Where in conflict with ANSI/AWWA C210- 97, the amendments hereunder shall take precedence. The full cost of all the testing is to be included in the rates for coating unless it is itemised separately in the Schedule of Quantities.

C3.3.2.3.10.18.2 ZUT 0003.10.18.2 Amendments to ANSI/AWWA C210-97

The section and sub-section numbers in this clause refer to the same section and sub-section numbers in ANSI/AWWA C210-97.

1) ANSI SECTION 1.1 SCOPE

ANSI Sub-Section 1.1.2 Coating and Lining Systems

The lining system is to be type (3), a single coat of a two part, chemically cured epoxy coating. In the event of the thickness being less than the minimum specified the coating shall be removed and the pipe length shall be re-blasted and re-lined to comply with the specification.

2) ANSI SECTION 4.2 QUALITY AND SAFETY

Details of all quality related controls and tests are to be included in the QCP&P referred to in Clause 4.13 of the Employer's specification above.

ANSI Sub-Section 4.2.2 Certification

Copies of the certification of the products used, as required by this section, are to be submitted with the tender documents.

3) ANSI SECTION 4.3 COATING SYSTEMS

ANSI Sub-Section 4.3.1 Liquid-Epoxy Coatings.

Add the following: -

The following products have been approved: - Sigma Line 523, Carboline 891 and Denso ST100. Should the Manufacturer/ Supplier wish to offer an alternative product it will be necessary to get the approval of the client. Only solvent free epoxies which have been certified non- toxic and non-tainting and suitable for use with potable water will be permitted. Any delays in approval will not be accepted as a reason for late delivery.

ANSI Sub-Section 4.3.2 Coating Thickness

The pipes shall be lined to a dry film thickness of a minimum of 406 and a maximum of 1000 microns and shall be free from sags and runs.

ANSI Sub-Section 4.3.4 Physical Requirements

Replace Table 1 with the following new Table 1

Tests 1 through 3 in the new TABLE 1 new shall be conducted on every pipe.

Tests 4 and 5(a) and 5(b) in the new TABLE 1 below shall be applied to at least one pipe selected at random from the first day's production or from each new batch of liquid epoxy, whichever is more frequent.

Tests 6, 7 and 8 in the new TABLE 1 below shall be applied to at least one pipe selected at random from the first day's production of each item.

Should the Manufacturer experience difficulties in achieving this specification, additional tests may be required by the Purchaser until the problem(s) has been identified and rectified. Such additional tests shall be to the Purchaser's account.

NEW TABLE 1

No	PROPERTY	REQUIREMENT	TEST METHOD
1	Visual	Smooth glossy or semi-glossy finish, free from excessive runs, sags, orange peel, occlusions or other visible defects	Use an experienced observer
2	Coating Thickness	Min 406 Max 600 microns	SABS Method 141. Take a minimum of 2 readings per m^2 of surface up to 300 mm nominal bore, or 12 per m^2 over 300 mm
3	Electrical Insulation Defects	Nil defects at 90 Volts, 10 Mega-ohm	SABS 1217, Section 8.12.1
4	Impact Resistance	No defect at 1 Joules	SABS 1217, Section 8.7 but modified as given in Note 1

5a	Degree of cure: Static Test	No softening or discolouration when fully cured	SABS 1217, Section 8.9. Cure time shall be in accordance with the manufacturer's data
5b	Dynamic Test	No softening or discolouration when fully cured	50 Double rubs with cotton wool swab soaked in MEK. Cure time shall be in accordance with the manufacturer's data
6	Adhesion (Hot water soak)	Not more than 15 mm disbonding from point of V	Immerse in water at 75ºC for 48 hrs. Make V cut at 30º angle. Test adhesion when panel has cooled to 25ºC
7	Cathodic Disbonding	Total disbonded area not to exceed 40 mm diameter after 30 days. Current flow not to exceed 5mA	ASTM G8 Method B – Magnesium Anode - 20ºC – 7 mm holiday
8	Cathodic Disbonding	Total disbonded area (including holiday) not to exceed 20 mm diameter	Impressed current -3, 5 volts potential at 75ºC for 48 hours 3 mm artificial holiday

NOTE: Impact resistance shall be carried out on a sample of production pipe firmly clamped and choked (to be rebound free) to a rigid base. No electrical insulation defects shall be detected at the point of impact when tested at 1 Joule.

4) ANSI SECTION 4.4 COATING APPLICATION

ANSI Sub-Section 4.4.1 General

Application by airless spray is required.

ANSI Sub-Section 4.4.2 Pipe Preparation

The requirements of section 4.4.2 of ANSI/AWWA C210-97 will apply and will take precedence over the Purchaser's Clause 3.2 above.

ANSI Sub-Section 4.4.3.2 Hold-Back for Field Welds

The hold backs (cut backs) are to comply with the Clause 4.15.1 of this Specification.

ANSI Sub-Section 4.4.3.4 Application Temperature

Add the following:-

The cure rate of liquid epoxy coating is very dependent upon temperature, with the rate of cure being very slow below 10ºC and the reaction generally ceasing below 5ºC. Manufacturer's tendering for this type of lining are therefore expected to have a heated shop or warm air blowers with suitable heat insulating tunnels to enable the temperature of the coating to be maintained at not less than 15ºC from the time of application until full cure has taken place. Adverse weather conditions will not be accepted as a reason for delay in supply.

5) ANSI SECTION 4.5 COATING REPAIR ANSI Sub-Section 4.5.1 Defective Coating

Add the following at the beginning of the Clause:

Repairs of electrical insulation defects may be carried out provided that the number of repairs necessary does not exceed 3 per pipe. A cluster of pinholes within a radius of 25mm shall be regarded as one defect. Any pipe needing repairs in excess of this number or where the lining shows any sign of flaking or loss of adhesion shall not be repaired. The lining shall be removed and the pipe length shall be re-blasted, cleaned and re-coated to comply with the requirements of the specification.

ANSI Sub-Section 4.5.1.1

Delete this sub-section and replace with the following:-

Repairs with Epoxy

When repairs with epoxy are permissible, the following method shall be used :-

- Abrade an area at least 25mm diameter around and beyond the defective area. The abrasive paper shall not be coarser than 220 mesh and shall be preferably 400 mesh. It shall be used preferably wet to avoid excessive removal of coating.
- The repair area shall be smoothly feathered into the surrounding sound area. The repair area shall be abraded to a matt finish, free from deep scratches and excessive removal of coating. After abrasion, the area shall be wiped clean with M.E.K. or other suitable approved clean solvent and allowed to dry.
- All repairs shall be undertaken using a repair product recommended by the material manufacturer.
- Repair material shall be mixed in the proportions supplied by the manufacturer. No splitting of packs shall be permitted unless the material is supplied in self metering packs.
- The mixed repair material shall be applied to the clean, dry, abraded repair area so as to cover the defect and extend to within 1 or 2mm of the edge of the abraded area. A “halo” of abraded area shall be visible around the repair material.
- After curing, the repair and at least 250mm surrounding area shall be tested for electrical insulation defects as specified in the contract. There shall be no electrical insulation defects.

C3.3.2.3.11 ZUT 0003.11 COMPLIANCE WTH REQUIREMENTS

C3.3.2.3.11.1 ZUT 0003.11.1 TESTING

Tests, instruments, methods and criteria shall be as specified below or in the Amendments of this Specification.
The requirements of Clauses 4.13 shall apply.

C3.3.2.3.11.1.1 ZUT 0003.11.1.1 Visual Inspection

All surfaces shall be inspected visually and shall be free from tears, runs, sags, wrinkles, blisters, change in colour or gloss, orange peel, dirt, visible pinholes, dust or fluff occlusions or any other visible defects.

C3.3.2.3.11.1.2 ZUT 0003.11.1.2 Holiday Inspection

100% of all coated surfaces shall be tested and there shall be no electrical insulation defects on any area inspected.

For films exceeding 500 µm thickness, a high voltage, electrical insulation defects detector shall be used in accordance with SABS 1217.

Except on system containing conductive pigment (Zn, Al), low-voltage wet sponge electrical insulation defects inspection shall be carried out in accordance with SANS 1217 for coatings and linings of thickness not exceeding 500 µm.

For systems exceeding 500 µm thickness, the high voltage, sparking electrical insulation defects detector shall be used in accordance with SANS 1217.

During the inspection procedure the Contractor shall ensure that sufficient moisture is always present on the surfaces to be tested.

C3.3.2.3.11.1.3 ZUT 0003.11.1.3 Dry Film Thickness

The dry film thickness (DFT) shall also conform to the requirements of Clause 9.9

a) Measurements shall be taken in accordance with ISO 2808.

b) 100% of all system thicknesses measured shall comply with the minimum requirements of this Specification.

c) Film thickness more than the prescribed maxima shall not necessarily constitute reason for rejection if the system is demonstrated to be sound in all respects.

d) The method used to measure film thickness, and the significance of the readings for each project, shall be agreed upon by all parties prior to commencement of the work.

C3.3.2.3.11.1.4 ZUT 0003.11.1.4 Degree of Cure of Fusion-Bonded Materials

The degree of cure of corrosion protection material shall be assessed by solvent wiping in accordance with the method given in SABS 1217 (methyl ethyl ketone resistance test)

C3.3.2.3.11.1.5 ZUT 0003.11.1.5 Free of Oil and Grease

C3.3.2.3.11.1.5.1 ZUT 0003.11.1.5.1 Wetting with Water

All surfaces cleaned of oil and grease shall be tested using the “water-break-free” method. The surface shall be wetted with water and the entire surface shall be covered by an unbroken film.

C3.3.2.3.11.1.5.2 ZUT 0003.11.1.5.2 Solvent-Wiping

Where water soluble lubricants may be present the surface shall be further tested by wiping with a clean cotton wool swab soaked in solvent. No stain shall be evident on the swab after solvent-wiping.

C3.3.2.3.11.1.6 ZUT 0003.11.1.6 Water Soluble Salt Contaminants

Substrate surfaces shall be tested for the presence of water soluble salt contaminants in accordance with SABS Method 770 or by means of the Weber Reilly Test.

C3.3.2.3.11.1.7 ZUT 0003.11.1.7 Standard of Mechanical Surface Preparation

Mechanical surface preparation shall be visually compared to the standard shown in SABS ISO 8501-1.

C3.3.2.3.11.1.8 ZUT 0003.11.1.8 Blast Profile

The blast profile of the substrate surfaces shall be determined in accordance with SABS Method 772.

C3.3.2.3.11.1.9 ZUT 0003.11.1.9 Residual Dust and Debris

Substrate surfaces shall be tested for the presence of residual dust and debris in accordance with SABS Method 769.

C3.3.2.3.11.1.10 ZUT 0003.11.1.10 Blasting Material

All blasting-materials shall be approved by the Engineer.

C3.3.2.3.11.1.10.1 ZUT 0003.11.1.10.1 Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11125 for particle size, hardness, density, foreign matter and moisture.

C3.3.2.3.11.1.10.2 ZUT 0003.11.1.10.2 Non-Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11127 for particle size, hardness, density, moisture and water soluble contaminants.

C3.3.2.3.11.2 ZUT 0003.11.2 PIPE AND SPECIALS SPECIFIC TESTING

C3.3.2.3.11.2.1 ZUT 0003.11.2.1 Dry Film Thickness (DFT)

Measurements shall be taken in accordance with ISO 2808.

100% of all system thicknesses measured shall comply with the minimum requirements of this Specification.

In the case of coats applied after the erection of steel work on Site, the frequency at which measurements of the DFT are taken shall be at the discretion of the Engineer, and may be dictated by accessibility.
DFT in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the paint film is demonstrated to be sound in all respects.

DFT shall be tested within 7 days of application.

The method used to measure DFT, and the significance of the readings for each particular item, shall be agreed upon by all parties prior to commencement of the coating work.

C3.3.2.3.11.2.1.1 ZUT 0003.11.2.1.1 Automated Shop Applied Lining and Coating

The film thickness on the first pipe of a production run and thereafter on at least one pipe selected at random from every day's production, but not less than one pipe out of every ten pipes, shall be measured non-destructively by an approved eddy current instrument. At least four readings at equally spaced intervals around the circumference, approximately 300 mm from each end of the pipe, shall be taken. The first reading shall be over the weld bead. When practicable an additional four readings at equally spaced intervals around the circumference in the centre of the pipe shall be taken. The thickness shall not be less than the minimum specified over 100% of the area including weld beads. The Engineer may at his discretion supplement the above test by checking wet film thickness on any or all pipes during application of the coats.

C3.3.2.3.11.2.1.2 ZUT 0003.11.2.1.2 Hand and In-situ Applied Lining and Coating

All the hand applied lining and coating thicknesses shall be tested by means of an approved eddy current or magnetic instrument. At least four readings shall be taken at equally spaced intervals around the pipe circumference at any test point. The first reading shall be over the weld bead. The thickness shall not be less than the minimum specified over 100% of the area including weld beads.

C3.3.2.3.12 ZUT 0003.12 MEASUREMENT AND PAYMENT

C3.3.2.3.12.1 ZUT 0003.12.1 GENERAL

Payment for the requirements of this Specification (excluding those stipulated in Clause 12.2.1) will be included in the payment item for the particular item supplied including painting or corrosion protection. No separate payment shall be made for painting and corrosion protection unless specifically allowed for in the Bill of Quantities.

C3.3.2.3.12.2 ZUT 0003.12.2 SCHEDULED ITEMS

C3.3.2.3.12.2.1 ZUT 0003.12.2.1 PQP and documentation……..Unit: lump sum (Sum)

Separate Items are provided in the Bill of Quantities for the submission of the PQP and all other pre- manufacture documentation.

The rate shall include full compensation for the preparation and submission of the PQP and the submission of all pre-manufacture documentation in compliance with the Specification.

Payment will only be made after the PQP and all documentation has been approved by the Engineer.

Annexures A: Applicable Standards

ANNEXURE A: APPLICABLE STANDARDS

The following Standards and Codes of Practice are referred to in this Specification:

American Water Works Association	
AWWA M11	Steel pipe – A guide for design and installation (3rd. edition)
AWWA: C207 – 1994	Steel pipe flanges 4" through 144".
AWWA: C208 – 1996	Dimensions for fabricated steel water pipe fittings.
South African National of Standards	
SANS 062-1	Steel pipes Part 1
SANS 064	The preparation of surfaces for coating.
SANS 044	Filler materials for manual welding
SANS 770	Cleanliness of blast-cleaned steel surfaces for painting (freedom of soluble salts).
SANS 772	Profile of blast-cleaned steel surfaces for painting (profile gauge).
SANS 769	Cleanliness of blast-cleaned steel surfaces for painting (freedom from dust and debris).
SANS 10044	Welding
SANS 10064	The preparation of steel surfaces for coating
SANS 10121	Cathodic protection of buried and submerged structures
SANS 10129	Plastics tape wrapping of steel pipelines
SANS 1091	National colour standard
SANS 1117	Plastics wrappings for the protection of steel pipelines
SANS 1123	Steel Pipe Flanges (1977 edition shall apply)
SANS 1130	Fibre reinforcing material for pipe wrapping
SANS 1344	Medium duty solvent detergent.
SANS 1178	The production of lined and coated steel pipes using bitumen or coal tar enamel

SANS 1200 L	Standardized specification for civil engineering construction Section L: Medium-pressure pipe lines
SANS 121	Hot-dip galvanised coatings on fabricated iron and steel articles
SANS 1217	The production of painted and powder-coated steel pipes
SANS 1274	Coatings applied by the powder-coating process
SANS 1344	Medium duty solvent detergent
SANS 1431	Weldable structural steels
SANS 14713	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines
SANS 1476	Fabricated steel pipework
SANS 1700	ISO metric black bolts, screws and nuts (hexagon and square)
SANS 1700	ISO metric precision hexagon-head bolts, screws and nuts (coarse thread medium fit series)
SANS 2063	Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys
SANS 2808	Paints and varnishes - Determination of film thickness
SANS 32	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic Plants
SANS 5770	Preparation of steel substrates before the application of paints and related products - Test for the assessment of cleanliness of blast-cleaned steel surfaces - Freedom from certain soluble salts
SANS 5772	Preparation of steel substrates before the application of paints and related products - Surface roughness characteristics of blast-cleaned steel surfaces - Profile of blast-cleaned surfaces determined by a micrometre profile gauge
SANS 719	Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)
SANS 9000	Quality management systems - Fundamentals and vocabulary
British Standards Institution	
BS 970	Specification for wrought steels
BS 2494	Materials for elastomeric joint rings for pipe work and pipelines
BS 2633	Class I arc welding of ferritic steel pipe work for carrying fluids

BS 2815	Compressed asbestos fibre jointing
BS 4504	Flanges and bolting for pipes, valves and fittings (metric series)
BS 534	Steel pipes and specials for water and sewage
BS 5493	Protective coating of iron and steel structures against corrosion
BS 5500	Unfired fusion welded pressure vessels
American Petroleum Institute	
API 1104	Standard for welding pipelines and related facilities
API 5L	Specification for line pipe
American Society for Testing of Materials	
ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A312	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
Swedish Standards Institute	
SIS 05590	Pictorial surface preparation standards for painting steel surfaces
American Society of Mechanical Engineers	
ASME IX	Boiler and Pressure Vessel Code
South African Electrolytic Corrosion Committee	
SAECC/1	Code of Practice
American National Standards Institute	
ANSI B31.3	Standards of pressure piping
International Organization for Standards	
ISO 11125	Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.
ISO 11127	Preparation of steel substrates before application of paints – Non-metallic blast–cleaning abrasives.
ISO 2808	Paints and varnishes
ISO 752	Specifies the classifications, chemical compositions, markings and other

ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
ISO 8504-2	Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
ISO 9000	A family of standards for quality management systems
European Standards	
EN 1179	Zinc and zinc alloys

Annexures B: Paint Colour Coding

MECHANICAL AND GENERAL

ITEMS	COLOUR	SANS 1091 CODE
Structural steel, Gates	Light grey	G29
Hydraulic power Pack	Strong blue	F11
Hydraulic oil	Salmon pink	A40
Hazardous objects/areas (restricted headroom, crane hook etc.)	Golden yellow with black chevron	B49*
Handwheels and levers	Golden yellow	B49
Handrails: vertical - horizontal	Black Golden yellow	 G49
Handrails on dam walls - Aluminium - Stainless steel - Galvanized	 Un-coated Un-coated Light grey	 G29
Floors: - safe and walking areas - restricted areas - open flooring (gratings) – MS galvanized 3Cr12 Stainless steel	 Emerald green Golden yellow Un-coated Un-coated Un-coated	 E14 B49*
Fire protection Plant	Signal red	A11*
Control panels	Eau de nil	H43

PUMP STATION

ITEMS	COLOUR	SANS 1091 CODE
Electric motors	Light beige	C57
Pumps/control valves: for raw water for chem-treated water	Apple green Middle blue	H29 F07
Fan and coupling guards	Signal red	A11*
Base plates	Black	
Overhead traveling cranes	Golden yellow	B49
Isolating valves: for raw water for chem-treated water	Brilliant green Arctic blue	H10 F28

ELECTRICAL

ITEMS	COLOUR	SANS 1091 CODE
Low voltage panels: Indoor Outdoor	Light orange Light orange	B26* B26
Medium voltage panels: Indoor Outdoor	Admiral grey Admiral grey	G12 G12
Panel accessories (gland plates, back plates, interior)	White	
UPS Plant items	Light orange	B26
Transformers	Light stone	C37
LV distribution kiosks, mini subs	Light stone	C37
Standby electrical Plant items(Permanently powered)	Signal red	A11*
General outdoor	Light grey green	H40
All Plant– interior	White	

WATER TREATMENT PLANT

ITEMS	COLOUR	SANS 1091 CODE
Plant	Same colour of respective pipe work	
Handwheels (remote valves)	Same colour of respective pipe work	
PIPE WORK		
Raw water	Brilliant green	H10
Chemical treated raw water	Verdigris green	E22
Clarified raw water	Eau de nil	H43
Filtered water	Pale blue	E39
Chlorinated filtered water	Arctic blue	F28
Backwash water	Cornflower blue	F29
Air saturated water	Turquoise blue	E18
Wash water recovery	Middle buff	B33
Raw sewage	Dark earth	B11
Settled sewage effluent	Brilliant green	H10
Biologically treated sewage effluent	Verdigris green	E22
Final/chlorinated effluent	Eau de nil	H43
Digested sewage sludge	Middle brown	B07
Raw sewage sludge	Dark brown	B03
Humus sludge	Golden brown	B13

ITEMS	COLOUR	SANS 1091 CODE
Return activated sludge	Golden brown	B13
Waste activated sludge	Middle brown	B15
Supernatants/underflows returning to head of works	Middle buff	B33

DOSING/CONTROL PIPE WORK

ITEMS	COLOUR	SANS 1091 CODE
Poly-electrolyte	Pinotage	A08
Alum/Ferric chloride	Jacaranda	F18
Chlorine solution	Primrose	C67
Chlorine gas	Lemon	C54
Chlorine liquid	Light orange	B26
Lime slurry	Biscuit	B64
Lime hydrated	Biscuit	B64
Lime saturated water	Biscuit	B64
Air/compressed air	White	
Steam	Pastel grey	G54

NOTE: Colours marked thus ***** are restricted for specified Plant only.

C3.3.2.4 ZUT 1003 LIFTING EQUIPMENT

C3.3.2.4.1 ZUT 1003.1 SCOPE

ZUT 1003 specifies the general requirements for lifting equipment and the specific requirements for steel gantries, overhead travelling cranes, hoists, hoist trolleys, crawl beams, davits and hand cranked winches.

C3.3.2.4.2 ZUT 1003.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification.

b) ZUT 0001: General Mechanical Requirements.

c) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

d) SANS 50025: Hot Rolled Products of Structural Steels.

e) BS 466: Specification for Power Driven Overhead Travelling Cranes, Semi-Goliath and Goliath Cranes for General Use.

f) BS 2573: Rules for the Design of Cranes. Specification for Classification, Stress Calculations and Design Criteria for Structures.

g) BS EN 13001: Cranes. General Design.

h) SANS 4310: Cranes – Test code and procedures.

i) BS EN 1011: Welding. Recommendations for welding of metallic materials.

j) BS 4872: Specification for approval testing of welders when welding procedure approval is not required.

Equipment, materials and operational methods shall comply with the latest edition of the relevant national and/or international standard.

C3.3.2.4.3 ZUT 1003.3 GENERAL

The scope of work for which the Contractor is responsible is specified elsewhere.

The installation shall be as shown on any applicable drawings provided with the tender documents.

Lifting equipment shall be designed, constructed and installed in accordance with an internationally accepted technical design standard for the type of lifting equipment to be provided in terms of this Contract. The standard shall be noted on Contractor's drawings submitted for approval. The guidelines given in the Southern African Steel Construction Handbook may be used where applicable and where these do not conflict with the technical design standard.

The design, fabrication and installation of lifting equipment shall be in accordance with the relevant aspects of the Occupational Health and Safety Act and Regulations and, in particular, with Regulation 18 of the Driven Machinery Regulations.

The safe working load (SWL) shall be permanently marked on all components.

Equipment which has not previously been in common use in South Africa shall not be acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.
The Contractor may only use the lifting equipment for the installation of other parts of the Works if testing and certification for the complete lifting installation, including the supporting structure, has been successfully completed and submitted to the Engineer.

C3.3.2.4.4 ZUT 1003.4 INSPECTIONS

The Contractor shall arrange for the Engineer to inspect all fabrications at the following stages:

a) after fabrication. During this inspection and in the presence of the Engineer, the Contractor shall conduct dye penetrant testing of all welds on structural members. This includes any welding onto structural members.

b) after blasting.

c) after the final coat (but before the items are removed from the coatings yard).

C3.3.2.4.5 ZUT 1003.5 TESTING

Lifting equipment and installations shall be tested after installation over the complete vertical and horizontal lifting range. The Contractor shall make arrangements for the Engineer to witness this test.

The testing shall be done in accordance with the requirements of SANS 4310 and, in accordance with this Standard, the test load used shall be 125 % of the SWL.

The Contractor shall make all arrangements for the testing procedures and shall provide the test load.

A test report shall be provided in accordance with SANS 4310.

C3.3.2.4.6 ZUT 1003.6 PERFORMANCE REQUIREMENTS

The equipment shall lift and shall travel the full operating footprint with the range of loads between zero load and the specified safe working load.

The lifting equipment shall also safely lift the test load, and shall be capable of traversing the full operating footprint of the lifting equipment whilst holding the test load. All three travel movements shall be free of shake, shudder and crabbing.

Lift and travelling actions shall be snag and snatch free.

C3.3.2.4.7 ZUT 1003.7 TECHNICAL REQUIREMENTS

The technical requirements in this clause apply to all lifting equipment.

The lifting equipment shall be suitable for continuous use unless otherwise stated.

The lifting equipment, when erected and installed, shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

Fabrication shall comply with the requirements of the clauses “Fabrication of Steels” and “Welding” in ZUT 0001.

Hollow steel sections are not acceptable as structural members unless the section is fully closed by welding.

Steel foot-plates for securing steel structures to concrete shall have a minimum of four anchor bolts.

Anchor fasteners shall have a diameter of not less than M16 and shall be of EN Grade 1.4401 (316), or better. Other fasteners, including high tensile fasteners, shall be of stainless steel or of hot-dip galvanised steel. Fasteners which form standard parts of proprietary equipment shall remain as provided but might require an additional, suitable anti-corrosion coating to suit the environment.

Chemical anchor shall not be used where the load on the anchor fastener is vertically downwards. Such anchors shall preferably be through-bolted. Mechanical anchors will also be acceptable but application of the test load shall not cause the loading on the anchor to exceed 70 % of the anchor manufacturer's recommended loading.
Corrosion protection shall comply with the requirements of ZUT 0003.

Motors shall comply with the clause "Electric Motors" in ZUT 0001. Motors shall have ingress protection to at least IP 55 and shall comply with the electrical specifications. Motors shall be provided with a tropical rated corrosion protection system.

High-tensile and alloy steel chains shall have a factor of safety of at least four. Other chains shall have a factor of safety of at least five. Steel-wire ropes shall have a factor of safety of at least six. Man-made fibre ropes or woven webbing shall have a factor of safety of at least six.

C3.3.2.4.8 ZUT 1003.8 ADDITIONAL REQUIREMENTS FOR STEEL GANTRIES

C3.3.2.4.8.1 ZUT 1003.8.1 General

The same technical design standard used for the design of a crane or crawl beam shall be used for designing the gantry which supports that crane or crawl beam.

Columns shall be cross-braced and/or "triangulated" in more than one plane. In other words, columns shall not be cantilevered in any vertical plane.

C3.3.2.4.8.2 ZUT 1003.8.2 Corrosion Protection

Gantry steelwork shall be hot-dip galvanised.

If it is not feasible to protect the gantry steelwork using hot-dip galvanising, it shall be hot-metal zinc-sprayed, sealed and coated as follows:

a) The coating shall consist of the zinc metal spray plus the application of a suitable organic sealant and a suitable organic coating.
b) Thermal spray metal coatings shall be in accordance with SANS 2063.
c) The minimum zinc coating thickness shall be 150 µm.

Sealing and coating shall consist of a low viscosity sealant and a suitable coating system. The sealant shall be applied immediately after the thermal spray and until absorption is complete.

The following sealant and coating is acceptable:

d) Application of one coat of a two-part epoxy primer to a dry film thickness of 40 µm; (Carboline Rustbond Penetrating Sealer, Intergard 269, or equivalent).
e) Application of two coats of a two-part polyurethane enamel (two part) to a minimum combined dry film thickness of 70 µm.

C3.3.2.4.9 ZUT 1003.9 ADDITIONAL REQUIREMENTS FOR TRAVELLING CRANES

C3.3.2.4.9.1 ZUT 1003.9.1 TRAVELLING CRANES

C3.3.2.4.9.1.1 ZUT 1003.9.1.1 Certificate

The Contractor shall supply to the Engineer a certificate from the crane manufacturer which certifies that the crane has been manufactured in accordance with the requirements of the Driven Machinery Regulations of the Occupational Health and Safety Act. It shall also specify the technical design standard used and shall state the SWL and the test load.

This certificate shall be provided to the Engineer prior to delivery of the crane to Site.

C3.3.2.4.9.1.2 ZUT 1003.9.1.2 Construction

Construction of overhead travelling cranes, goliath cranes and semi-goliath cranes shall be in accordance with BS 466 and BS 2573 (or BS EN 13 001), as applicable. Suitable equivalent standards are acceptable.

All welding of steelwork shall be carried out in accordance with BS EN 1011 by competent artisans meeting the requirements of BS 4872. Suitable equivalent standards are acceptable.

All materials shall be new and unused and suited to the application. Structural steelwork shall comply with the requirements of SANS 50025 for grade S 355 JR or for grade S 355 JO.

The structures shall be designed with suitable dimensions, wheel spacings and gusset plates or diagonal bracing to prevent slewing.

End stops with rubber buffers shall be fitted to prevent the hoist from moving off the travelling beam. Stops and buffers are also required to limit the long travel on the rails.

C3.3.2.4.9.1.3 ZUT 1003.9.1.3 Operation

All three directions of travel shall have a fast speed, a slow speed and an inching facility.

C3.3.2.4.9.1.4 ZUT 1003.9.1.4 Rails

The crane rails shall be standard rail sections (i.e. shall not be square section steel bar).

Rail lengths shall be joined using fish-plates, with at least four fasteners, to provide the crane wheels with a smooth passage across the join.

C3.3.2.4.9.1.5 ZUT 1003.9.1.5 Machine Components

Gear wheels and other machine components shall be fully enclosed against dust. If mounted externally, they shall have ingress protection to at least IP 55.

Bearings shall be mounted in sealed, cast iron bearing housings and provided with grease nipples.

C3.3.2.4.9.1.6 ZUT 1003.9.1.6 Configuration

The long travel, cross travel and hook travel shall be electrically-powered unless otherwise specified.

The lowest hook level shall be floor level. The operating chains of manually operated cranes shall fall to one metre above floor level. These details are to be confirmed with the Engineer prior to finalisation.

C3.3.2.4.9.1.7 ZUT 1003.9.1.7 Installation

The crane and rails, when erected and installed, shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order. The crane rails shall be straight, over their entire length, to within the permissible deviations given in BS 466.

Every rail length shall be supported at both its ends; i.e. the ends shall not be cantilevered.

The distance between rail supports shall not exceed 1 000 mm.

Crane rail anchor fasteners shall be M16 or larger and shall be of EN Grade 1.4401 (316) or better. Crane rails which are mounted directly on concrete beams shall be grouted along the full length of the rails. A suitable gap between the rails and the beam shall be provided for application of the grout. The grout shall be applied strictly in accordance with the manufacturer's instructions. The grout shall be neatly finished with a 45º chamfer. The Engineer shall be notified prior to application of the grout.

The use of multiple shims for alignment is not acceptable. Shims shall be fully grouted in to provide corrosion protection.

Grouting shall be done using a non-shrink, cementitious grout, ABE Duragrout 1000 or equivalent, to the approval of the Engineer and in accordance with the manufacturer's instructions.

C3.3.2.4.9.1.8 ZUT 1003.9.1.8 Cabling

Cables shall be of the insulated, festooned arrangement and shall be suitable for the applicable hazardous zone classification.

Winding drum cables will be acceptable if approved by the Engineer.

Travelling brush contacts are not generally acceptable and are prohibited on wastewater treatment works and in other corrosive environments.

C3.3.2.4.9.1.9 ZUT 1003.9.1.9 Corrosion Protection

C3.3.2.4.9.1.9.1 ZUT 1003.9.1.9.1 General

The Contractor shall arrange for the fabrication of the crane to be inspected by the Engineer at the fabricator's premises prior to preparation for corrosion protection.

Corrosion protection shall comply with ZUT 0003.

Smaller items, such as cable brackets and protective covers, shall be hot-dip galvanized.

C3.3.2.4.9.1.9.2 ZUT 1003.9.1.9.2 Crane Rails

Crane rails shall be hot-dip galvanized.

C3.3.2.4.9.1.9.3 ZUT 1003.9.1.9.3 Crane Beam and End Carriages

The crane beam and end carriages shall be hot-metal zinc-sprayed, sealed and coated in accordance with ZUT 0003. The coating shall consist of the zinc metal spray plus the application of a suitable sealant and a suitable coating. The metal coating shall be in accordance with SANS 2063. The minimum zinc coating thickness shall be 150 µm.

Sealing and coating shall consist of a low viscosity sealant and a suitable coating system. The sealant shall be applied immediately after the thermal spray and until absorption is complete.

The following sealant and coating are acceptable:

a) Application of one coat of a two-part epoxy primer to a dry film thickness of 40 µm; (Carboline Rustbond Penetrating Sealer, Intergard 269, or equivalent).

b) Application of two coats of a two-part polyurethane enamel (two part) to a minimum combined dry film thickness of 70 µm.

C3.3.2.4.9.2 ZUT 1003.9.2 GOLIATH (AND SEMI-GOLIATH) CRANES

Goliath and Semi-Goliath cranes shall be provided with an operator's cab which is mounted on the crane. The cab shall be provided with a platform which will allow inspection of the hoist and cross travel. A ladder shall be provided on one of the legs of the goliath crane in order to provide safe access to the cab and platform.

The design and position of the cab, platform and ladder shall be decided in conjunction with the Engineer.

C3.3.2.4.9.3 ZUT 1003.9.3 OVERHEAD CRANES

C3.3.2.4.9.3.1 ZUT 1003.9.3.1 General

Electrical control pendants shall be arranged to move independently along the length of the crane beam and shall hang to one metre above floor level.

C3.3.2.4.9.3.2 ZUT 1003.9.3.2 Rail Beam, Rails and Crane Beam

The hoist and hoist trolley shall travel on a steel crane beam(or beams).

The steel crane beam shall be supported on end carriages which travel along crane rails.

The crane rails shall be supported along their full length by crane rail beams. These rail beams shall be of hot-dip galvanised steel unless the drawings indicate that they are of reinforced concrete. If the beams are of reinforced concrete, they will be provided by others but the Contractor shall submit the requirements for fixing and installation of the crane rails to the Engineer.

C3.3.2.4.9.3.3 ZUT 1003.9.3.3 Access for Installation

The Contractor shall determine a suitable method of installation and shall submit a method statement to the Engineer for approval.

C3.3.2.4.9.3.4 ZUT 1003.9.3.4 Maintenance Platform and Ladder

A maintenance platform for two people shall be provided along the length of the crane beam overhead cranes with a SWL above 3 000 kg.

The crane beam structure shall incorporate welded lugs onto which the platform shall be bolted; i.e. the platform shall be removable and shall not be welded to the crane beam. The platform floor shall have a minimum width of 500 mm. Guard rails shall be provided on the maintenance platform and shall comply with the clause "Guard Rails" in ZUT 0001. The complete platform and all guard-railing shall be hot-dip galvanised after fabrication.

A hot-dip galvanised, fixed steel ladder shall be provided at a suitable position within the building for accessing the platform on the crane. This shall comply with ZUT 1001. The design shall ensure that neither persons nor the ladder can be crushed by crane movement.

C3.3.2.4.10 ZUT 1003.10 ADDITIONAL REQUIREMENTS FOR MANUAL AND ELECTRIC HOISTS

C3.3.2.4.10.1 ZUT 1003.10.1 GENERAL

Hoists, including crane mounted hoists, shall be provided with an overload prevention device; e.g. a clutch which slips upon overloading.

The bottom hook shall swivel on a ball or roller bearing through 360º and the bearing shall have a protective skirt. The hook shall be fitted with a safety latch.

Chain boxes shall be provided for holding unloaded lengths of lifting chain.

C3.3.2.4.10.2 ZUT 1003.10.2 ELECTRIC HOISTS

Powered hoists shall comply in all applicable respects with Driven Machinery Regulation 18 of the Occupational Health and Safety Act.

Powered hoists shall hold the load stationary upon power failure.

Lifting chain is preferred for hoists of up to 5 tonnes but corrosion-protected steel wire rope is acceptable where appropriate.

Wire rope hoists shall comply with the following:

a) Drum diameter shall be at least 25 times the wire rope diameter.

b) Drums shall have no more than three layers of wire rope when fully wound up.

c) Drums shall have no fewer than three full turns of wire rope remaining when the hook is at the lowest level.

C3.3.2.4.10.3 ZUT 1003.10.3 MANUAL HOISTS

The operating chain shall be as short as feasible in order to prevent entanglement with the lifting chain.

C3.3.2.4.11 ZUT 1003.11 ADDITIONAL REQUIREMENTS FOR HOIST TROLLEYS

Hoist trolleys shall be designed so that the trolley remains on the support beam if a wheel falls off or if a wheel axle breaks.

Hoist trolleys shall have chain/gear operated movement. The operating chain shall be as short as feasible in order to prevent entanglement with the hoist chains.

C3.3.2.4.12 ZUT 1003.12 ADDITIONAL REQUIREMENTS FOR CRAWL BEAMS

Crawl beams shall be fabricated from standard I-Sections or standard H-Sections.

Crawl beams shall be hot-dip galvanised after all fabrication is complete. If this is not done and the steel is exposed by drilling or welding or any other activity, the complete beam shall have the zinc removed by abrasive blasting and it shall be returned to the galvanisers for hot-dip galvanising.

Crawl beams anchored to concrete shall be secured using EN Grade 1.4401 (316), or better, anchor bolts. The anchor bolts shall, preferably, be through-bolted. Chemical anchor secured bolts are not acceptable where the load is vertically downwards.

Crawl beams fastened to steel support structures shall be secured using hot-dip galvanised fasteners.

Fasteners which secure crawl beams shall be provided with spring washers in addition to the flat or fender washer.

C3.3.2.4.13 ZUT 1003.13 ADDITIONAL REQUIREMENTS FOR DAVITS

Davits shall be column mounted with swivelling booms and shall be designed to suit the application. Where specified, each davit shall be provided with a winch rigidly fixed to the davit at a convenient height and position.

The davit shall be designed for a SWL at least 50 % above the maximum load requirements of the equipment installation.

Guide pulleys shall be provided to suit the arrangement. These pulleys shall be machined with a groove having a radius 5 % to 7,5 % greater than the rope radius and with a flare angle of 52º. The pulley effective diameter shall be not less than 25 times the wire rope diameter. The groove depth shall be twice the rope diameter or greater.

The davit shall either be manufactured of LDX 2101 or of EN Grade 1.4401 (316), or better, or of carbon steel, hot-dip galvanized and painted. All fasteners, pins, shafts, shackles, hooks, etc., shall be of EN Grade 1.4401 (316), or better. Guide pulleys and shafts shall be made of EN Grade 1.4401 (316), or better, or other approved corrosion resistant material, and shall use suitable non-metallic bearings which do not require lubrication.

The slewing arrangement shall be properly designed for easy operation, shall be accurately fitted and shall not be subject to corrosion problems. Bushes made of nylon, "Vesconite" or other suitable non-metallic material shall be used and any metallic mating face shall be of EN Grade 1.4401 (316) stainless steel.
Operating levers, locking arrangements, fixing arrangements, etc., shall not present a hazard. If necessary, operating levers shall be hinged so that they can be swung out of the way when not in use.

C3.3.2.4.14 ZUT 1003.14 ADDITIONAL REQUIREMENTS FOR HAND CRANKED WINCHES

Hand cranked winches shall be rated for a SWL of at least 50 % in excess of the maximum expected working load. All gears, clutches, etc., shall be enclosed in a robust cast iron, cast steel or fabricated stainless steel casing which shall be grease filled and sealed against ingress of dirt and moisture. The winch shall hold the load stationary when the hand crank is released during raising and lowering. In addition, a locking arrangement to lock the position of the load at any point shall be provided.

The force required to operate the winch at its maximum rated load shall not exceed 130 Newtons.

The wire rope shall be of stainless steel. The wire rope shall be long enough to reach the lowest required position and still have at least 3 turns remaining on the drum. The drum size shall easily store the full rope length. The drum shall have a diameter of at least 25 times the diameter of the wire rope.

The support brackets, all exposed fasteners, shafts, handles, pins, etc., shall be of EN Grade 1.4401 (316), or better, and the casing shall be hot-dip galvanized or hot-metal zinc-sprayed (to a thickness of 150 µm) and then painted.

C3.3.2.4.15 ZUT 1003.15 MEASUREMENT AND PAYMENT

The tendered rates or sums shall cover the cost of anything not specially mentioned, but which an experienced contractor can reasonably foresee as being required to enable the apparatus and Plant to be installed and/or function safely and correctly as specified. No claims whatsoever for extras will

be allowed on the grounds that a necessary piece of Plant or part thereof is not specifically mentioned in the Bill of Quantities.

C3.3.2.4.15.1 ZUT 1003.15.1 Supply and Delivery…….Unit: number (No.)

The rates tendered shall include full compensation for the supply and delivery of plant to Site including supply of raw materials and bought-out items and associated operating Plant items; fabrication, manufacture and assembly; quality assurance and quality control; inspection and Factory Acceptance Testing (including attendance on inspections and tests witnessed by the Engineer); type and routine tests; application of finishes (painting and corrosion protection); trial erection and dismantling; preparation and packing for transport; transport from place of manufacture to the Site; insurance, harbour dues etc., during transport; loading and unloading; storage under appropriate conditions from date of delivery until commencement of erection; and any other work as specified. Payment will be made per unit. Payment will only be effected after full compliance of the items with this Section and associated documentation has been approved by the Engineer.

C3.3.2.4.15.2 ZUT 1003.15.2 Installation, Testing and Commissioning……...Unit: number (No.)

The rates tendered shall include for full compensation for the installation, testing and commissioning of the plant on Site including the provision of all labour, transport, materials and Temporary Works necessary to install the complete Works; on-site quality assurance and quality control, inspection, testing (including attendance at tests witnessed by the Engineer); the installation of all auxiliary items; necessary for the operation of the installation until taken over by the Client; the putting into service of the complete installation of the Plant; and any other work as specified.

The rate shall also include for submission of O&M Manuals, all commissioning testing and the provision of equipment therefore including all disruptions to installation caused by such testing. Payment will be made per unit. Payment will only be effected after full compliance of the items with this Section and associated documentation has been approved by the Engineer.

C3.3.2.5 ZUT 1008 VENTILATION FOR PLANT ROOMS

C3.3.2.5.1 ZUT 1008.1 SCOPE

ZUT 1008 specifies the standard requirements for ventilation equipment and installations in plant rooms.

The installation shall be as shown on any applicable drawings provided with the tender documents.

The scope of work for which the Contractor is responsible is specified elsewhere.

C3.3.2.5.2 ZUT 1008.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments.

b) ZUT 0001: General Mechanical Requirements.

c) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.5.3 ZUT 1008.3 GENERAL

As required in terms of the General Conditions, the Contractor shall:

- provide the details of all civil requirements to the Engineer for incorporation into the civil structure,
- measure on Site,
- ensure that the design can accommodate a civil tolerance of +/- 40 mm (unless a tighter tolerance is called for by the Contractor and agreed to by the Engineer).

C3.3.2.5.4 ZUT 1008.4 PERFORMANCE REQUIREMENTS

The completed installation shall provide the minimum air flow required for each room volume or shall provide for the maximum allowable temperature rise in each room; whichever is specified.

The maximum noise levels specified shall not be exceeded.

C3.3.2.5.5 ZUT 1008.5 OPERATION AND CONTROL

Unless specified otherwise, the fan(s) shall operate continuously.

A flow switch for each fan shall lead to an alarm being recorded if the flow fails.

Manual start and stop of each item of equipment shall be provided **but all protections shall be active during manual operation**.

C3.3.2.5.6 ZUT 1008.6 DESIGN AND CONSTRUCTION

C3.3.2.5.6.1 ZUT 1008.6.1 FLOW

Resistance to flow for all ductwork and associated equipment shall be calculated by the Contractor prior to equipment selection.

At least 250 Pa shall be allowed for resistance losses in filters unless the Contractor can confirm a lower figure.

Reasonable modification to ductwork during installation shall be provided for in the design, i.e. a suitable safety factor shall be incorporated in the design.

C3.3.2.5.6.2 ZUT 1008.6.2 FANS

Direct drive, axial flow fans shall incorporate manually adjustable pitch, cast aluminium, aerofoil section blades, clamped in split, metallic hubs. Fan casings shall cover the full length of the fan and motor assembly. Terminal boxes shall be mounted on the fan unit. Suspended fans shall be restrained to prevent excessive torsional and axial movement during start-up. Fan casings shall be of hot-dip galvanized steel unless otherwise specified. Axial flow fans installed in corrosive flows shall be either belt driven or shall have their motors protected by bifurcated airstreams.

Centrifugal fans shall be constructed of galvanized sheet steel with spun steel inlet cones and machined shafting supported on rolling bearings mounted in sealed bearing housings provided with grease nipples. Fans shall be mounted on steel channel base frames sized to accommodate the drive motors.

Fans and motors shall preferably have a nominal speed of 1 500 rpm or lower and motors shall have a nominal voltage of 400 Volts. Special consideration and acoustic treatment shall be provided for fans operating above 1 500 rpm.

Fans shall be dynamically balanced to ISO 1940, grade G6,3.

Fans shall be flexibly connected to ducting.

Fans shall be flexibly supported using spring or rubber-in-shear mountings having a minimum static deflection of 20 mm.

Belt drives shall be accurately aligned axially and angularly and shall be to the Engineer's approval.

Guarding shall totally enclose drives, shall be rigidly mounted off base plates and shall be to the Engineer's approval.

Pressure gauges shall be provided upstream and downstream of each fan. A differential pressure gauge or graduated manometer will be acceptable.

C3.3.2.5.6.3 ZUT 1008.6.3 DAMPERS

Dampers for the regulation of air flow shall be fabricated from the same material as the ductwork.

Adjustment, position indication and a locking arrangement shall be provided for each damper.

C3.3.2.5.6.4 ZUT 1008.6.4 DUCTING AND SHEET METALWORK

Ducting shall be manufactured in accordance with SANS 1238.

Unless otherwise specified, materials used in the fabrication of ventilation ductwork shall be of hot-dip galvanized, low carbon steel and sheet steel material thicknesses shall be in accordance with SANS 1238.

A flexible connection shall be provided on each side of each fan/attenuator assembly in order to isolate the ducting from the fan vibration and movement upon start-up. The connections shall be by means of coated fabric collars with sewn and cemented seams. Flexible collars shall have sufficient free movement to take up the deflection of the connected moving equipment. They shall not be used as a means of accommodating misalignment. When installed, collars shall not restrict the free area of the ducting.

Take off sockets shall be provided where grilles or louvres are mounted in distribution ducting. Sockets shall be long enough to ensure that no part of the grille or its associated control mechanism projects into the duct cross-section. Duct-mounted grilles shall be provided with opposed blade, volume control dampers or flap type volume controls with straightening blades.

Rectangular ducting shall be supported on trapeze type hangers constructed from hot-dip galvanized, low carbon steel angle with stainless steel hanger rods. Rod diameter shall be not less than 10 mm and support spacing shall be less than 2 000 mm.

Circular ducting shall be supported in hoops constructed from 40 mm X 5 mm hot-dip galvanized low carbon steel flat bar suspended from Ø 10 mm stainless steel rod at 3 000 mm maximum centres.

C3.3.2.5.6.5 ZUT 1008.6.5 FILTERS

Filter cells shall be mounted in proprietary frames and clip-fixed to achieve zero discernible by pass. Slide frame mounted filters shall have wing nut fixed airtight cover plates.

Filter banks shall have a differential manometer connected across them. Manometers shall be correctly set up and levelled and shall be provided with red gauge oil of the correct specific gravity.

The filter frame shall be fabricated from hot-dip galvanised steel (minimum thickness of 0,5 mm) unless otherwise specified.

Flow speed through the filter opening shall be not greater than 2 m/s.

C3.3.2.5.6.6 ZUT 1008.6.6 SCREENS

Inlets and discharges shall be effectively guarded with removable stainless steel wire screens of approximately 20 mm mesh and 1,6 mm minimum gauge.

C3.3.2.5.6.7 ZUT 1008.6.7 SOUND

C3.3.2.5.6.7.1 ZUT 1008.6.7.1 General

Sound pressure levels of a fan shall not exceed 80 dBA at 3 metres from the outer surface.

C3.3.2.5.6.7.2 ZUT 1008.6.7.2 Sound Attenuators

Attenuators shall be fabricated of the same material as the ductwork.

Circular attenuators shall be directly connected to axial flow fan flanges. Where diameters differ by more than 20 mm, hot-dip galvanized low carbon steel connecting cones shall be bolted between the fan and the attenuator to adapt the respective diameters. Attenuators containing an acoustic pod shall have leading and trailing fairings in moulded grp or spun hot-dip galvanized steel. Pods shall be securely and concentrically fitted in the casings to the Engineer's approval.

Splitter attenuators shall be fabricated with mating flanges.
Splitters shall comprise acoustic lining material mounted on galvanized sheet steel and shall be securely supported within the attenuator casing. Leading and trailing ends of splitters shall have fairings in moulded grp or hot-dip galvanized steel sheet.

Attenuators shall be constructed to achieve the acoustic performance specified. Acoustic infill material shall be "Eurolon" by Donkin or equivalent. Where air passageway velocities exceed 20 m/s, the infill material shall be supported by pre-galvanised perforated sheet steel having a thickness of at least 0,8 mm.

Where attenuators are to be used in grease or oil-laden atmospheres, a polyester membrane shall be interposed between the infill material and the perforated sheet.

Each attenuator shall not impose a resistance of more than 50 Pa at rated air-flow.

External surfaces of the attenuators shall be painted as for the general ductwork.

C3.3.2.5.6.7.3 ZUT 1008.6.7.3 Acoustic Louvres

Acoustic louvres shall be designed by a manufacturer which specialises in acoustic applications and who can provide attenuation graphs for the equipment.

C3.3.2.5.6.8 ZUT 1008.6.8 EQUIPMENT BASES IN ACOUSTICALLY SENSITIVE AREAS

Inertia bases shall be provided for centrifugal fans and motors where specified. The bases shall consist of reinforced concrete cast into sheet metal formers and shall be at least 150 mm deep. Bases shall be reinforced with Ø 13 mm reinforcing bars located at 150 mm centres each way.

The mass of bases shall be chosen to avoid operation at critical speeds and the mass ratio between bases and equipment shall be at least 1:1 for fans. Concrete bases for pump sets shall be large enough to accommodate the motors, driven equipment and any required supports and fittings. Equipment shall be bolted onto baseplates which are themselves bolted onto the concrete inertia bases.

Spring isolators shall be installed between concrete inertia bases and floor plinths. Either free standing stable spring units or caged spring units with snubbers may be used. Spring isolators shall be installed with levelling bolts and shall incorporate 6 mm thick ribbed neoprene acoustic pads bonded to the base. Spring diameters shall be large enough to prevent excessive rocking of equipment during start-up as well as normal operation.

Isolators shall be chosen to give a static deflection corresponding to a ratio of 3:1 of the lowest disturbing frequency to the natural frequency of the mounting.

Bases and spring isolators shall be arranged to give a clearance of approximately 25 mm between the underside of the bases and floor plinths.

Floor plinths shall be provided for all equipment bases. Plinths shall be large enough to accommodate the concrete inertia bases and the spring isolators.

C3.3.2.5.6.9 ZUT 1008.6.9 WEATHER LOUVRES

Weather louvres shall be of hot-dip galvanised steel and shall be of the storm resistant type.

C3.3.2.5.7 ZUT 1008.7 MOTOR/ELECTRICAL EQUIPMENT

Motors shall have a nominal rating of at least 10 % above the maximum power requirement of the fans as installed.

Motors which drive fans for wet well applications shall be of the bifurcated design; i.e. the motor shall be isolated from the air flow.

The motor shall comply with the requirements of the clause “Electric Motors” in ZUT 0001.

Motors shall have ingress protection to at least IP 55.

Motors shall be provided with a tropical rated corrosion protection system.
Motors shall comply with the requirements of the hazardous location zone for the area in which they are installed.

C3.3.2.5.8 ZUT 1008.8 INSTRUMENTATION

An hour meter which cannot be reset shall be provided for each fan motor.

Where specified, flow switches and pressure measurement shall be provided.

Instrumentation shall comply with the clause “Instrumentation” in ZUT 0001.

C3.3.2.5.9 ZUT 1008.9 FABRICATION

Fabrication shall comply with the clause “Fabrication of Steels” and welding shall comply with the clause “Welding” in ZUT 0001.

Fabrications will generally be inspected by the Engineer after fabrication is complete.

C3.3.2.5.10 ZUT 1008.10 FASTENERS

Fasteners shall comply with the clause “Fasteners” in ZUT 0001.

C3.3.2.5.11 ZUT 1008.11 SPARES

The spares which are to be provided are specified elsewhere.

C3.3.2.5.12 ZUT 1008.12 CORROSION PROTECTION

Corrosion Protection shall comply with ZUT 0003.

Corrosion protection of motors, gearboxes and bearing housings shall be the manufacturer’s standard for a tropical marine environment.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.

C3.3.2.5.13 ZUT 1008.13 INSTALLATION

Installation work shall comply with the clause “Installation” in ZUT 0001.

Equipment shall be mounted firm and level.

The installation shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level and plumb.

Apertures through structures for ductwork shall be neatly closed using an appropriate method. A neat hard wood frame is preferred but plaster shall be used if noise breakout is to be prevented.

Where ductwork penetrates brickwork, a wrot timber frame shall be built in to locate and mount the ductwork.
Where ductwork penetrates concrete slabs or walls, a flange shall be provided on one side to stabilize the duct and weak grout or fire stopping shall be applied to the spaces between the ducting and the structure to effectively seal the clearance.

Where ducting penetrates between areas having differing fire risk or mandatory fire separation, fire dampers to the latest amendment of SANS 193 shall be installed.

Drain points shall be provided in ductwork where condensed water could pool.

C3.3.2.5.14 ZUT 1008.14 SAFETY

The Contractor shall design and install all equipment installations in accordance with the requirements of SANS 10108.

Each motor driven device shall be provided with an emergency stop station in an appropriate position.

C3.3.2.5.15 ZUT 1008.15 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

C3.3.2.5.16 ZUT 1008.16 TESTING

The correct operation of the equipment and the achievement of the specified air flow and sound level shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.5.17 ZUT 1008.17 MEASUREMENT AND PAYMENT

The tendered rates or sums shall cover the cost of anything not specially mentioned, but which an experienced contractor can reasonably foresee as being required to enable the apparatus and Plant to be installed and/or function safely and correctly as specified. No claims whatsoever for extras will be allowed on the grounds that a necessary piece of Plant or part thereof is not specifically mentioned in the Bill of Quantities.

C3.3.2.5.17.1 ZUT 1008.17.1 Supply and Delivery…….Unit: number (No.)

The rates tendered shall include full compensation for the supply and delivery of plant to Site including supply of raw materials and bought-out items and associated operating Plant items; fabrication, manufacture and assembly; quality assurance and quality control; inspection and Factory Acceptance Testing (including attendance on inspections and tests witnessed by the Engineer); type and routine tests; application of finishes (painting and corrosion protection); trial erection and dismantling; preparation and packing for transport; transport from place of manufacture to the Site; insurance, harbour dues etc., during transport; loading and unloading; storage under appropriate conditions from date of delivery until commencement of erection; and any other work as specified. Payment will be made per unit. Payment will only be effected after full compliance of the items with this Section and associated documentation has been approved by the Engineer.

C3.3.2.5.17.2 ZUT 1008.17.2 Installation, Testing and Commissioning……..Unit: number (No.)

The rates tendered shall include for full compensation for the installation, testing and commissioning of the plant on Site including the provision of all labour, transport, materials and Temporary Works necessary to install the complete Works; on-site quality assurance and quality control, inspection, testing (including attendance at tests witnessed by the Engineer); the installation of all auxiliary

items; necessary for the operation of the installation until taken over by the Client; the putting into service of the complete installation of the Plant; and any other work as specified.

The rate shall also include for submission of O&M Manuals, all commissioning testing and the provision of equipment therefore including all disruptions to installation caused by such testing. Payment will be made per unit. Payment will only be effected after full compliance of the items with this Section and associated documentation has been approved by the Engineer.

C3.3.2.6 ZUT 4020 PIPE SCREEN

C3.3.2.6.1 ZUT 4020.1 INTRODUCTION

Zut 4020 specifies the requirements for flanged in-line pipe screens..

C3.3.2.6.2 ZUT 4020.2 SCOPE OF WORKS

See project specification.
The installation shall be configured as shown on applicable drawings.

C3.3.2.6.3 ZUT 4020.3 NORMATIVE REFERENCES

The following form part of the Contract Document:

- Amendments, Additions and Detailed Requirements (ZUT 4020).
- ZUT 0001: General Mechanical Requirements.
- ZUT 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.
- National Occupational Health and Safety Act and Regulations.
- SANS 12944-2: Paints and varnishes – Corrosion protection of steel structures by protective paint systems; Part 2: Classification of environments.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.6.4 ZUT 4020.4 CONFIGURATION

The screen shall be a double flanged unit which is installed in a pipeline.

C3.3.2.6.5 ZUT 4020.5 PERFORMANCE REQUIREMENTS

The screen shall remove all solids above a size as specified.

C3.3.2.6.6 ZUT 4020.6 DESIGN AND CONSTRUCTION

C3.3.2.6.6.1 ZUT 4020.6.1 REQUIREMENTS FOR ALL SCREENS

The screen shall consist of a flanged, pressurised, in-line body and an internal screen basket which is easily removable for cleaning.

The design shall minimise restriction to flow. The screen element shall have a total free area of not less than 2,5 times the cross-sectional area of the pipe.

The body shall be of double flanged configuration and shall have a pressure rating to match the pipework in which it is installed.

The installation shall be provided with an upstream and a downstream pressure gauge. The gauges shall match the expected design pressure range and shall comply with ZUT 0001.

All fasteners to be undone to clean the screen element shall be provide with nuts with ears to facilitate opening by hand.

C3.3.2.6.6.2 ZUT 4020.6.2 REQUIREMENTS FOR SMALLER SCREENS

The unit shall incorporate a bolted flange cover to provide access for cleaning the screen basket. This may be at the bottom of the body.

The flange cover shall incorporate a threaded plug which can be used to evacuate solids which

collect at the low point.

C3.3.2.6.6.3 ZUT 4020.6.3 REQUIREMENTS FOR LARGER SCREENS

Covers larger than 500 mm shall be on the top of the body and shall be provided with an arrangement to assist with safely lifting the cover during cleaning of the screen element.

A manually operated air release valve shall be provided in the cover. A manual drain valve shall be provided at the low point and shall provide easy discharge of heavy solids collected at this point. It shall be a stainless steel ball valve of DN 50 or larger.

C3.3.2.6.7 ZUT 4020.7 MATERIALS AND COATINGS

Equipment shall comply with the table below. Components not specified in the table shall be designed to the high corrosivity category (C4) of SANS 12944-2.

ITEMS	MATERIAL	COATING
Body and Cover	Cast iron or cast steel	Rilsan coating; or, Wet applied corrosion resistant coating of at least 500 microns. The system used shall be specifically suitable for pump internals such as asolids bearing vinyl ester acrylic copolymer such as Corrocoat Polyglass VEF or a ceramic coating
	Fabricated Stainless Steel	Pickle and passivate
Screen element	Stainless steel perforated plate	Pickle and passivate
	Stainless steel mesh	Pickle and passivate
Fasteners	EN Grade 1.4401	N/A
Flange fasteners for connection to pipework	As per pipework	As per pipework
Auxiliary metal components	EN Grade 1.4401 (316)	Pickle and passivate
Lifting arrangement for cover	Carbon steel	Hot dip galvanise
	Stainless steel	Pickle and passivate

Coatings shall be applied in accordance with the coating supplier's instructions but abrasive blasting of wetted surfaces to Sa 3 prior to coating application is a minimum requirement. Corrosion protection shall comply with Zut 0003.
Materials shall comply with Zut 0001.
Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning.
Metal plating of ferrous materials is not an acceptable corrosion protection system. Steel and cast iron items which have been hot dip galvanised but which are then welded, cut, ground, drilled or have the steel exposed by any other means shall be rejected.

C3.3.2.6.8 ZUT 4020.8 FABRICATIOON

Fabrication and welding shall comply with Zut 0001.

C3.3.2.6.9 ZUT 4020.9 FASTENERS

Fasteners shall comply with Zut 0001.

C3.3.2.6.10 ZUT 4020.10 INSTALLATION

Installation work shall comply with Zut 0001.

The Contractor shall ensure that the corrosion protection coatings are not damaged during transport and installation. Repair methods shall be approved by the Engineer prior to execution.

Small units shall be installed so that the screen element is removed downwards, and the plug is at the bottom. Large units shall be installed so that the cover is on top.

C3.3.2.6.11 ZUT 4020.11 SAFETY

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

The cover to be removed for cleaning of the screen element and the element itself shall be designed to facilitate safe removal by a person of normal strength.

The Contractor shall provide all safety signage required for the equipment installation.

C3.3.2.6.12 ZUT 4020.12 INSPECTIONS

C3.3.2.6.12.1 ZUT 4020.12.1 WORKSHOP/ FACTORY

The Contractor shall arrange for fabrications to be inspected by the Engineer for acceptance after fabrication is complete but prior to corrosion protection.

C3.3.2.6.12.2 ZUT 4020.12.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed, cleaned installation on Site for acceptance prior to commissioning. The Contractor shall remove all litter,

shall ensure floors are dry, that dust is not present, and that all pipework has been wiped clean before the Engineer's inspection.

C3.3.2.6.13 ZUT 4020.13 TESTING REQUIREMENTS

C3.3.2.6.13.1 ZUT 4020.13.1 FACTORY, ETC.

A body pressure test, with the cover bolted in position, shall be performed by the Contractor and the test results shall be submitted to the Engineer.

C3.3.2.6.13.2 ZUT 4020.13.2 SITE

The Contractor shall successfully demonstrate the following to the Engineer prior to the commissioning of the Works:
a) equipment operation.
b) compliance with the specification.

C3.3.2.6.14 ZUT 4020.14 DOCUMENTATION TO BE PROVIDED

The fabrication drawing shall be submitted to the Engineer for acceptance.

C3.3.2.7 ZUT 7001 DESIGN AND MANUFACTURE OF MEDIUM-PRESSURE STEEL SPECIALS

C3.3.2.7.1 ZUT 7001.1 SCOPE

This Specification covers the design, manufacture and delivery to site of electrically welded low carbon steel specials of outside diameter up to 2 280 mm, for transporting water and sewage at ambient temperatures and under working pressures of up to 2,5 MPa.

This Specification shall be read in conjunction with SANS 1200 L. Where conflict between this specification and SANS 1200 L occurs, the provisions of this specification shall apply.

Interpretations and variations of this specification are set out in the Amendments preceding this Specification.

C3.3.2.7.2 ZUT 7001.2 NORMATIVE REFERENCES

C3.3.2.7.2.1 ZUT 7001.2.1 SUPPORTING SPECIFICATIONS

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

a) Amendments;

b) SANS 1200 Series of Standardized Specifications;
   i) SANS 1200 L: Medium-pressure pipelines (see 1. above)

c) Specification ZUT 0003: Painting and corrosion protection for water and wastewater works

d) Specification ZUT 7003: Laying, jointing, and testing of medium-pressure steel pipes and specials

The latest issues of the specifications listed in Appendix A shall be deemed to apply to the design and manufacture of welded steel specials manufactured using approved welding techniques.

C3.3.2.7.3 ZUT 7001.3 DEFINITIONS AND ABBREVIATIONS

C3.3.2.7.3.1 ZUT 7001.3.1 DEFINITIONS

For the purposes of this Specification the definitions and abbreviations given in the applicable clauses of the specifications listed in 2.1 and the following definitions shall apply:

Cut-and-shut bend	:	A bend formed by cutting out one or more V-shaped sections equally disposed about a line at right angles to the axis of the pipe, preparing the cut-out edges for welding; bending the pipe to form the bend and welding the pipe shut along the prepared edges to complete the bend (see BS 2633, Fig 25)
Fitting	:	a) A special or valve. b) Any process of jointing (except welding) straight pipes to one another and to specials and valves.
Flexible pipe	:	A pipe of which the diameter is reduced by more than 1% under an external radial force before the appearance of cracks.
"H"	:	The cross-sectional shape of a weld at a skelp.
Manual shielded electric arc process welding	:	Electric arc welding done by hand using a filler electrode coated with a material that gasifies at the point of arc and excludes oxygen from the weld, thus improving the metallurgical quality of the completed weld.

Mitre welds	:	Welds which join two lengths of pipe at an angle point in such a manner that the axis of both lengths of pipe proceed in a straight line to the point of intersection.
Nominal diameter (size)	:	A numerical designation of diameter which is common to all components in the piping system other than components designated by OD or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.
Nominal pressure	:	A numerical designation which is a convenient round number for reference purposes. All equipment of the same DN designated by the same PN number shall have compatible mating dimensions.
Pinhole	:	A very small hole indicating a flaw in the weld.
Pipe end bevel	:	A bevel cut made on the end of a pipe to afford a groove between abutting joints in order to receive weld metal.
Pipework	:	Includes all pipes, joints, specials, fittings and valves.
Skelp	:	The jointing edges of steel coils used in the manufacture of spiral welded pipe.
Special	:	Any pipe other than a straight pipe. Note: Under this definition shall be included all sizes of specials of shapes such as bends, tees, crosses, angle branches, reducers, tapers and flexible couplings with or without centre registers.
Straight pipe	:	A straight pipe of uniform bore and of standard or non-standard length.
Welding icicles	:	Congested droplets of metal which extend through the weld to the interior of the pipe, caused by excessive heat or improper welding technique.

C3.3.2.7.3.2 ZUT 7001.3.2 ABBREVIATIONS

The following abbreviations (additional to those referred to in 3.1) shall have the meanings given:

AISI	:	American Iron and Steel Institute
DN	:	Nominal diameter (e.g. DN 200 = 200 mm nominal diameter)
DS-AW	:	Double submerged-arc welded
FBE	:	Flanged both ends
FOE	:	Flanged one end
ID	:	Internal diameter
MS	:	Mild Steel
OD	:	Outside diameter, which shall mean the internal diameter + 2x (lining thickness + pipe wall thickness)
p.e.	:	Plain ended
PN	:	Nominal working pressure (e.g. PN 10 = 1 000 kPa)

Scab : Unbonded piece of plate in tight contact with the plate
SS : Stainless Steel

t : Wall thickness of pipes

TP : Test pressure

WP : Weld preparation

C3.3.2.7.4 ZUT 7001.4 REQUIREMENTS

C3.3.2.7.4.1 ZUT 7001.4.1 MATERIALS

C3.3.2.7.4.1.1 ZUT 7001.4.1.1 General

Specials and fittings shall be of the types shown on drawings or billed and, unless otherwise required in terms of the Amendments, they and their couplings shall be capable of withstanding the applicable test pressure. All specials and fittings shall be supplied complete with couplings and jointing material.

C3.3.2.7.4.1.2 ZUT 7001.4.1.2 Types of steel

Unless otherwise billed or shown on drawings, specials and fittings shall be manufactured from the following materials:

C3.3.2.7.4.1.2.1 ZUT 7001.4.1.2.1 Nominal diameter equal to or less than 150 mm

Medium or heavy class steel, complying with the applicable requirements of SANS 62.

C3.3.2.7.4.1.2.2 ZUT 7001.4.1.2.2 Mild steel

Steel grade	Minimum Yield Stress (MPa)	Chemical Composition and Physical Properties
B	241	SANS 719, Table 1
300WA	300	SANS 1431
X42	289	API 5L Table 3.1 & 4.1
X46	317	API 5L Table 3.1 & 4.1
X52	358	API 5L Table 3.1 & 4.1
X56	386	API 5L Table 3.1 & 4.1
X60	413	API 5L Table 3.1 & 4.1
X65	450	API 5L Table 3.1 & 4.1

C3.3.2.7.4.1.2.3 ZUT 7001.4.1.2.3 3CR12 Corrosion resistant steel

3CR12 corrosion resistant steel plate shall have a No.1 finish and shall be supplied ex-factory ready pickled and passivated.

C3.3.2.7.4.1.2.4 ZUT 7001.4.1.2.4 Stainless steel

Stainless steel shall be either EN Grade 1.4301 (304L stainless steel) or EN Grade 1.4401 (316L stainless steel).

C3.3.2.7.4.1.2.5 ZUT 7001.4.1.2.5 Super duplex stainless steel

Duplex stainless steel shall be either EN Grade 1.4162 (2101) or EN Grade 1.4462 (2205). Super Duplex stainless steel shall be EN Grade 1.4410 (2507).

C3.3.2.7.4.1.3 ZUT 7001.4.1.3 Flanges

Flanges on pipe ends, where applicable, shall be manufactured from the same material as the pipe, unless otherwise specified in the Amendments.

Where mild steel flanges are specified, flanges shall be manufactured from steel plate conforming to BS 4360 or SANS 1431 Grade 300W for working pressures up to PN 25. Flanges rated more than PN 25 and up to PN 60 shall be made from steel manufactured in accordance with BS EN 10222 Grade 460 or as approved. Flanges for pressures exceeding PN 60 and up to PN 250 shall be special flanges and gaskets manufactured by Hydro Power Engineering or equal approved.

C3.3.2.7.4.1.4 ZUT 7001.4.1.4 Certification

The Contractor shall submit to the Engineer the steel maker's certificates covering all steel used in the manufacture of the specials as required in Clause 4.4 of SANS 719. In addition, all information relevant to pipework fabrication shall be made available to the Engineer during the course of the manufacturing process.

C3.3.2.7.4.2 ZUT 7001.4.2 DESIGN

C3.3.2.7.4.2.1 ZUT 7001.4.2.1 General

The Contractor shall be responsible for the design of all specials in accordance with the general arrangement shown on the drawings and/or described in the Bill of Quantities and in conformity to BS 534. He shall submit his design calculations and shop drawings to the Engineer for approval before manufacturing commences. The design of saddle type reinforcement shall be in accordance with AWWA M11.

Specials shall be fabricated by welding from pipes which have been tested to SANS 719 and that conform to the requirements applicable to the Manufacture of medium-pressure steel pipes.

Lifting eyes (lugs) shall be welded to all unwieldy specials and to all specials of DN 600 and larger to facilitate handling and minimise damage to the protective coating.

C3.3.2.7.4.2.2 ZUT 7001.4.2.2 Wall thickness

Specials shall be designed so that 50% of the minimum yield stress of the steel is not exceeded under maximum working pressure and so that 75% of the minimum yield stress of the steel is not exceeded under maximum surge pressure.

An OD/t ratio of more than 100 will not be permitted unless specifically indicated otherwise on the drawings or in the Bill of Quantities.

For all branch connections (tees) the plate thickness of the barrel and branch shall be such that the maximum stress shall not be greater than that for an uncut pipe of the theoretical required minimum thickness. Where it is more economical to provide external reinforcement in the form of collar type rings or crotch plates, as shown on the drawings, these forms of reinforcement shall be used to achieve the same results

C3.3.2.7.4.2.3 ZUT 7001.4.2.3 Bends

Unless otherwise indicated on the drawings or scheduled in the Bill of Quantities, the dimensions for bends shall be determined in accordance with AWWA C208.
Bends shall either be smooth formed (hot bent) or segmented. The maximum angle between oblique butt- ends of segments for mitred bends shall not exceed 22.5º. Cut-and-shut bends are not permitted. Segmented bends shall be classified as short, medium and long with radii equal to one, two or three diameters respectively. All bends shall be of the long radii type, unless otherwise shown on the drawings or specified in the Amendments or Bill of Quantities.

Mitres for bends (kinks) of 10 degrees and less shall be made in the field as part of the pipe laying operation for buried pipelines.

C3.3.2.7.4.2.4 ZUT 7001.4.2.4 Branches and nozzles

The attachment of reinforcement to the pipe branches shall be by full penetration welding. The extent and positioning of external reinforcement is to be determined in accordance with AWWA M11.

Branch connections shall be as remote as possible from the seam weld on the barrel and shall generally be placed as follows, except where specifically indicated to the contrary on the drawings:

a) For air valve tees the centre lines of the air valve branch and the barrel shall intersect at right angles or vertically, as shown on the drawings, depending on the type of tee specified. The branch shall be flanged and have a nominal diameter greater than 50% of the main pipe diameter.

b) For scour valve tees the branch, consisting of a 90-degree bend, shall be located centrally on the pipe invert and point vertically downwards with the horizontal section at right angles to the barrel of the pipeline. The branch flange shall be set so that the scour valve spindle points vertically upwards, as shown on the drawings.

Nozzles shall be “stub in” in accordance with ANSI B31.3 and of minimum size DN25. Such nozzles shall be threaded to BSPT and provided with appropriate reinforcement. The Contractor shall ensure that the design will withstand the test pressure of the system.

C3.3.2.7.4.2.5 ZUT 7001.4.2.5 Reducer pieces

Taper pieces shall not have more than two longitudinal weld seams and shall have a maximum angle of divergence of 10 degrees, as shown on the drawings.

C3.3.2.7.4.2.6 ZUT 7001.4.2.6 Pipe supports

Supports for pipework, valves and specials inside chambers and pump stations shall be designed by the Contractor to adequately secure the pipework to the walls and floors. Details and locations of the supports shall be submitted for approval by the Engineer.

C3.3.2.7.4.2.7 ZUT 7001.4.2.7 Dimensions

The dimensions of the pipe specials and fittings are shown on the drawings.

C3.3.2.7.4.2.8 ZUT 7001.4.2.8 Provision of cadwelding pads

Where specials are to be jointed by means of flexible couplings the manufacturer shall weld steel plates not less than 50 x 75 x 6 mm thick, 250 mm from each end of all pipes, during the pipe manufacturing process (i.e. before lining and coating) to provide adequate area for cadwelding bonding cables to the piping to make it electrically continuous and enable a cathodic protection system to be applied without damage to the coating.

C3.3.2.7.4.2.9 ZUT 7001.4.2.9 Shop drawings

The Contractor shall, before issuing of shop drawings for manufacture, provide detailed pipework layout drawings for approval in principle by the Engineer. Such drawings shall contain general arrangements and assemblies for the pipes, pipe auxiliaries, pipe specials and valves and include materials schedules, standard parts, etc. Drawings shall provide all the information necessary to demonstrate full compliance with the drawings and specifications and to facilitate subsequent submission of shop drawings free of fit-up error. The Contractor shall be fully responsible for determining the actual dimensions of the specials.

Pipe layout drawings shall incorporate all relevant prime and subsidiary dimensions (primarily, but not necessarily limited to, face-to-face dimensions).

Drawings shall be prepared to acceptable industry standards, an example of which shall be submitted for approval before draughting commences. Due account is to be taken in preparing drawings of the necessity, inter alia, to facilitate straight-forward subsequent fit-up on site, without undue site trimming and site preparation for butt welding, so minimizing also the necessity for extensive site repairs to, or extensions of, internal and external corrosion protection.

Only after approval of final pipework layout drawings by the Engineer shall shop drawings for manufacture of pipes and specials commence. For subsequent approval by the Engineer these shall be in such detail as is appropriate for manufacture. No manufacturing of pipework shall be permitted without approval of the shop drawings by the Engineer.

Approval by the Engineer of any drawing shall not relieve the Contractor of responsibility for correct manufacture and subsequent fit-up on site.

C3.3.2.7.4.3 ZUT 7001.4.3 JOINTING

C3.3.2.7.4.3.1 ZUT 7001.4.3.1 Flexible couplings

Flexible couplings for plain-ended steel pipe and adaptor couplings shall be either of the slip-on type complying with Clause 15 of BS 534 or of the slip-on type without centre register conforming to the drawings, as scheduled. Slip-on flange adaptors for steel pipes shall conform to the relevant drawings.

A coupling shall be able to withstand without failure a hydrostatic test pressure of twice the working pressure specified for the pipe for which the coupling is required, and coupling flanges shall be capable of withstanding without damage all stresses caused by proper tightening of the bolts. Rubber rings shall comply with the relevant requirements of SANS 974: Part I and shall have a hardness of 66 to 75 IRHD.

All grinding off of welds shall conform accurately with the profile of the rolled section and so that no flats occur on surfaces that are supposed to be curved. The centre register (where present) shall be ground off on either side of the weld in such a manner that all sharp edges which would result in weakening of the protective coating are removed. Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

C3.3.2.7.4.3.2 ZUT 7001.4.3.2 Flanges

Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the Drawings. Flanges not covered by BS EN 1092

shall be manufactured according to the detailed dimensions and requirements shown on the Drawings.

All flanges shall be suitable for Site welding (SW) to pipes and specials and shall conform to BS 2633, Section 7 with preparation of plate flanges as shown in Fig 41 ("slip-on") for pipes and specials up to DN 100 and Fig 39 or 40 ("bore and fillet") for pipes and specials DN 125 and larger.
The drilling of steel and cast iron flanges shall be off-centre and shall conform to the requirements of SANS 1123, BS EN 1092: Section 3.1, or ISO 7005: Part 1 as applicable, appropriate to the class of pipe specified, except that in the case of flanges, where M27 and M33 bolts are specified in BS EN 1092: Section 3.1, M24 and M30 bolts respectively shall be used as specified in SANS 1123.

Any pipe that has flanges which are incorrectly drilled will be rejected. Reaming of bolt holes to oversize dimension in order to make a particular piece fit will not be permitted.
All flanges shall be machined overall with gramophone finish in accordance with SANS 1123, or as specified below:

a) Flange sizes up to and including DN 400 with a pressure rating up to and including 1600 kPa shall have flat joint faces, and where the pressure rating exceeds 1600 kPa, shall have a raised face sealing arrangement;

b) Flange sizes exceeding DN 400 up to and including DN 1000 shall have a raised face sealing arrangement for all pressure ratings up to and including 2500 kPa.

For flanges not covered by BS EN 1092, and for domes and conical ends, thicknesses shall be calculated and where applicable the flanges manufactured in accordance with Section 3 of BS 5500.

C3.3.2.7.4.3.3 ZUT 7001.4.3.3 Insulated flanges

Where called for, insulating flanges and materials shall be arranged as set out in Code of Practice No. SAECC/1 or SANS 15589-1.

The design, manufacturing, supplying, installation and testing of the insulating flanges complete with spark gap arrestors shall be in accordance with drawing no. 1A-C6-066 and to the approval of the Engineer. Insulating flanges shall be provided at locations as indicated on the Drawings.

All insulating gaskets, irrespective of pressure rating, shall be full-face gaskets to prevent foreign material from collecting and creating a bridge, thus shorting out the isolation.

C3.3.2.7.4.3.4 ZUT 7001.4.3.4 Loose flanges

Loose flanges for welding onto steel pipes on Site shall be manufactured from at least the same steel as specified for the pipes and shall be in accordance with SANS 1123 where applicable (see also 4.3.2), or alternatively in accordance with BS EN 1092.

Loose flanges shall be suitable for field welding to pipes and specials and shall conform to 4.3.2 in respect of attachment.

C3.3.2.7.4.3.5 ZUT 7001.4.3.5 Gasketing

Each flanged pipe and fitting of less than DN 400 and rated for PN 16 or less shall be supplied complete with one insertion piece (gasket) of the appropriate diameter and made of a material that is suitable for the maximum test pressure, and one set of bolts, nuts and washers.

Unless otherwise specified in the Amendments, asbestos gaskets in accordance with BS 1832 Grade B, and having a minimum thickness of 1,5 mm, shall be supplied for working pressures not exceeding PN 16.

Where working pressures exceed PN 16, and for DN 400 and over, rubber "O" rings dimensioned in accordance with BS EN 1092 Section 3.1, Fig. 4 for Types G and H flanges, shall be supplied to suit appropriately machined flanges.

Where flanges have not been machined in accordance with the above, spiral wound gaskets, style CG to BS 3381 shall be used. The external ring shall be made of carbon steel and electro plated. The metal windings shall consist of Grade 316 L stainless steel with asbestos filler.
Where flanges with flat faces as specified in 4.3.2, paragraph 1, are jointed, the gaskets shall be of the type manufactured by HPE and as specified below:

The gasket shall consist of a seal ring made from ultra-high molecular weight polyethylene (UHMWPE) (section 10 mm x 5 mm minimum) which fits snugly inside a 3 mm thick x 30 mm wide (minimum) flat steel outer ring. The reuse of UHMWPE seal rings is inadmissible.

The outer ring shall consist either of:

a) A mild steel ring, hot-dip galvanized in accordance with SANS 121 to a minimum mean coating thickness of 65 µm. The finish shall be of even thickness to ensure that the ring bears evenly throughout between the two flanges.

   Or

b) A 3CR12 steel ring where specified in the Amendments.

C3.3.2.7.4.3.6 ZUT 7001.4.3.6 Bolts, nuts, and washers

Bolts and nuts shall comply with the relevant requirements of SANS 1700 or, where high strength friction grip bolts are specified in the Amendments or considered necessary by the Contractor, the bolts shall comply with the requirements of BS 3139, and their use and design shall be as specified in BS 3294: Part 1 and BS 4604.

Locking devices for nuts shall be provided wherever there is a possibility of the nuts becoming loose during service. Bolts shall be of sufficient length for at least two screw-threads to protrude from the nut when assemblies are fully tightened. Two washers complying with SANS 1700 shall be supplied with each bolt.

All bolts, nuts and washers shall be of a material with equal or better corrosion properties than the pipe materials being joined. All anchor bolts and nuts shall be Grade 316 stainless steel or as approved.

C3.3.2.7.4.3.7 ZUT 7001.4.3.7 Screwed joints

The threads for screwed joints shall comply with the relevant requirements of SANS 1109. Male ends shall have taper threads and female ends shall have parallel threads.

C3.3.2.7.4.3.8 ZUT 7001.4.3.8 Plain ended specials

Each plain ended or spigot ended special, as shown on the drawings, shall be supplied with one sleeve coupling (or such other type of coupling as is shown on the drawings) to suit the particular pipe with which the special mates. The coupling shall fit the larger end of the barrel in the case of a reducer.

C3.3.2.7.4.4 ZUT 7001.4.4 PLANT

All specials and fittings shall be manufactured in an approved works which has the necessary tools, plant and equipment to manufacture pipework consistently in accordance with the specifications.

Manufacturing at only one works will be permitted. No site fabrication of specials, other than kinks of 10 degrees or less on buried pipelines, will be permitted.

C3.3.2.7.4.5 ZUT 7001.4.5 FABRICATION

C3.3.2.7.4.5.1 ZUT 7001.4.5.1 Qualified welders

Only qualified welders, certified as having passed the qualification tests as specified in Clauses 6.1 to 6.7 inclusive of API Standard 1104 or alternatively, SANS 10044: Part IV, shall be used to do all welding required. Copies of the certificates shall be made available to the Engineer.

C3.3.2.7.4.5.2 ZUT 7001.4.5.2 Welding

Welding and inspection of welds shall be in accordance with Clauses 7 to 11.4 inclusive of API Standard 1104 or alternatively, SANS 10044: Part III. Where radiographic inspection is specified in the Amendments, the procedure followed shall be in accordance with Clause 11.1 of API Standard 1104. Only qualified radiographers as specified in API Standard 1104 shall be employed to do the radiography.

All butt welds and branch fillet welds on specials shall where practicable have an internal weld. The weld bead of this internal weld shall not protrude above the prolongation of the original inside surface of the special by more than 1 mm.

Internal reinforcement in the form of backing rings at weld seams shall not be permitted.

C3.3.2.7.4.5.3 ZUT 7001.4.5.3 Preparation of special ends for:

C3.3.2.7.4.5.3.1 ZUT 7001.4.5.3.1 Mechanical couplings

Ends for use with mechanical couplings shall be square cut or bevelled plain ends, cut square to the pipe axis, with all edge burrs, weld splatter and scratches removed. The outside of the pipe shall be free of indentations, projections or roll marks for a distance of 250 mm from each end to permit proper make-up of the coupling. Longitudinal or spiral welds on the outside of the plain end shall be ground to plate or sheet surface for a minimum distance of 250 mm.

C3.3.2.7.4.5.3.2 ZUT 7001.4.5.3.2 Fillet welds

Ends for use with fillet welded sleeve joints shall be prepared as specified in 4.5.3.1.

C3.3.2.7.4.5.3.3 ZUT 7001.4.5.3.3 Butt welds

Specials which require joints to be butt welded on site shall be supplied with ends bevelled in accordance with the requirements of SANS 719, Clause 5.1.5. Square cut ends will require approval.
For specials to be jointed by butt welding, the internal weld bead shall be ground flush with the internal surface of the pipe or special for a length of 200 mm from the ends to be jointed.

C3.3.2.7.4.5.3.4 ZUT 7001.4.5.3.4 Bevelling

All bevelling, where required, shall be delayed until after all non-destructive testing has been completed.

C3.3.2.7.4.5.3.5 ZUT 7001.4.5.3.5 Flanges

Ends to be fitted with flanges shall have the longitudinal or spiral welds ground to plate or sheet surface for a distance from the ends sufficient to accommodate the flange.

C3.3.2.7.4.5.4 ZUT 7001.4.5.4 Rectification of defects

If a special fails to pass any of the tests specified, it will be rejected but the Engineer may permit repairs or alterations to be made to enable the special to pass the test.
Repairs of welded joints will be permitted during the process of manufacture. Where repairs are required the defective weld metal shall be cut out, and the parent metal prepared by grinding, and re-welded, to the satisfaction of the Engineer.
The repair procedure and performance on repairs shall be in accordance with Section 10 of API Specification 5L where not in conflict with SANS 719. Only qualified welders shall be employed. Each repair weld shall be marked with the welder's identifying stamp.

When the repair has been made, it shall be radiographically tested (X-rayed) over the full length of the repair.

On discovery of defective welds the Engineer may, at his discretion, call for additional radiographic examination until it is shown that the necessary standard is being maintained.

Should a weld repair be required on a special subsequent to hydraulic testing, the repaired special shall be retested in accordance with Clause 5.3.2 Hydraulic testing of this specification.

C3.3.2.7.4.6 ZUT 7001.4.6 COATINGS AND LININGS

Coatings and linings of specials shall be undertaken in accordance with the requirements of Specification ZUT 0003.

C3.3.2.7.4.7 ZUT 7001.4.7 MARKING

Upon fabrication, each special shall be hard stamped with a unique reference number to ensure traceability. The stamp is to be 100mm from the pipe end and next to a weld. On completion of the contract or at reasonable intervals during the contract, the following pipe information shall be supplied to the Engineer in Microsoft Excel ® format:

a) Pipe reference number

b) Contract number

c) Date of manufacture

d) Outside diameter

e) Wall thickness/pressure rating

f) Grade of steel

g) Coating type and nominal thickness

h) Lining type and nominal thickness

i) Mass of uncoated and unlined special in kg/m

j) Applicable drilling tables stamped on the periphery of all flanges

k) Bends shall have their "centre plane" marked with two small punch marks close to both ends of the bends to facilitate correct positioning of the bends during laying.

C3.3.2.7.4.8 ZUT 7001.4.8 STORAGE, HANDLING AND TRANSPORT

C3.3.2.7.4.8.1 ZUT 7001.4.8.1 Handling and rigging

Specials shall be protected against damage at all stages from manufacture to delivery. Particular care shall be taken to protect the ends of all specials against denting.

In the transportation, loading and unloading of specials, an adequate fleet of vehicles shall be operated and maintained at all times to ensure that specials and their protective linings and coatings are not damaged.

Specials shall be so transported, stored and handled that they are not overstressed at any time and fittings are not damaged in any way. All thin-walled and soft-coated specials shall be handled with particular care and shall be so stored that they are not subjected to concentrated pressure from stones or other objects. Specials damaged or cracked in any way shall be removed from the Site at no cost to the Employer.

If cradles are used to transport the specials they must be rubber lined to avoid damage to the coating. During transportation specials shall be safely secured.
The Contractor shall be responsible for dispatching and transporting of the pipes to site and off-loading.

C3.3.2.7.4.8.2 ZUT 7001.4.8.2 Protection of pipe ends

Satisfactory temporary end covers shall be provided for the protection of flanges, prepared ends of plain- ended fittings, and threads, and to prevent damage to the internal lining during transportation and during handling on Site.

C3.3.2.7.4.8.3 ZUT 7001.4.8.3 Material that deteriorate under the action of sunlight

All rubber rings or other materials which will deteriorate under the action of sunlight, ozone or inclement weather, shall be stored in permanent shade in lockable weather-proof sheds. Welding and the running of welding machines and electric machinery shall not be permitted in or near places where rubber or plastic products are stored and care shall be taken at all times to prevent contamination of these products by oil or other petroleum derived products.

C3.3.2.7.5 ZUT 7001.5 COMPLIANCE WITH REQUIREMENTS

C3.3.2.7.5.1 ZUT 7001.5.1 FACILITIES FOR TESTING

The Contractor shall provide at his own cost, all facilities and equipment required for testing and shall carry out all tests at his own expense. Complete records of test results shall be kept.

The testing machines shall be of a design which will allow a steady application of the test pressure and shall be equipped with an accurate pressure gauge. Provision shall be made for expelling all air from any special under test during filling and before application of the pressure.

Test calibration certificates from an independent laboratory, verifying the accuracy of all measuring and testing instruments requiring calibration, shall be provided by the Contractor. Recalibration shall be carried out as necessitated by circumstances but at intervals not exceeding 3 months.

C3.3.2.7.5.2 ZUT 7001.5.2 QUALITY ASSURANCE

All steel specials shall be fabricated and tested in accordance with an approved quality control plan and procedure. The quality assurance of all specials rated over PN 16 shall be in accordance with ISO 9002 and the manufacturer shall be in possession of a current ISO 9002 certificate.

Manufacture shall not commence until such time as the quality control plan and procedure has been approved by the Engineer.

The quality control plan and procedure shall address, as a minimum, the following tests/inspections:

a) Material certification

b) Non-Destructive Evaluation (NDE) testing
c) Verification of tolerances

d) Workmanship

e) Surface preparation (e.g. cleanliness and blast profile for coatings and linings)

f) Material identification

g) Personnel certification (including welders and NDE)

h) Welding procedures and certification

i) Weld preparation

j) Compliance with drawings

k) Hydrostatic testing

C3.3.2.7.5.3 ZUT 7001.5.3 INSPECTIONS

C3.3.2.7.5.3.1 ZUT 7001.5.3.1 Visual inspections

All finished pipework shall be visually inspected and shall be free of injurious defects as defined in API 5L Section 10.7.

C3.3.2.7.5.3.2 ZUT 7001.5.3.2 Hydraulic testing

When all aspects of fabrication have been completed, but before being cleaned, lined or coated, each and every special is to be tested to a hydrostatic pressure test of P,

Where P = the lesser of: $2 \times 0.85 \times Y \times t/D$ or 7 MPa
Y = Minimum Specified Yield Stress (MPa)
t = Nominal Wall Thickness of pipe (mm)
D = Nominal Diameter of Pipe (mm)

Pipe end plugs shall be restrained during the test to ensure that no longitudinal stresses are induced in the pipe wall. Upon completion of the hydraulic test, the ends of the pipe specials shall be tested by means of Go, No-go gauges to check whether flaring or cupping has occurred. If necessary the ends shall be expanded or ground until they comply with the specification.

The test pressure in the pipe special shall be maintained for at least 10 seconds and thereafter shall be inspected for weeps, leaks or deformation. The special will be deemed defective and may be rejected if any leaks, weeps or deformation are evident. Where defects are repaired, the special shall be re-tested. Should the special, after repair, fail to pass the second hydraulic test the Engineer may order its rejection.

C3.3.2.7.5.3.3 ZUT 7001.5.3.3 Non-destructive testing

Non-destructive testing shall be in accordance with Section 9 of API Specification 5L.

On completion of the hydrostatic testing (see 5.3.2) and before the ends of the specials are bevelled, non-destructive tests shall be carried out on all manual or semi-automatic welds, as follows:

a) All welds shall initially be radiographically tested (X-rayed) over 100% of the weld length. When consistently acceptable results are obtained, the number of welds to be so tested may be reduced on a sound statistically controlled basis by mutual agreement between the Engineer, Inspectorate and Contractor. At least 10% of all welds shall be radiographically tested.

b) Repairs to welds (see 4.5.4), shall be radiographically tested (X-rayed) over the full length of the repair.

Each radiograph, the test-pieces and results and interpretations of examinations and tests shall be submitted to the Engineer within 24 hours of the particular examination or test.

C3.3.2.7.5.3.4 ZUT 7001.5.3.4 Testing of specials

Where hydrostatic testing of specials is not practicable, the welds shall be subjected to 100% dye penetrant tests to determine surface cracks, and/or where ordered by the Engineer, to one of the tests specified in 5.3.3 to determine internal defects. Dye penetrant testing shall be done as specified in Subclause 7.2.1 of SANS 1200 L.

C3.3.2.7.5.3.5 ZUT 7001.5.3.5 Magnetic particle testing

Where requested by the Inspectorate, magnetic particle testing shall be done in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

C3.3.2.7.5.4 ZUT 7001.5.4 INSPECTORATE

The Engineer may at his sole discretion appoint an independent inspection authority to carry out additional Quality Surveillance at the premises of the manufacturer. The manufacturer shall provide all facilities and shall facilitate access to their premises at reasonable times as may be necessary for the independent inspectorate to perform its function.

The manufacturer's quality control records shall be available for inspection by the independent inspectorate at all reasonable times, and copies of such records shall be made available on request.

Notwithstanding any surveillance carried out by, or on behalf of the Engineer, the Contractor shall retain full responsibility for the quality of specials supplied.

C3.3.2.7.5.5 ZUT 7001.5.5 MARKING PROCEDURE

All weld lengths to be radiographed shall be clearly marked by the Inspector using his identification symbol. This symbol shall appear on the respective radiograph. The radiographed weld and symbol shall not be obliterated by finishing processes until the respective weld has been accepted by the Inspector.

C3.3.2.7.5.6 ZUT 7001.5.6 COATINGS AND LININGS

The testing of the coatings and linings of specials shall be undertaken in accordance with the requirements of Specification ZUT 0003.

C3.3.2.7.6 ZUT 7001.6 TOLERANCES

Refer to Clauses 4 and 5 above.

C3.3.2.7.7 ZUT 7001.7 TESTING

Refer to Clause 5 above.

C3.3.2.7.8 ZUT 7001.8 MEASUREMENT AND PAYMENT

C3.3.2.7.8.1 ZUT 7001.8.1 BASIC PRINCIPLES

C3.3.2.7.8.1.1 ZUT 7001.8.1.1 Corrosion protection

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for corrosion protection. The rates tendered for item 8.2.1 will be held to cover the cost of any protection system specified.

C3.3.2.7.8.2 ZUT 7001.8.2 BILLED ITEMS

C3.3.2.7.8.2.1 ZUT 7001.8.2.1 Supply of specials

Unit: ……number (No)

Specials will be measured by the number of each type, class, and size.

The unit rates shall cover the cost of the provision of each special, complete with couplings and/or other jointing materials as appropriate, and for the design of all specials including all drawings and shop drawings.

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for the supply and delivery to Site of any additional couplings and jointing materials which may be required for the connection of the specials.

Annexures

APPENDIX A. APPLICABLE STANDARDS

Reference is made to the latest issues of the following standards:

API Specification 5L	American Iron and Steel Institute - Specification for LINEPIPE
API Standard 1104	American Iron and Steel Institute - Standard for welding pipelines and related facilities
ASME	Boiler and Pressure vessels Code, Section V, Article 7
AWWA M 11	Steel pipe - A guide for design and installation (3rd edition)
BS 534	Steel pipes and specials for water and sewage
BS 639	Covered electrodes for the manual metal-arc welding of carbon and carbon-manganese steels
BS 1387	Steel tubes and tubulars suitable for screwing to BS 21 pipe threads
BS 1640	Steel butt-welding pipe fittings for the petroleum industry: Part 1 : Wrought carbon and ferritic alloy steel fittings
BS 1832	Compressed asbestos fibre jointing
BS 2633	Class 1 arc welding of ferritic steel pipe work for carrying fluids
BS 3139	High strength friction grip bolts for structural engineering
BS 3294	The use of high strength friction grip bolts in structural steelwork : Part 1 : General grade bolts
BS 3381	Metallic spiral wound gaskets for use with flanges to BS 1560 : Part 1 and 2
BS 4360	Weldable structural steels
BS 4604	The use of high strength friction grip bolts in structural steelwork (metric series)
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories. Steel flanges
BS EN 10222	Steel forgings for pressure purposes
PD 5500	Unfired fusion welded pressure vessels
ISO 7005	Metallic Flanges: Part 1 : Steel flanges
ISO 9000	Quality management
ISO 9002	Quality systems. Model for quality assurance in production, installation and servicing
SANS 62	Steel pipes Part 1 Pipes suitable for threading and of nominal size not exceeding 150 mm Part 2 Screwed pieces and pipe fittings of nominal size not exceeding 150 mm.
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specification and test methods
SANS 719	Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)
SANS 974	Rubber joint rings (non-cellular) Part I : Joint rings for use in gas, water, sewer, and drainage systems
SANS 1109	Pipe threads where pressure-tight joints are made on the threads Part 1 Dimensions, tolerances and designation Part 2 Verification by means of limit gauges
SANS 1123	Pipe flanges
SANS 1431	Weldable structural steels
SANS 1476	Fabricated flanged steel pipework
SANS 1700	Fasteners
SANS 10044	Welding
SANS 10121	Cathodic protection of buried and submersed structures
SANS 1200 L	Medium-pressure steel pipelines
SAECC/1	Code of Practice

C3.3.2.8 ZUT 7002 MANUFACTURE OF MEDIUM-PRESSURE STEEL PIPELINES

C3.3.2.8.1 ZUT 7002.1 SCOPE

This Specification covers the design, manufacture and delivery to site of electrically welded low carbon steel pipes of outside diameter up to 2 280 mm, for transporting water and sewage at ambient temperatures and under working pressures of up to 2,5 MPa.

This Specification shall be read in conjunction with SANS 1200 L. Where conflict between this specification and SANS 1200 L occurs, the provisions of this specification shall apply.

Interpretations and variations of this specification are set out in the Amendments preceding this Specification.

C3.3.2.8.2 ZUT 7002.2 NORMATIVE REFERENCES

C3.3.2.8.2.1 ZUT 7002.2.1 Supporting specifications

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

a) Amendments;

b) SANS 1200 Series of Standardized Specifications;

c) SANS 1200 L: Medium-pressure pipelines (see 1. above)

d) Specification ZUT 7001: Design and manufacture of medium-pressure steel fittings and specials

e) Specification ZUT 0003: Painting and corrosion protection for water and wastewater works

f) Specification ZUT 7003: Laying, jointing, and testing of medium-pressure steel pipes and specials

The latest issues of the specifications listed in Appendix A shall be deemed to apply to the manufacture of pipes using either submerged arc spiral welding or longitudinal welded “cans” rolled from low carbon or steel plate and joined by submerged arc circumferential welding to form suitable pipe lengths.

C3.3.2.8.3 ZUT 7002.3 DEFINITIONS AND ABBREVIATIONS

C3.3.2.8.3.1 ZUT 7002.3.1 Definitions

For the purposes of this Specification the definitions and abbreviations given in the applicable clauses of the specifications listed in 2.1 and the following definitions shall apply:

Cut-and-shut bend	:	A bend formed by cutting out one or more V-shaped sections equally disposed about a line at right angles to the axis of the pipe, preparing the cut-out edges for welding; bending the pipe to form the bend and welding the pipe shut along the prepared edges to complete the bend (see BS 2633, Fig 25)
Fitting	:	a) A special or valve. b) Any process of jointing (except welding) straight pipes to one another and to specials and valves.

Flexible pipe	:	A pipe of which the diameter is reduced by more than 1% under an external radial force before the appearance of cracks.
"H"	:	The cross-sectional shape of a weld at a skelp.
Manual shielded electric arc process welding	:	Electric arc welding done by hand using a filler electrode coated with a material that gasifies at the point of arc and excludes oxygen from the weld, thus improving the metallurgical quality of the completed weld.
Nominal diameter (size)	:	A numerical designation of diameter which is common to all components in the piping system other than components designated by OD or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.
Nominal pressure	:	A numerical designation which is a convenient round number for reference purposes. All equipment of the same DN designated by the same PN number shall have compatible mating dimensions.
Pinhole	:	A very small hole indicating a flaw in the weld.
Pipe end bevel	:	A bevel cut made on the end of a pipe to afford a groove between abutting joints in order to receive weld metal.
Pipework	:	Includes all pipes, joints, specials, fittings and valves.
Skelp	:	The jointing edges of steel coils used in the manufacture of spiral welded pipe.
Special	:	Any pipe other than a straight pipe. Note: Under this definition shall be included all sizes of specials of shapes such as bends, tees, crosses, angle branches, reducers, tapers and flexible couplings with or without centre registers.
Straight pipe	:	A straight pipe of uniform bore and of standard or non-standard length.
Welding icicles	:	Congested droplets of metal which extend through the weld to the interior of the pipe, caused by excessive heat or improper welding technique.

C3.3.2.8.3.2 ZUT 7002.3.2 ABBREVIATIONS

The following abbreviations (additional to those referred to in 3.1) shall have the meanings given:

AISI : American Iron and Steel Institute

DN : Nominal diameter (e.g. DN 200 = 200 mm nominal diameter)

DS-AW : Double submerged-arc welded

E-RW : Electric-resistance welded

FBE : Flanged both ends

FOE : Flanged one end

ID : Internal diameter
MSEAP : Manual Submerged Electric Arc Process

MS : Mild Steel

OD : Outside diameter, which shall mean the internal diameter plus 2 x (lining thickness + pipe wall thickness)

p.e. : Plain ended.

PN : Nominal working pressure (e.g. PN 10 = 1 000 kPa)

SA-AW : Semi-automatic arc welded

SAW : Submerged arc weld

Scab : Unbonded piece of plate in tight contact with the plate

SS : Stainless Steel

t : Wall thickness of pipes

TP : Test pressure

WP : Weld preparation

C3.3.2.8.4 ZUT 7002.4 REQUIREMENTS

C3.3.2.8.4.1 ZUT 7002.4.1 MATERIALS

C3.3.2.8.4.1.1 ZUT 7002.4.1.1 General

Steel pipe shall be manufactured in accordance with SANS 719:2011 Edition 3.2, except as added or amended hereunder. Where the amendments hereunder are in conflict with SANS 719, the amendments shall take precedence.

C3.3.2.8.4.1.2 ZUT 7002.4.1.2 Chemical composition (SANS 719, Clause 4.2)

Delete Clause 4.2 and replace with:

Unless otherwise billed or shown on drawings, pipes shall be manufactured from the following materials:

Nominal diameter equal to or less than 150 mm:

Medium or heavy class steel, complying with the applicable requirements of SANS 62.

Nominal diameter larger than 150 mm:

Table 1a

Steel grade	Minimum Yield Stress (MPa)	Chemical Composition and Physical Properties
B	241	SANS 719, Table 1
300WA	300	SANS 1431
X42	289	API 5L Table 3.1 & 4.1
X46	317	API 5L Table 3.1 & 4.1
X52	358	API 5L Table 3.1 & 4.1
X56	386	API 5L Table 3.1 & 4.1
X60	413	API 5L Table 3.1 & 4.1
X65	450	API 5L Table 3.1 & 4.1

Flanges on pipe ends, where applicable, shall be manufactured from steel plate conforming to BS 4360 or SANS 1431 Grade 300W for working pressures up to PN 25. Flanges rated more than PN 25 and up to PN 60 shall be made from steel manufactured in accordance with BS EN 10222 Grade 460 or as approved. Flanges for pressures exceeding PN 60 and up to PN 250 shall be special flanges and gaskets manufactured by Hydro Power Engineering or equal approved.

C3.3.2.8.4.1.3 ZUT 7002.4.1.3 Physical properties (SANS 719, Clause 4.3)

Insert in the first sentence after "the requirements given in table 1" the following:

"and table 1a".

C3.3.2.8.4.1.4 ZUT 7002.4.1.4 Certification (SANS 719, Clause 4.4)

Add the following sentence:

"All information relevant to pipe fabrication shall be made available to the Engineer during the course of the manufacturing process."

C3.3.2.8.4.2 ZUT 7002.4.2 DESIGN

C3.3.2.8.4.2.1 ZUT 7002.4.2.1 Dimensional requirements

C3.3.2.8.4.2.1.1 ZUT 7002.4.2.1.1 Pipe length (SANS 719, Clause 5.1.1)

1) General (SANS 719, Clause 5.1.1.1)

Add the following under Clause 5.1.1.1:

"Unless otherwise specified, all pipes shall be manufactured in one fixed standard length between 9 m and 19.5 m. The standard lengths of pipes supplied shall be 9.14 m, 12.19 m or 18.28 m."

2) Random lengths (SANS 719, Clause 5.1.1.2)

Delete the wording of Clause 5.1.1.2 and replace with:

"Pipes of random length will be accepted subject to their total length not exceeding 10% of the supplied length for each category of pipe and subject to the length of each pipe being within 10% of a standard pipe length.
Standard pipes from which samples for destructive testing have been cut may be jointed together by butt-welding to form single pipe lengths of the required standard length.

Each change in steel grade, pipe diameter or wall thickness will be classes as a separate category."

3) Exact lengths (SANS 719, Clause 5.1.1.3)

The exact lengths of pipes shall be to a tolerance of -0 mm and +50 mm.

C3.3.2.8.4.2.2 ZUT 7002.4.2.2 Dimensions (SANS 719, Clause 5.1.2)

Insert the following after b):

"The tolerances on outside diameters of pipe ends for pipe diameters greater than 1250mm and less than 2230mm shall be as for pipes of 1250mm diameter (refer to Table 3 of SANS 719)."

C3.3.2.8.4.2.3 ZUT 7002.4.2.3 Wall thickness (SANS 719, Clause 5.1.3)

Delete "+10% or – 8%" and replace with:

"+13.5% or – 0%"

C3.3.2.8.4.2.4 ZUT 7002.4.2.4 Pipe ends (SANS 719, Clause 5.1.5)

Add at the beginning of Clause 5.1.5 the following:

"Pipes shall be supplied with each end complying with one of the following criteria:

a) Bevel ended to be joined by field welding

b) Plain ended to be joined by flexible couplings

c) Bell and spigot (plain) ended to be joined by fillet weld as specified in the Amendments and Additions or Bill of Quantities

d) Flanged ends to be joined by bolts, nuts, and washers.

Where both ends are specified as bevel ended or plain ended the requirements of SANS 719 Clause 5.1.5 shall apply.

Bell and spigot ends will generally be specified on pipe diameters of 508 mm or smaller.

The welding requirements for the preparation of these pipe ends shall comply with Clause 4.4.7 of this specification."

C3.3.2.8.4.2.5 ZUT 7002.4.2.5 Flanges

Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the Drawings. Flanges not covered by BS EN 1092 shall be manufactured according to the detailed dimensions and requirements shown on the Drawings.

All flanges shall be suitable for Site welding (SW) to pipes and specials and shall conform to BS 2633, Section 7 with preparation of plate flanges as shown in Fig 41 ("slip-on") for pipes and specials up to DN 100 and Fig 39 or 40 ("bore and fillet") for pipes and specials DN 125 and larger. The drilling of steel and cast iron flanges shall be off-centre and shall conform to the requirements of SANS 1123, BS EN 1092: Section 3.1, or ISO 7005: Part 1 as applicable, appropriate to the class of pipe specified, except that in the case of flanges, where M27 and M33 bolts are specified in BS EN 1092: Section 3.1, M24 and M30 bolts respectively shall be used as specified in SANS 1123.

Any pipe that has flanges which are incorrectly drilled will be rejected. Reaming of bolt holes to oversize dimension in order to make a particular piece fit will not be permitted.

All flanges shall be machined overall with gramophone finish in accordance with SANS 1123, or as specified below:

a) Flanges for nominal pipe diameters greater than DN 250 shall have Type B raised faces in accordance with Fig 4 and Table 7 of BS EN 1092, unless otherwise approved.

b) Where the working pressure exceeds PN 16, and for all nominal diameters of DN 400 and over, flange faces shall be machined in accordance with matching flanges Type G (O-ring recess) and Type H (O-ring groove) as detailed in Fig 4 of BS EN 1092.

For flanges not covered by BS EN 1092, and for domes and conical ends, thicknesses shall be calculated and where applicable the flanges manufactured in accordance with Section 3 of BS 5500.

C3.3.2.8.4.2.6 ZUT 7002.4.2.6 Provision of cadwelding pads

Where pipes are to be jointed by means of flexible couplings the manufacturer shall weld steel plates not less than 50 x 75 x 6 mm thick, 250 mm from each end of all pipes, during the pipe manufacturing process (i.e. before lining and coating) to provide adequate area for cadwelding bonding cables to the piping to make it electrically continuous and enable a cathodic protection system to be applied without damage to the coating.

C3.3.2.8.4.3 ZUT 7002.4.3 PLANT

Pipes shall be manufactured in an approved works which has the necessary tools, plant and equipment to manufacture pipes consistently in accordance with the specifications.

C3.3.2.8.4.4 ZUT 7002.4.4 FABRICATION

C3.3.2.8.4.4.1 ZUT 7002.4.4.1 General

Only qualified welders, certified as having passed the qualification tests as specified in Clause 6 of API Standard 1104 or alternatively, SANS 10044: Part IV, shall be used to do all welding required. Copies of the certificates shall be made available to the Engineer.

C3.3.2.8.4.4.2 ZUT 7002.4.4.2 Forming (SANS 719, Clause 5.2.1)

Delete the sub-clause and replace with the following:

"Unless otherwise specified in the Amendments and Additions, pipes shall be formed in accordance with one of the following forming techniques:

a) Electric resistance welding (ERW). This technique may be used for pipes ranging in outside diameter from 219mm to 610mm and ranging in wall thickness from 3.5mm to 12mm.
b) Submerged arc welding (SAW). This technique may be used for manufacturing spirally welded pipes ranging in outside diameter from 219mm to 2230mm and wall thicknesses ranging from 4.5mm to 18mm.

Where automatic submerged arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside of all pipes.

The number of longitudinal weld seams on pipes shall not exceed 1 for pipes up to and including DN 1000, and 2 for pipes larger than DN 1000 up to DN 2200.

The fabrication of larger diameters and/or use of thicker plate using these techniques may be agreed between the Manufacturer and the Engineer. In both techniques, circumferential joints shall be at least 1.5m apart and longitudinal welds of mated sections shall be at least 30° apart."

C3.3.2.8.4.4.3 ZUT 7002.4.4.3 Welds (SANS 719, Clause 5.2.2.1)

Add the following as the first sentence:

"All X-grade steel is to be welded in accordance with API 1104 'Welding of Pipelines and Related Facilities'."

C3.3.2.8.4.4.4 ZUT 7002.4.4.4 Weld reinforcements (SANS 719, Clause 5.2.2.2.7)

All butt welds and branch fillet welds on pipes shall where practicable have an internal weld. The height of the inner weld shall not exceed 1mm.

Internal reinforcement in the form of backing rings at weld seams shall not be permitted.

C3.3.2.8.4.4.5 ZUT 7002.4.4.5 Seams

Longitudinal seams, spiral seams and shop girth seams shall all be butt welded.

C3.3.2.8.4.4.6 ZUT 7002.4.4.6 Rounding of pipe and sizing of ends

If it is necessary to reshape pipes after they have been welded, reshaping shall be performed by rerolling or by pressure. Reshaping of pipes by dropping or hammering is not permitted. Sizing of pipe ends to come within specified end tolerances is permitted. This may include expanding pipe ends either mechanically or hydraulically up to a maximum of 1,5% of its original diameter.

C3.3.2.8.4.4.7 ZUT 7002.4.4.7 Preparation of pipe ends for:

C3.3.2.8.4.4.7.1 ZUT 7002.4.4.7.1 Mechanical couplings

Ends for use with mechanical couplings shall be square cut or bevelled plain ends, cut square to the pipe axis, with all edge burrs, weld splatter and scratches removed. The outside of the pipe shall be free of indentations, projections or roll marks for a distance of 250 mm from each end to permit proper make-up of the coupling. Longitudinal or spiral welds on the outside of the plain end shall be ground to plate or sheet surface for a minimum distance of 250 mm.

C3.3.2.8.4.4.7.2 ZUT 7002.4.4.7.2 Fillet welds

Ends for use with fillet welded sleeve joints shall be prepared as specified in 4.4.7.1.

C3.3.2.8.4.4.7.3 ZUT 7002.4.4.7.3 Butt welds

Pipes which require joints to be butt welded on site shall be supplied with ends bevelled in accordance with the requirements of SANS 719, Clause 5.1.5. Square cut ends will require approval.

For pipes to be jointed by butt welding, the internal weld bead shall be ground flush with the internal surface of the pipe or special for a length of 200 mm from the ends to be jointed.

C3.3.2.8.4.4.7.4 ZUT 7002.4.4.7.4 Spigot and socket

Spigot and socket ends shall be rolled or fabricated from plate, sheet or special sections to the required shape without hammering. Longitudinal or spiral welds on the inside of the socket and the outside of the spigot shall be ground to plate or sheet surface for a distance not less than the depth of insertion of the spigot into the socket.

C3.3.2.8.4.4.7.5 ZUT 7002.4.4.7.5 Bevelling

All bevelling, where required, shall be delayed until after all non-destructive testing has been completed.

C3.3.2.8.4.4.7.6 ZUT 7002.4.4.7.6 Flanges

Ends to be fitted with flanges shall have the longitudinal or spiral welds ground to plate or sheet surface for a distance from the ends sufficient to accommodate the flange.

C3.3.2.8.4.4.8 ZUT 7002.4.4.8 Rectification of defects (SANS 719, Clause 5.2.3)

Add the following to Clause 5.2.3:

"If a pipe fails to pass any of the tests specified, it will be rejected but the Engineer may permit repairs or alterations to be made to enable the pipe to pass the test.

Repairs of welded joints will be permitted during the process of manufacture. Where repairs are required the defective weld metal shall be cut out, and the parent metal prepared by grinding, and re-welded, to the satisfaction of the Engineer.

The repair procedure and performance on repairs shall be in accordance with Section 10 of API Specification 5L where not in conflict with SANS 719. Only qualified welders shall be employed. Each repair weld shall be marked with the welder's identifying stamp.

When the repair has been made, it shall be radiographically tested (X-rayed) over the full length of the repair.

On discovery of defective welds, the Engineer may, at his discretion, call for additional radiographic examination until it is shown that the necessary standard is being maintained.

Should a weld repair be required on a pipe subsequent to hydraulic testing, the repaired pipe shall be retested in accordance with Clause 5.5 Hydraulic testing of this specification.
Dents shall, where practicable, be jacked out."

C3.3.2.8.4.5 ZUT 7002.4.5 COATINGS AND LININGS

Coatings and linings of pipes shall be undertaken in accordance with the requirements of Specification ZUT 0003.

C3.3.2.8.4.6 ZUT 7002.4.6 MARKING (SANS 719, Clause 7)

Delete this clause and replace with the following:

Upon fabrication, each pipe shall be hard stamped with a unique reference number to ensure traceability. The stamp is to be 100mm from the pipe end and next to a weld. On completion of the contract or at reasonable intervals during the contract, the following pipe information shall be supplied to the Engineer in Microsoft Excel ® format:

a) Pipe reference number

b) Contract number

c) Date of manufacture

d) Outside diameter

e) Wall thickness

f) Grade of steel

g) Coating type and nominal thickness

h) Lining type and nominal thickness

i) Forming technique

j) Length

k) Mass of uncoated and unlined pipe in kg/m

l) Applicable drilling tables stamped on the periphery of all flanges

In addition to the hard stamping, all pipes shall be clearly marked with the unique reference number in appropriate height characters in durable paint on a black background at one end of each pipe. The supplier's and Employer's name and logo shall be stenciled on each pipe.

Where specified in the Amendments, all pipes shall also be clearly marked with colour bands to reflect the grade steel and wall thickness."

C3.3.2.8.4.7 ZUT 7002.4.7 STORAGE, HANDLING AND TRANSPORT

C3.3.2.8.4.7.1 ZUT 7002.4.7.1 Handling and rigging

The plant and rigging equipment used for the handling of pipes shall be such that no pipe shell is over-stressed
during any operation.

In the transportation, loading and unloading of pipes, an adequate fleet of vehicles shall be operated and maintained at all times to ensure that pipes and their protective linings and coatings are not damaged. In particular, the use of excavation equipment for handling of pipes will not be permitted.

Coated pipes shall be moved with the use of padded slings of width sufficient to prevent damage to the coating. The slings shall be at least 500mm wide for pipes up to DN600, 600mm wide for pipes of DN700 and up to DN1200, and 800mm wide for pipes of DN1400 and larger, or as approved by the Engineer. Chain slings, hooks, wire ropes, rope slings without canvas covers, composition belt slings with protruding rivets and any other equipment liable to damage the coating shall not be used.

Slings shall be suitably rated for the loads to be handled and in good condition. The use of deteriorating and frayed slings is prohibited.

All pipes are to be lifted and handled with the aid of a "spreader" lifting beam. Special care shall be taken to ensure that no damage occurs to pipes or coatings as a result of pipes sliding on or hitting adjacent pipes. The dragging or skidding of pipes in contact with the ground is not permitted.

If cradles are used to transport the pipes they must be rubber lined to avoid damage to the pipe coating.

During transportation pipes shall be safely secured to its final destination with slings of an adequate width.

The Contractor shall be responsible for dispatching and transporting of the pipes to site and off-loading.

C3.3.2.8.4.7.2 ZUT 7002.4.7.2 Dunnage and storage

Whenever pipes are stacked or otherwise stockpiled or are transported (unless special cradles are used), use shall be made of suitably resilient material as dunnage which shall not disintegrate or deteriorate when exposed to the elements for prolonged periods. Pipes of 6m length shall be stacked with a minimum of 2 dunnage supports. Pipes of 9m and 12m lengths shall be stacked with a minimum of 3 supports (one support at each pipe end and one at mid-span). Pipes of 18m length shall be stacked with a minimum of 4 supports at equal spacing. The supports shall have a minimum width of 500mm for pipes up to DN500 and 1000mm wide for larger pipes. The length of the support shall be a minimum length of 1.5 times the diameter of the pipe to be supported and shall be profiled to match the coated outside radius of the pipe.

Pipes shall be stacked with a minimum clearance of 50mm between adjacent pipe walls and a minimum of 200mm clear of the ground.

Pipes shall be stacked with sufficient supports to prevent permanent longitudinal deflections or deformation of the pipe body in excess of 2 per cent of the pipe diameter. Pipes shall also be stacked in a manner that limits loading on lower layers of pipes. Any pipe showing permanent ovality as a result of surcharge loading shall be rejected. Dents causing a protrusion in excess of 3mm into the interior of a pipe may also result in the pipe being rejected.

Each class and size of pipe shall be stacked and stored separately.

Coated steel pipes shall always be supported on a sufficient number of approved soft bolsters to prevent damage or the permanent deformation of coatings. Coated steel pipes shall not be stacked more than two pipes high, each layer separated by bolsters.

The number of layers of bare steel pipes in a stockpile shall not exceed:

$$N = \frac{1730.f.t}{(D-t)^2}$$

Where N is the permissible number of layers, D is the outside diameter of the pipe in mm, f is the guaranteed minimum yield strength in MPa for the steel plate, and t is the nominal wall thickness in mm.
Any material which is not delivered and off-loaded on Site in the same condition as it left the factory may be rejected by the Engineer.

C3.3.2.8.4.7.3 ZUT 7002.4.7.3 Protection of pipe ends

Before transportation all pipes are to be fitted with end caps made from plastic or other suitable material. Each end cap must remain in place until its pipe has been laid and the pipe end is no longer open to the elements. It must, therefore, remain in place until it is no longer needed to protect the pipe from ingress of foreign material.

In addition, bevel-ended pipes are to be fitted with bevel protectors before leaving the Manufacturer's premises. These are to remain in place until removed to permit the welding operation.

C3.3.2.8.5 ZUT 7002.5 COMPLIANCE WITH REQUIREMENTS

C3.3.2.8.5.1 ZUT 7002.5.1 FACILITIES FOR TESTING

The Contractor shall provide at his own cost, all facilities and equipment required for testing and shall carry out all tests at his own expense. Complete records of test results shall be kept.
The testing machines shall be of a design which will allow a steady application of the test pressure and shall be equipped with an accurate pressure gauge. Provision shall be made for expelling all air from any pipe under test during filling and before application of the pressure.

Test calibration certificates from an independent laboratory, verifying the accuracy of all measuring and testing instruments requiring calibration, shall be provided by the Contractor. Recalibration shall be carried out as necessitated by circumstances but at intervals not exceeding 3 months.

C3.3.2.8.5.2 ZUT 7002.5.2 QUALITY ASSURANCE

All steel pipes shall be fabricated and tested in accordance with an approved quality control plan and procedure. Manufacture shall not commence until such time as the quality control plan and procedure has been approved by the Engineer.

The quality control plan and procedure shall address, as a minimum, the following tests/inspections:

a) Material certification

b) Non-Destructive Evaluation (NDE) testing

c) Verification of tolerances

d) Workmanship

e) Surface preparation (e.g. cleanliness and blast profile for coatings and linings)

f) Material identification

g) Personnel certification (including welders and NDE)

h) Welding procedures and certification

i) Weld preparation

j) Compliance with drawings

k) Hydrostatic testing

C3.3.2.8.5.3 ZUT 7002.5.3 INSPECTIONS

C3.3.2.6.5.3.1 ZUT 7002.5.3.1 Visual inspections

All finished pipes shall be visually inspected and shall be free of injurious defects as defined in API 5L Section 10.7.

C3.3.2.8.5.3.2 ZUT 7002.5.3.2 Dimensions (SANS 719, Clause 6.1.1)

Add the following as the first sentence:

"The outside diameter, ovality and straightness of each pipe is to be checked in accordance with this clause."

C3.3.2.8.5.3.3 ZUT 7002.5.3.3 Welds (SANS 719, Clause 6.1.2)

Add the following at the end of the clause:

"The welds of each pipe are to be tested using one of the two options below. If not specifically stated elsewhere, pipes manufactured by ERW are to be tested as per Option 2 and spirally welded pipes as per Option 1.

a) Option 1 (excluding ERW pipes)
100% of the welds of all pipes shall be tested by fluoroscopic means. Where defects are detected they shall be adjudicated in accordance with API 5L and, if necessary, repaired in accordance with the requirements of API 1104.

b) Option 2 (ERW pipes)
100% of the welds of all pipes shall be tested by ultrasonic means. Where defects are detected in a pipe by means of ultrasonic testing, the defection section of pipe shall be 100% re-tested by means of X-ray and adjudicated in accordance with API 5L and, if necessary, repaired in accordance with the requirements of API 1104.

For rail, road, river and stream crossings, 100% of the total length of all welds shall be examined radiographically."

C3.3.2.8.5.4 ZUT 7002.5.4 DESTRUCTIVE TESTS (SANS 719, CLAUSE 6.2)

At least one set of the three tests described in SANS 719, Clauses 6.2.1, 6.2.2 and 6.2.3, shall be carried out for each pipe diameter and wall thickness combination. The Engineer may require that, after the first pipe, every 500th subsequent pipe of each diameter and wall thickness combination be tested.

C3.3.2.8.5.5 ZUT 7002.5.5 HYDRAULIC TEST (SANS 719, CLAUSE 6.3)

Delete this clause and substitute with the following:

"When all aspects of fabrication have been completed, but before being cleaned, lined or coated, each and every pipe is to be tested to a hydrostatic pressure test of P,

Where P = the lesser of: $2 \times 0.85 \times Y \times t/D$ or 7 MPa
Y = Minimum Specified Yield Stress (MPa)
t = Nominal Wall Thickness of pipe (mm)
D = Nominal Diameter of Pipe (mm)

Pipe end plugs shall be restrained during the test to ensure that no longitudinal stresses are induced in the pipe wall. Upon completion of the hydraulic test, the ends of the pipes shall be tested by means of Go, No-go gauges to check whether flaring or cupping has occurred. If necessary the ends shall be expanded or ground until they comply with the specification.

The test pressure in the pipe shall be maintained for at least 10 seconds and thereafter shall be inspected for weeps, leaks or deformation. The pipe will be deemed defective and may be rejected if any leaks, weeps or deformation are evident. Where defects are repaired, the pipe shall be re-tested. Should the pipe, after repair, fail to pass the second hydraulic test the Engineer may order its rejection."

C3.3.2.8.5.6 ZUT 7002.5.6 INSPECTORATE

The Engineer may at his sole discretion appoint an independent inspection authority to carry out additional Quality Surveillance at the premises of the pipe manufacturer. The manufacturer shall provide all facilities and shall facilitate access to their premises at reasonable times as may be necessary for the independent inspectorate to perform its function.

The manufacturer's quality control records shall be available for inspection by the independent inspectorate at all reasonable times, and copies of such records shall be made available on request.

Notwithstanding any surveillance carried out by, or on behalf of the Engineer, the Contractor shall retain full responsibility for the quality of pipes supplied.

C3.3.2.8.5.7 ZUT 7002.5.7 MARKING PROCEDURE

All weld lengths to be radiographed shall be clearly marked by the Inspector using his identification symbol. This symbol shall appear on the respective radiograph. The radiographed weld and symbol shall not be obliterated by finishing processes until the respective weld has been accepted by the Inspector.

C3.3.2.8.5.8 ZUT 7002.5.8 COATINGS AND LININGS

The testing of the coatings and linings of pipes shall be undertaken in accordance with the requirements of Specification ZUT 0003.

C3.3.2.8.6 ZUT 7002.6 TOLERANCES

Refer to Clauses 4 and 5.

C3.3.2.8.7 ZUT 7002.7 TESTING

Refer to Clause 5.

C3.3.2.8.8 ZUT 7002.8 MEASUREMENT AND PAYMENT

C3.3.2.8.8.1 ZUT 7002.8.1 BASIC PRINCIPLES

C3.3.2.8.8.1.1 ZUT 7002.8.1.1 Corrosion protection

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for corrosion protection. The rates tendered for item 8.2.1 will be held to cover the cost of any protection system specified.

C3.3.2.8.8.1.2 ZUT 7002.8.1.2 Pipes tested to destruction

Pipes tested to destruction and the repair of the tested pipes for use in the Works, if ordered by the Engineer, will be measured and paid on a daywork basis.

C3.3.2.8.8.2 ZUT 7002.8.2 BILLED ITEMS

C3.3.2.8.8.2.1 ZUT 7002.8.2.1 Supply of pipes

Unit:…….metre (m)

The supply of pipes will be measured by length. The maximum length measured will be equal to the length as laid, no deductions being made for specials and valves and no extra length measured for waste. (See Subclause 8.2 of SANS 1200 L)

Separate items will be billed for each diameter and wall thickness.

The unit rates shall cover the cost of the fabrication and supply of the pipes, complete with couplings where applicable, the cost of handling where applicable, and the cost of factory testing, inspection

and transportation to Site and shall, where it is necessary to limit ovality to within the specified limits, also cover the cost of bracing the pipes internally.

Separate items are provided in the Bill of Quantities for the laying, jointing, testing and commissioning of the pipes.

Annexures

APPENDIX A. APPLICABLE STANDARDS

Reference is made to the latest issues of the following standards:

API Specification 5L	American Iron and Steel Institute - Specification for LINEPIPE
API Standard 1104	American Iron and Steel Institute - Standard for welding pipelines and related facilities
ASME	Boiler and Pressure vessels Code, Section V, Article 7
AWWA M 11	Steel pipe - A guide for design and installation (3rd edition)
BS 534	Steel pipes and specials for water and sewage
BS 639	Covered electrodes for the manual metal-arc welding of carbon and carbon-manganese steels
BS 1387	Steel tubes and tubulars suitable for screwing to BS 21 pipe threads
BS 1640	Steel butt-welding pipe fittings for the petroleum industry: Part 1 : Wrought carbon and ferritic alloy steel fittings
BS 1832	Compressed asbestos fibre jointing
BS 2633	Class 1 arc welding of ferritic steel pipe work for carrying fluids
BS 3139	High strength friction grip bolts for structural engineering
BS 3294	The use of high strength friction grip bolts in structural steelwork: Part 1 : General grade bolts
BS 3381	Metallic spiral wound gaskets for use with flanges to BS 1560 : Part 1 and 2
BS 4360	Weldable structural steels
BS 4604	The use of high strength friction grip bolts in structural steelwork (metric series)
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings, and accessories. Steel flanges
BS EN 10222	Steel forgings for pressure purposes
PD 5500	Unfired fusion welded pressure vessels
ISO 7005	Metallic Flanges: Part 1 : Steel flanges
ISO 9000	Quality management
ISO 9002	Quality systems. Model for quality assurance in production, installation and servicing
SANS 62	Steel pipes Part 1 Pipes suitable for threading and of nominal size not exceeding 150 mm Part 2 Screwed pieces and pipe fittings of nominal size not exceeding 150 mm.

SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specification and test methods
SANS 719	Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)
SANS 974	Rubber joint rings (non-cellular) Part I : Joint rings for use in gas, water, sewer, and drainage systems
SANS 1109	Pipe threads where pressure-tight joints are made on the threads Part 1 Dimensions, tolerances and designation Part 2 Verification by means of limit gauges
SANS 1123	Pipe flanges
SANS 1431	Weldable structural steels
SANS 1476	Fabricated flanged steel pipework
SANS1700	Fasteners
SANS 10044	Welding
SANS 10121	Cathodic protection of buried and submersed structures
SANS 1200 L	Medium-pressure steel pipelines
SAECC/1	Code of Practice
Specification ZUT 0003	Painting and corrosion protection for water and wastewater works
Specification ZUT 7001	Design and manufacture of medium-pressure steel specials
Specification ZUT 7003	Laying and jointing of medium-pressure steel pipes and specials

C3.3.2.9 ZUT 7003 LAYING AND JOINTING OF MEDIUM-PRESSURE STEL PIPES AND SPECIALS

C3.3.2.9.1 ZUT 7003.1 SCOPE

This Specification covers the laying and jointing of electrically welded low carbon steel pipes and specials of diameter up to 2 280 mm, for transporting water and sewage under working pressures of up to 2,5 MPa.

This Specification shall be read in conjunction with Specification ZUT 7001.

This Specification contains clauses that are generally applicable to the laying and jointing of medium- pressure steel pipes and specials. Interpretations and variations of this specification are set out in the Amendments preceding this Specification.

C3.3.2.9.2 ZUT 7003.2 NORMATIVE REFERENCES

C3.3.2.9.2.1 ZUT 7003.2.1 SUPPORTING SPECIFICATIONS

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

a) Amendments;

b) Specification ZUT 7001 : Design and manufacture of medium-pressure steel specials;

c) Valves specifications

d) Flow meter specifications

e) Specification ZUT 0003 : General corrosion protection for pipelines, water and wastewater works; and

f) Standards listed in Appendix A.

C3.3.2.9.3 ZUT 7003.3 DEFINITIONS AND ABBREVIATIONS

For the purposes of this Specification the definitions and abbreviations given in the specifications listed in
2.1 shall apply.

C3.3.2.9.4 ZUT 7003.4 REQUIREMENTS

C3.3.2.9.4.1 ZUT 7003.4.1 MATERIALS

C3.3.2.9.4.1.1 ZUT 7003.4.1.1 General

Refer to Subclause 4.1.1 of ZUT 7001

Pipes and fittings shall be of the types specified in the Bill of Quantities or in the project specification and, unless otherwise required in terms of the project specification, they and their couplings shall be capable of withstanding the applicable test pressure specified in the Amendments. All pipes and fittings shall be supplied complete with couplings and jointing material.

Satisfactory temporary end covers shall be provided for the protection of threads, flanges, and prepared ends of plain-ended pipes and fittings, and to prevent damage to internal lining during transportation and during handling on Site.

C3.3.2.9.4.1.2 ZUT 7003.4.1.2 Flanges

Refer to Subclauses 4.1.3 and 4.3.2 of ZUT 7001.

C3.3.2.9.4.1.3 ZUT 7003.4.1.3 Insulating flanges

Refer to Subclause 4.3.3 of ZUT 7001.

C3.3.2.9.4.1.4 ZUT 7003.4.1.4 Gaskets

Refer to Subclause 4.3.5 of ZUT 7001.

C3.3.2.9.4.1.5 ZUT 7003.4.1.5 Bolts, nuts, and washers

Refer to Subclause 4.3.6 of ZUT 7001.

C3.3.2.9.4.1.6 ZUT 7003.4.1.6 Bricks

Bricks shall be obtained from an approved manufacturer and shall be either general purpose (special), burnt clay, or engineering bricks that comply with the applicable requirements of SANS 227, or Class S14 calcium silicate bricks that comply with the applicable requirements of SANS 285.

The Contractor shall submit to the Engineer samples of the bricks he intends using in the construction of the Works. The samples of bricks that are approved will be retained by the Engineer.

C3.3.2.9.4.1.7 ZUT 7003.4.1.7 Precast cylinders

Precast cylinders may be of spun concrete, glass reinforced polyester, or PVC, except where particular materials are required in terms of the Bill of Quantities or the project specification. Precast concrete cylinders shall comply with the applicable requirements of SANS 1294. Sectional spun concrete cylinders shall comply with the requirements for pipes of SC type, Class A, of SANS 677. Jointing between cylinders shall be of the interlocking self-centering type suitable for sealing.

C3.3.2.9.4.1.8 ZUT 7003.4.1.8 Concrete

Concrete shall comply with the requirements of SANS 1200 G or SANS 1200 GA, as applicable.

C3.3.2.9.4.1.9 ZUT 7003.4.1.9 Welding rods

The Contractor shall supply all the necessary welding electrodes, which shall be of the shielded type. The chemical composition of weld metal and parent metal shall be similar. Electrodes that show signs of deterioration or damage shall be removed from Site and replaced at the Contractor's expense. Electrodes shall comply with the requirements of BS 639.

C3.3.2.9.4.1.10 ZUT 7003.4.1.10 Corrosion protection

Refer to Specification ZUT 0003.

C3.3.2.9.4.1.11 ZUT 7003.4.1.11 Records of materials on site

The Contractor shall keep and maintain a complete and comprehensive record of each pipe, special and fitting delivered to Site. The record shall at least denote the reference number, size, pressure class, location in the pipeline, date and condition of delivery and the location of delivery and the

location of storage. Copies of the record shall be submitted to the Engineer at the end of each month or whenever requested by the Engineer.

Where pipes, specials and fittings are delivered without reference numbers, same shall be provided by stenciling, labelling or other methods approved by the Engineer.

C3.3.2.9.4.2 ZUT 7003.4.2 PLANT

C3.3.2.9.4.2.1 ZUT 7003.4.2.1 Packing

Goods shall be suitably packed in such a manner as will ensure safe and efficient transport by road or rail, and the Contractor shall include in his prices for whatever packing may be necessary in this respect. Small items particularly liable to damage or loss in transit should be crated. All crates and packing material shall, after use, become the property of the Employer, unless distinctly specified otherwise, or if returnable, shall be so at the Contractor's expense.

C3.3.2.9.4.2.2 ZUT 7003.4.2.2 Handling and rigging

The plant and rigging equipment used by the Contractor for the handling and placing of pipes shall be such that no pipe shell is over-stressed during any operation covered by the specification.

C3.3.2.9.4.2.3 ZUT 7003.4.2.3 Setting out

The Contractor may use any acceptable device, including one incorporating a laser beam, to control the alignment and laying of the pipeline.

C3.3.2.9.4.2.4 ZUT 7003.4.2.4 Site equipment

The Contractor shall furnish all equipment, tools, and supplies, including the necessary welding electrodes. Welding machines shall be operated within the amperage and voltage ranges recommended for each size and type of electrode. Any equipment that does not meet these requirements shall be repaired or replaced upon request of the Engineer. (Refer also API 1104 Clause 1.3.)

C3.3.2.9.4.2.5 ZUT 7003.4.2.5 Testing

The Contractor shall provide all equipment, materials, tools, and fittings required for the performance of the tests given in Clause 5.

C3.3.2.9.4.3 ZUT 7003.4.3 METHODS AND PROCEDURES

C3.3.2.9.4.3.1 ZUT 7003.4.3.1 Laying

C3.3.2.9.4.3.1.1 ZUT 7003.4.3.1.1 General

The pipelines shall be laid and bedded to even grades and to the levels and alignments shown on the drawings or as directed. It shall be laid centrally in the trench in such a manner that the side allowance conforms to the applicable value specified in Clause 8 of SANS 1200 DB. For ease of inspection and testing the pipes shall be laid with the manufacturer's class and quality identification marks visible from the top of the trench, unless, in the case of large pipes, the position of lifting eyes render this impracticable.

Control of laying and bedding shall be by means of boning rods and sight rails or an acceptable laser beam device. Sight rails shall be painted black and white and shall be fixed securely and accurately.

C3.3.2.9.4.3.1.2 ZUT 7003.4.3.1.2 Damage

Each pipe, pipe special and fitting shall be thoroughly cleaned and carefully examined for damage and defects prior to laying. Should any damaged or defective pipe, pipe special or fitting be laid, it shall be removed and replaced at the Contractor's expense and to the satisfaction of the Engineer.

During laying, the anti-corrosion lining of pipes being joined by butt welding shall be protected against damage by foot traffic or weld spatter, to the satisfaction of the Engineer and in the manner described in Clause 4.3.2.4.6.

C3.3.2.9.4.3.1.3 ZUT 7003.4.3.1.3 Keeping pipelines clean

Every reasonable precaution shall be taken to prevent the entry of foreign matter and water into the pipe(s). At the close of each day's work, or at any time when work is suspended for a significant period, the last laid section of the pipeline shall be plugged, capped or otherwise tightly closed until laying is recommenced.

The interior of pipes shall be perfectly clean before being laid and the Engineer may instruct that the pipe interior be cleaned or washed before the pipes are lowered into the trench. All brushes, trowels, welding rod stumps, pieces of mortar, dust and all foreign matter shall be removed from pipes immediately before laying. Once a section of pipeline has been cleaned, it shall be sealed off and not be entered again unless permitted by the Engineer.

During laying and jointing of pipes and until the pipeline has passed the required acceptance tests and the trench has been backfilled, the trench shall be kept in a state which, in the opinion of the Engineer, is reasonably dry.

The Contractor shall at his own expense make good any damage to valves and fittings or clogging of off- takes or malfunctioning of fittings which result from his failure to keep the pipeline in a thoroughly clean condition.

C3.3.2.9.4.3.1.4 ZUT 7003.4.3.1.4 Depths and cover

Unless otherwise specified in the Amendments, shown on the Drawings, or ordered by the Engineer, the minimum cover for pipelines shall be 1.0 m.

The minimum clearance between the outside of a pipeline being laid and the outside of any other pipe that it crosses shall be 300 mm. Where this requirement conflicts with the requirements for cover over the pipeline the Contractor shall ask the Engineer for written instructions and shall carry out the work in accordance with those instructions.

C3.3.2.9.4.3.1.5 ZUT 7003.4.3.1.5 Cold stresses and deflection in pipe curvature

Pipes shall be laid free from cold stresses. No deflections shall be taken in curvature of pipes, but shall be taken with approved bends with exceptions as hereinafter specified. All deflections in pipes with flexible couplings shall not exceed those recommended by the manufacturer of the couplings after making allowance for ground movements.

C3.3.2.9.4.3.1.6 ZUT 7003.4.3.1.6 Mitres to effect pipe deflections

All deflections in the axis of butt-welded steel pipelines of 10 degrees or less shall be made by mitering equally the ends of the two pipes to be joined so that the maximum mitre in any one pipe shall be 5 degrees. Where the total deflection is 3 degrees or less, the mitering may be made in

one pipe end only. Ends to be mitred shall be carefully and accurately marked and then either machine cut or machine planed.

Hand planing will not be permitted. After mitering, the pipe ends shall be re-chamfered as described in Clause 5.1.5 of SANS 719. The minimum gap between pipe end root faces before welding shall be 1,5 mm and the maximum gap shall be 3,0 mm. After mitering all pipe ends shall be thoroughly cleaned before the field weld is carried out.

C3.3.2.9.4.3.1.7 ZUT 7003.4.3.1.7 Cold bends

Where the Engineer gives written approval for cold bends on pipes with diameters of 450 mm and smaller, they shall be made by the cold stretch method in such a manner as to preserve the cross-sectional shape of the pipe. The minimum radius of any such bend shall be twenty five times the outside diameter of the pipe. Approved bending shoes shall be used for bending of the pipes.

C3.3.2.9.4.3.1.8 ZUT 7003.4.3.1.8 Snaking

Snaking into the trench of butt-welded sections of steel pipeline which has been factory lined and/or coated will not be permitted without the written approval of the Engineer.

C3.3.2.9.4.3.1.9 ZUT 7003.4.3.1.9 Stringing of pipes

The Contractor shall ensure that pipes are strung in accordance with a method statement to be approved by the Engineer. The method statement shall cover the proper placement by diameter, wall thickness and specifications. Any movement of pipes resulting from failure to comply with the approved method statement shall be rectified at the Contractor's expense.

C3.3.2.9.4.3.1.10 ZUT 7003.4.3.1.10 Handling and transporting

Pipes and specials shall be handled as specified in Clause 4.8 of ZUT 7001.
Wrapped pipes shall be protected from grit and other sharp objects while the pipe is in the trench prior to bedding. Walking on wrapped pipes will not be allowed. The Engineer may reject any length of wrapping on which physical damage due to any cause whatsoever is visible.

Cement mortar lined pipes shall not be moved or transported for a period of 14 days after the date of lining.

C3.3.2.9.4.3.1.11 ZUT 7003.4.3.1.11 Skids

Skids of sufficient number shall be supplied to support the pipe to proper height. If a pipe is supported over the trench, skids shall be of sufficient length to prevent collapsing of the trench and of sufficient strength to carry the pipe.

For coated pipe a sufficient number of skids shall be used to prevent damage to the coating.

C3.3.2.9.4.3.2 ZUT 7003.4.3.2 Jointing methods

C3.3.2.9.4.3.2.1 ZUT 7003.4.3.2.1 Flexible couplings

The joints of steel pipes by flexible couplings shall be made only in their final laid position. Before assembling the joint, care shall be taken to ensure that pipe ends and couplings are clean and free from burrs and ridges. Such burrs and ridges shall be removed if present. Pipe ends shall be mated carefully before joints are made. Pipe ends shall be concentric and perfectly lined up and the coupling shall not be relied upon to line up or to support the pipe.

Joints shall be made and couplings assembled to the manufacturer's instructions. Two-thirds of the number of coupling bolts, equally spaced, shall first be partially tightened up in a regular sequence, using a short spanner. The remaining bolts shall then be similarly tightened. After checking the coupling alignment, the bolts shall then be finally tightened evenly, using a torque wrench.
Where couplings without central registers are used, precautions shall be taken to ensure that the pipe ends are apart by the same distance as if a coupling with central register had been used and the coupling shall be carefully centred over the pipe ends.

Flexible couplings shall be provided with external protection as soon as the pipeline has been hydrostatically tested and electrically bonded, where applicable.

C3.3.2.9.4.3.2.2 ZUT 7003.4.3.2.2 Flanged joints

All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre lines of the flanges. Flanges shall be installed truly square to the axis of the pipe.

In the jointing of steel pipes with flanges, special care shall be taken to align, grade and level the pipes, specials and valves to avoid straining of the flanges. All bitumen and paint shall be removed from the mating face of each flange immediately before jointing. Epoxy paints shall not be removed from flange faces. Insertion pieces that have accurately cut holes for bolts shall be placed to form a continuous one- piece ring between the flanges. Bolts shall be tightened up to ensure uniform bearing on the insertion. Care shall be taken to avoid damage to the internal surface of the pipes during assembly of the pipeline.

Wherever loose flanges are welded onto pipelines, the Contractor shall ensure that the inner lining is restored to the thickness specified for such lining and that the new repaired lining is soundly jointed to the existing lining.

In making the joint the Contractor shall ensure that the flanges are truly parallel with all bolts evenly firm before being finally drawn up with torque wrenches to watertightness. Taper gauges shall be used to check that there is a uniform gap before and after final tightening up of bolts. Bolts shall be tightened in an approved sequence with bolts equally spaced and tightened equally at opposite ends first. The Contractor shall ensure that the correct jointing materials, i.e. gaskets and bolts and nuts are available when required. The gaskets shall be in accordance with Subclause 4.3.5 of ZUT 7001. In the case of insulated joints the insulated materials shall be arranged as set out in Code of Practice No. SAECC/1.

Flanged fittings shall be so installed that there are no stresses induced into the pipework specials or fittings by forcing ill-fitting units into position or by bolting up flanges with faces not uniformly in contact with their gaskets over their whole faces.

C3.3.2.9.4.3.2.3 ZUT 7003.4.3.2.3 Bolts and nuts

Bolts and nuts shall be in accordance with Subclause 4.3.6 of ZUT 7001.
Only correct diameters and lengths of bolts and studs shall be used. Flat washers shall be used under all nuts and bolt heads. The length of bolts and studs shall be such that approximately two threads protrude from the nut when fully tightened. The threads of bolts, studs and nuts shall be thoroughly cleaned and then coated with a graphite-grease compound immediately prior to assembly.

C3.3.2.9.4.3.2.4 ZUT 7003.4.3.2.4 Field welding

1) General

Field welding of pipes which have been lined will only be permitted in pipes of DN 450 and larger where a man is able to enter the pipe to make good the lining after welding and testing in accordance

with Clause 5.1 has been completed. Pipes of lesser diameter may be field welded where concrete linings will be made after the pipeline has been laid and all welds have been tested and approved.

At the discretion of the Engineer, roll welding will be permitted, provided an alignment is maintained by use of skids or of structural framework to accommodate two or more lengths of pipe with an adequate number of roller dollies to prevent sag in the pipe. The entire root bead, however, shall be made with the pipe in a stationary position.

All pipes welded in the trench shall be properly laid and aligned before welding commences. Joint holes shall be excavated at all field welds. The Contractor shall not lift the pipe to provide adequate access for the welders to enable them to weld the joint.

The alignment of abutting ends shall be such that the offset will not exceed 1.5 mm. Line up clamps shall be used for joint “fit-ups”. The use of “bridges and wedges” or any method that may induce unnecessary stresses will not be permitted.

Both ends of coated and lined pipes shall be wrapped for a distance of at least 800 mm on either side of the weld by means of an asbestos mat or other approved material to ensure that weld spatter or other damage is not caused to the coating and lining during the welding process. The pipe trench shall be kept free of all dirt and water in the vicinity of the weld until after all corrosion protection measures have been completed and approved.

Destructive testing as specified in Clause 5.1.2.2 shall be carried out. The Contractor shall submit to the Engineer for approval a full procedure specification as detailed in API 1104 Clause 5.3 prior to any field welding being allowed.

2) Welding procedure and qualification of welders

Welding shall only be done by qualified welders who satisfy the requirements of API Std. 1104, Clause 6 and who have been tested at the Contractor’s expense by an Independent Inspectorate.

Before any welding of pipeline materials commences, the qualification of welders shall have been approved, all detailed welding procedure specifications with weld diagrams required for their completion shall have been submitted for approval in a neat form and the welding procedure qualification tests shall have been successfully concluded all in accordance with the relevant standard specifications. Each welder shall mark the pipe adjacent to the weld with the figure assigned to him.

Sufficient records shall be kept by the Contractor to ensure that all field welds can be subsequently identified with the welder concerned.

As far as practicable all out of trench welding shall preferably be done by an automatic submerged process and the Contractor shall provide all necessary plant to carry out this process. Manual submerged electric arc process (MSEAP) welding may be used where in-trench welding is done.

Pre- and post-heat treatment for welding shall be in accordance with API Std. 1104 if required by same and the Contractor shall provide an approved shield to protect the pipe joint from wind and weather during heat treatment and welding.

3) Line up

Pipes shall be lined up in such a manner as to prevent damage thereto. If the pipe to be used has a longitudinal seam, these seams shall be staggered by not less than twenty degrees and welded sections, or single lengths, shall be assembled in such a manner that this seam shall remain in the top quadrant of the pipe during coating operations and after lowering into the trench.

4) Cleaning of pipe ends

Before welding, all foreign matter shall be removed from the bevelled ends. If any of the ends of the pipe joints are damaged to the extent that satisfactory welding contact cannot be obtained, the damaged pipe ends shall be cut and bevelled with an approved bevelling machine. These field bevels of pipe ends shall be made to the satisfaction of the Engineer. Should laminations, split ends, or other defects in the pipe be discovered, the joints of pipes containing such defects shall be cropped, repaired, or removed from the line as designated by the Engineer.

5) Weather conditions

No welding shall be carried out during rain or high wind unless the welder and joint are adequately protected and sheltered, to ensure that the welding is not impaired.

6) Protection of paintwork

Before welding commences, a suitable apron at least 800 mm wide shall be wrapped around both sides of the area to be welded to ensure that weld spatter or fallout from arc weld does not damage the paintwork.

During the welding of joints, the Contractor shall ensure that either rubber mats or other suitable material is laid in the pipe invert of epoxy lined steel pipes to protect the lining against damage by traffic or fall-out from arc welding at the joint. The mats shall be placed the full distance from the point of access up to the point of weld or weld inspection and shall be of sufficient width.

Workmen shall wear soft rubber soled shoes before entering lined pipes. Care shall be taken not to stroke arcs on the epoxy lined areas adjacent to the weld joint. Immediately before welding of joints, the protective tape between the ends of concrete or epoxy linings and coatings and pipe ends shall be removed.

7) Butt-welding

Pipes and specials to be joined by field welding shall be supplied with ends bevelled for welding. All welding of joints shall comply with API Std. 1104 and only approved type welding rods shall be used.

If backing rings are used, they shall be placed in position and wedged up or adjusted so that the pipe ends are completely circular and properly mated. The space between abutting pipe ends, when aligned for welding, shall be such as to ensure complete penetration without burn-through. For pipes having the same dimensions, the spacing shall be approximately 1,5 mm.
The alignment of the abutting pipe ends shall be such as to minimize the offset between pipe surfaces. For pipes of the same nominal wall thickness, the offset shall not exceed 1,5 mm. Internal line-up clamps shall be used wherever practicable and may be removed after the root bead is 50 % completed, provided that the completed part of the root bead is in segments of approximately equal lengths, spaced about the circumference of the pipe. If conditions make it difficult to prevent movement of the pipe, or if the weld will be unduly stressed, the root bead shall be completed before releasing clamp tension.

External line-up clamps shall be used where it is impracticable to use internal line-up clamps. Partial root beads made when using external clamps shall be uniformly spaced about the circumference of the pipe, and shall have an accumulative length of not less than 50% of the pipe circumference before the clamps are removed.

Tack-welding shall be carried out to maintain the root gap and position of the pipe ends during the welding proper. The number of tack-welds shall be kept to a minimum but shall not be less than four around the circumference of the pipe.
After proper preparation and tack-welding, the root bead shall be carried out followed by successive filler passes, and capper finish pass in accordance with the approved welding procedure.

The filler and finish beads shall be deposited by an acceptable method and each filler bead shall be approximately 3 mm in thickness. Completed welds shall have a reinforcing of not less than 0,8 mm and not more than 1,5 mm above the pipe surface around the entire perimeter of the weld, and the width of the finish or cover shall be not more than 3 mm greater than the original groove.

The number of beads required shall be governed by the wall thickness of the pipe, so that the completed weld will have the reinforcement previously specified; provided, however, that each weld shall consist of at least three beads. No two beads shall be started at the same point. No mitre welds will be permitted, and all welds are to be at ninety degrees (± 5 degrees) to the axis of the pipe. All slag and scale shall be removed from each bead for visual inspection immediately after each bead is run.

In all field butt-welds where it is possible to work inside the pipe, the inside weld shall be done first. The chemical composition of weld metal and parent metal shall be similar and the inner weld metal or reinforcement shall not extend more than 1 mm above the inside metal surface of a pipe or special, and any excess shall be removed by grinding.

Defects caused by stray welding arc flashes shall be removed by grinding, provided that the pipe wall thickness is not reduced to less than the specified minimum thickness, otherwise the portion shall be cut out and repaired.

8) Fillet welding

Welding shall be as for butt-welding as applicable. All pipes of DN 600 and over shall be welded on both the outside and the inside.

9) Welding alongside the trench

The Contractor may butt-weld factory coated and/or lined steel pipes together alongside the edge of the trench to form continuous welded pipeline sections up to a maximum length of 45 m and to lower each section into the trench, provided the pipe, coating and/or lining are in no way damaged during these operations and provided furthermore that the deflection of the pipe barrel at any point during any stage of the operation does not exceed 2% of pipe outside diameter.

The linings and coatings of factory coated and/or lined pipes jointed together outside the trench shall be made good at these joints outside the trench.

C3.3.2.9.4.3.2.5 ZUT 7003.4.3.2.5 Repair of welds

Rectification of defective welds shall be in accordance with API Std. 1104 and to the satisfaction of the Engineer. All costs related to the repair of defective welds shall be borne by the Contractor. Defective welds shall be repaired immediately once they are found to be defective. The Engineer has the right to stop the Contractor proceeding with further pipe laying in the event of the Contractor delaying the rectification of defective welds. Furthermore, no consideration will be given to any claims arising from delays in construction resulting from such action.

C3.3.2.9.4.3.3 ZUT 7003.4.3.3 Installation of specials and fittings

C3.3.2.9.4.3.3.1 ZUT 7003.4.3.3.1 General

Welding shall comply with API Std. 1104. All specials and other fittings shall be installed in accordance with the drawings and instructions of the Engineer. Where "slip-on" or sleeve couplings are to be fitted, all surfaces shall be thoroughly cleaned to a smooth finish, care being taken to remove as little of the protective coating as possible.

C3.3.2.9.4.3.3.2 ZUT 7003.4.3.3.2 Bends

Bends shall be installed true to line, level and deflection and shall be anchored in concrete where required to counteract thrust. Bends shall normally be supplied with "centre planes" marked with two small punch marks close to both ends of the bends to facilitate correct positioning of the bends in laying.

C3.3.2.9.4.3.3.3 ZUT 7003.4.3.3.3 Tees

Tees for air valves shall be installed with branch barrels pointing vertically upwards. Tees for scour valves shall be installed with branch barrels pointing vertically downwards or at the gradients indicated on the drawings. Tees for off-takes shall be installed as shown on the drawings.

Field installation of the off-takes from the pipelines for air and scour valve connections or any other form of off-take shall not be permitted. All tees for these off-takes and connections shall be factory manufactured.

C3.3.2.9.4.3.3.4 ZUT 7003.4.3.3.4 Flanges

All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre lines of the flange. Flanges shall be installed truly square to the axis of the pipe.

C3.3.2.9.4.3.3.5 ZUT 7003.4.3.3.5 Insulated flanged joints

Insulated flange joints shall be provided and installed by the Contractor where specified or instructed by the Engineer. The Contractor shall supply all materials, labour and plant required and shall complete and prove that each insulated joint after installation in the pipeline has a resistance well in excess of the resistance to earth of the pipeline on both sides of the insulating joint.

C3.3.2.9.4.3.3.6 ZUT 7003.4.3.3.6 Temporary closure pipes

Temporary closure pieces shall be of the same standard, diameter and wall thickness as the pipeline, except where otherwise specified or instructed by the Engineer.

C3.3.2.9.4.3.3.7 ZUT 7003.4.3.3.7 Permanent closure pipes

Permanent closure pipes shall be provided and installed as pipe laying proceeds. They shall be either butt welded to adjacent pipes, or jointed to access pipes, fittings or specials by means of slip-on couplings.

C3.3.2.9.4.3.4 ZUT 7003.4.3.4 Temporary sealing of pipeline

C3.3.2.9.4.3.4.1 ZUT 7003.4.3.4.1 Night-caps

Metal night-caps shall be used to close off all ends of each laid section of pipework when work is stopped at the end of each day or for longer periods and shall be left on the ends of sections of completed pipework until such sections are tied-in with the remainder of the completed pipeline.

The night-caps shall consist of a steel plate welded into a half slip-on coupling which shall be provided with a sufficient number of lugs to secure the ring and gasket and shall be strong enough

to withstand external water and earth pressure in the event of flooding or collapse of earth. The joint shall be watertight.

The Contractor shall also, at his own expense, blank-off all air valve, scour valve and off-take tees with at least 6 mm thick blank flanges which shall be bolted with at least four bolts to tee flanges or shall be fixed to plain ended tee branches by using half couplings welded to the blank flanges. These shall be watertight and shall not be removed until the valves or other fittings are about to be fitted.

Notwithstanding the use of night-caps, the Contractor shall, at his own expense, make good all damage to pipe linings and fittings caused by the ingress of dirty water, silt, sand, debris, vermin, insects and other foreign matter. The Contractor shall, at this own expense and to the satisfaction of the Engineer, clean the interior of the pipeline of such contaminants.

C3.3.2.9.4.3.5 ZUT 7003.4.3.5 Prevention of flotation

Pipes to be encased in concrete shall be prevented from flotation during concreting operations. Apart from this special case during concreting operations, the Contractor shall prevent the flotation of pipe work due to storm runoff or groundwater entering the trench before backfilling has been completed.

Methods adopted to prevent flotation shall not damage coatings or linings and shall be approved by the Engineer. Notwithstanding this the Contractor shall at his own expense repair all damage to pipework caused by flotation and/or by the methods adopted to prevent it.

C3.3.2.9.4.3.6 ZUT 7003.4.3.6 Installation of valves and meters

Unless otherwise specified or directed, gate valves shall be set upright and butterfly valves shall be set with the main shafts horizontal. All valves and meters shall be correctly set, supported, and placed in position as the work proceeds, and shall be properly jointed to their respective pipes.

All valves and fittings shall be left in working order and shall be housed in chambers as shown on the Drawings.

Valves, meter bodies and fittings shall be supplied, painted externally and internally. The Contractor shall thoroughly clean damaged exterior painted surfaces of all valves, meter bodies and fittings of all dirt, rust, grease and other foreign matter by methods approved by the Engineer and shall make good all damaged surfaces in accordance with the requirements of ZUT 0003.

Valves requiring special adjustment after installation such as self-closing valves shall be commissioned by representatives of the valve manufacturers. Similarly, meters shall be commissioned by the respective suppliers after installation by the Contractor.

All valves and meters supplied under separate contracts, which are defective due to circumstances outside the Contractor's control shall be repaired, replaced or modified by the valve suppliers who will also be responsible for commissioning the valves.

The mass of valves or water meters shall at no time be carried by the pipe, the flange or the coupling. Support stools shall be constructed as soon as practicable after the installation of valves and meters, and shall generally be constructed of steel, concrete or masonry work. Where fabricated steel stools are approved or specified they shall comply with the requirements of SANS 10044-3 and shall be fabricated to the Engineer's approval. Supports shall be welded to the pipe only where specified and linings of pipes and specials shall be made good after welding.

Hydrostatic testing of individual sections of the pipeline shall only be carried out when all scour valves, air valves and control valves have been installed, except where otherwise instructed by the Engineer in writing.

Should line control valves or other equipment not be delivered timeously to enable the Contractor to lay continuously and to test the pipeline, the Engineer may order the Contractor to substitute specially made temporary flanged closure pieces. Such temporary closure pieces shall be supplied and installed by the Contractor to enable laying and testing to proceed. Subsequently after installation of the control valves, etc., they shall be removed and shall become the Contractor's property. These temporary closure pipes shall have the same face to face dimensions as the line control valves and shall be fitted with a suitably reinforced control diaphragm plate for sealing of the section of pipeline where it is fitted.

Wall thickness and diameter of the closure pipes shall be the same as the pipeline. A 100 mm nominal bore valve-controlled by-pass shall be fitted externally around the diaphragm plate.

C3.3.2.9.4.3.7 ZUT 7003.4.3.7 Casings, anchor blocks and chambers

C3.3.2.9.4.3.7.1 ZUT 7003.4.3.7.1 Concrete casing

Where the Engineer requires pipes to be encased in concrete, a strength 20 MPa/19 mm, or such other strength as is scheduled, shall be used. The work shall be done as follows:

a) Concrete casing shall be discontinuous at flexible couplings in the pipeline.

b) The pipe trench for the concrete encased pipeline shall be excavated to the depth below the bottom surface of the pipe, as ordered or shown on the drawings, and to sufficient width to allow for the concrete to be placed to the full specified width. The bottom of the trench shall be trimmed true to line and grade.

c) The in situ concrete bed 150 mm thick shall be cast and the pipeline laid thereon true to line and level leaving a gap nowhere less than 50 mm between the pipe and the bed.

d) After jointing the pipes shall be secured to steel loops left in the bed. Concrete shall then be pinned under and around the pipes from one side only until the bottom quarter of circumference of the pipes is in contact with the concrete bed.

e) The pipe shall be tested in accordance with the applicable tests given in Clause 5, care being taken to ensure that the pipe do not move during testing.

f) After the pipeline has been tested, suitable formwork shall be erected and concrete carefully placed and vibrated in position up both sides of the pipe. The concrete level shall be raised equally on both sides of the pipe until encasement is complete and a cover over the surface of the pipe is provided that is nowhere less than that ordered or shown on the drawings.

g) No earth filling over the concrete shall be commenced until at least 7 days after the concrete has been placed.

C3.3.2.9.4.3.7.2 ZUT 7003.4.3.7.2 Anchor blocks

At tees, bends, terminal valves, end caps and where otherwise directed, anchor/thrust blocks shall be constructed to dimensions ordered or shown on the Drawings. Unless otherwise specified or indicated on the Drawings, anchor/thrust blocks and pedestals shall be constructed of 20 MPa/19 mm concrete or such other class as is scheduled.

The concrete shall be well punned round the pipe and, if in trenches, against the undisturbed faces and bottom of the trench. Backfilling behind or under thrust faces will not be permitted. Excess excavation shall be replaced with the prescribed mix concrete given above for anchor/thrust blocks at the Contractor's expense unless an item is scheduled to cover payment for overbreak. Care shall be taken to leave the joints accessible. No anchor/thrust blocks and pedestals shall be concreted until the approval of the Engineer has been obtained.

C3.3.2.9.4.3.7.3 ZUT 7003.4.3.7.3 Valve chambers

Valve chamber shall be constructed as indicated on the Drawings. Concrete chambers shall be constructed in accordance with the relevant clauses of SANS 1200 G or GA.

Lifting and relaying of existing pipes

C3.3.2.9.4.3.8 ZUT 7003.4.3.8 Brickwork in chambers and manholes

Each chamber and manhole shall be built to the details shown on a particular drawing or as shown on the applicable type drawing. The walls shall be constructed in an approved bond comprising header and stretcher courses with the fair face on the inside. No false headers shall be built in and only whole bricks shall be used except where closures are required to form bond.

The bricks shall be well soaked in water immediately before being laid and the course of bricks last laid shall be well wetted before fresh bricks are laid upon it. All walls shall be carried up regularly so that no part of the walling is more than 1,3 m higher than any adjoining wall.

Joints shall be flushed up solid at every course throughout the whole width of each course, which shall be laid on a solid bed of mortar of thickness not exceeding 10 mm, and, when applicable, the joints shall be raked out as the works proceeds to form a key for plaster.

Mortar for brickwork and plasterwork shall be composed of one part of cement to three parts of sand. Sand shall be clean pit sand free from clay and other impurities and, if so directed, shall be properly screened and washed.

If required, step irons for a manhole shall be built into the straight of the wall at 300 mm intervals staggered right and left in vertical rows. Cast iron fittings shall be bitumen painted. Each cast iron cover and frame shall be grouted solidly onto the shaft. Concrete surrounds of each manhole shall be finished off to suit surrounding surfaces.

C3.3.2.9.4.3.9 ZUT 7003.4.3.9 Lifting and relaying of existing pipes

Where shown on the drawings and where scheduled, existing pipes and fittings that are to be removed shall be lifted and the materials recovered as far as is practicable. The pipes and couplings shall be removed from the trench and placed in the Contractor's site store where they shall be cleaned, sorted, and listed. A copy of the list of undamaged material recovered shall be handed to the Engineer.

Unless, in terms of the contract, other pipes are to be laid in the same trench, each trench shall be backfilled as specified in SANS 1200 DB.

Where recovered pipes are scheduled to be re-laid, rubber rings, insertion packings, damaged joints, and rusted bolts shall be replaced.

Before they are repaid, an acceptable number of pipes shall be tested for compliance with the requirements of the application specification for resistance to hydraulic pressure.

C3.3.2.9.4.3.10 ZUT 7003.4.3.10 Disinfection of potable water pipelines

After completion of the laying and testing, each potable water pipeline shall be disinfected. The Contractor will be required to submit a detailed method statement for approval by the Engineer. A minimum requirement will be that the method statement deals with the method of dosing and how the dosing rate will be controlled to ensure a uniform distribution throughout the pipeline to be disinfected, the chemicals to be used, the anticipated range of dosing rates and equipment to be used, and the name and qualification the Contractor's person supervising the disinfection.

Once a successful hydraulic test of the entire pipeline has been achieved and the connections have been completed, the pipeline shall be drained. The pipeline shall then be re-charged in accordance with Clause 5.1.3.5 “Initial Filling of the Pipeline”. Whilst being charged, a sodium hypochlorite solution shall be introduced into the pipeline in such a manner as to ensure that a theoretical total chlorine concentration of at least 25 ppm (mg/l) is achieved throughout the pipeline.

Once the entire pipeline has been filled in this manner, it shall be left for a 24-hour period. Thereafter, total chlorine concentrations shall be measured at each scour and off-take point. A concentration of 20 ppm total chlorine will be considered acceptable. Should this concentration not be achieved at all scours and off- takes, the Contractor shall take all steps considered necessary by the Engineer to achieve satisfactory disinfection, at his/her own cost.

Once satisfactory disinfection has been achieved, the pipeline shall be drained via the scour valves (or by other means approved by the Engineer) and sufficient sodium thiosulphate (typically 1 part of total chlorine) shall be dosed into the scour-wet wells to fully neutralise the chlorine before discharging to watercourses.

The pipeline shall then be re-charged in accordance with the stated procedure and, after 24 hours, samples will be taken by the Engineer for analysis (at no cost to the Contractor). Should the following limits not be achieved, the Contractor shall carry out at his/her own cost, all steps deemed necessary by the Engineer to achieve satisfactory disinfection:

a) E.coli: Count = 0
b) Coliforms: Count = 0
c) Faecal Streptocci: Count = 0
d) In addition to a), b) and c), the water quality shall meet the requirements for potable water of the local authority or of the authority supplying such water to the area.

C3.3.2.9.4.3.11 ZUT 7003.4.3.11 Corrosion protection

C3.3.2.9.4.3.11.1 ZUT 7003.4.3.11.1 Final painting

After successful hydrostatic testing of the pipeline, and after completion of all construction work under this Contract, all external surfaces of uncoated steelwork and surfaces of all valves and fittings shall be prepared and painted as specified in the relevant clauses of Specification ZUT 0003. In addition, all surfaces of materials which had received first coats of paint in the course of the Contract in accordance with the specifications shall receive final coats of paint of the same colour or such other colours as may be specified or instructed by the Engineer.

All paint used shall be out of the original containers of the manufacturer and such containers are to be brought onto the site unopened. No adulteration will be permitted and paints shall be used strictly in accordance with the manufacturer's instructions.

Painting shall not be done in wet or humid weather.

C3.3.2.9.4.3.11.2 ZUT 7003.4.3.11.2 Butt-welded steel pipes

As soon as practicable, but not more than 24 h after the welding of joints in the field has been approved and accepted by the Engineer, the internal lining of pipes and specials shall be made evenly continuous over the joints.

Materials for this work shall have the same properties as those used respectively for the adjacent lining or coating and shall be so applied that the finished work over the joint shall have the same quality as specified respectively for the adjacent lining or coating and shall be capable of passing the same tests as specified for adjacent lining or coating.

C3.3.2.9.4.3.11.3 ZUT 7003.4.3.11.3 Metal couplings

In addition, all buried metal couplings and all metal couplings located inside chambers, shall be protected with "Denso" petrolatum as per the requirements of Specification ZUT 0003.

C3.3.2.9.5 ZUT 7003.5 COMPLIANCE WITH REQUIREMENTS

C3.3.2.9.5.1 ZUT 7003.5.1 TESTING

C3.3.2.9.5.1.1 ZUT 7003.5.1.1 General

Testing shall be in accordance with this clause and Specifications ZUT 0003, 7001 and 7002, as relevant.

As the work proceeds, pipelines shall be hydrostatically tested by means of test equipment supplied by the Contractor.

Each test shall be carried out in the presence of the Engineer or his representative. The Contractor shall be responsible for carrying out all tests and for all expenses incurred.
When carrying out the hydrostatic tests, the Contractor shall ensure that all valves, tees, and bends are properly secured and shored to prevent movement of pipes and fittings and, should any such movement occur, the Contractor shall, at his own expense, reposition and, if necessary, repair the pipes and fittings and the securing means.

Until each section of the pipeline has been subjected to the hydrostatic test and has complied with the applicable requirement for leakage rate, the pipeline will not be accepted. The hydrostatic test shall be repeated until the Engineer is satisfied that the section under test complies with the said requirement.

C3.3.2.9.5.1.2 ZUT 7003.5.1.2 Testing of field welds

C3.3.2.9.5.1.2.1 ZUT 7003.5.1.2.1 Destruction tests

Tests as specified in API 1104 Clause 6.5 shall be carried out and approved prior to any field welding being done.

C3.3.2.9.5.1.2.2 ZUT 7003.5.1.2.2 Radiographic testing

Radiographic tests and adjudication of test records shall be carried out by an Independent Inspectorate, appointed by the Engineer to act on his behalf. The Inspectorate shall be afforded every facility during the course of pipeline construction and testing to enable the inspection to be carried out effectively. 10% of the total length of all manual field butt welds and 2,5% of the total length of field welds done by an approved automatic process shall be examined radiographically with particular reference to weld intersections, using equipment supplied and staffed by the Inspectorate. All welds on critical sections such as river, rail and road crossings shall be 100% radiographically tested.

The Engineer reserves the right to increase the length of welds to be radiographed if results obtained are not satisfactory or to reduce the length of welds radiographed to a minimum of 4% if the standard of welding is sufficiently high to warrant such a reduction.

The Inspectorate shall process and adjudicate radiographs on site. The standard of acceptability shall be in accordance with API 1104. All welds which are found to be unsatisfactory shall be repaired and 100% re- radiographed at the Contractor's expense. The additional radiography of repaired welds shall not be deemed to be included in the overall 10% or 2,5% radiography.

Field welds may be examined by radiographic inspection as stated in API 1104. Should two or more welders participate in making the weld, the welding foreman and the Engineer's Representative shall decide which welder is responsible for the defective work. The Engineer shall be privileged in the judgement of his inspector to cut out welds for further tests. The test welds (except the initial free test referred to in 5.1.2.1) that meet the Engineer's requirements and specifications when properly tested shall be replaced with a satisfactory tie-in at the Employer's expense. Should any test weld cut from the line prove unsatisfactory to the Engineer when properly tested, it shall be replaced at the Contractor's expense. Test welds shall be cut from the line as soon as practicable after completion to avoid unnecessary delay and expense, and shall consist of an annular ring not less than 230 mm long with the weld in the middle.

When welding the line together at places where the test welds have been cut out, one weld will be used if it is practicable to pull the line back into position; otherwise, two welds will be made by setting in a short length of pipe with a minimum length of 750 mm.

The Contractor shall furnish approved types of machines for testing. A record of the results of each test weld shall be made by the Engineer's inspector and jointly signed by the Engineer's Representative and Contractor's Representative. The Contractor will be reimbursed for extra welds at the rates tendered if scheduled in the Contract as a separate item. Extra welds shall be construed to mean those welds cut out at the Engineer's request which, after specified tests, are found to meet the Engineer's specifications, except those free initial test welds referred to herein.

Claims arising from delays in construction caused by justifiable additional radiography which may be ordered by the Engineer or re-radiography of repairs, will not be considered.

C3.3.2.9.5.1.2.3 ZUT 7003.5.1.2.3 Dye-penetrant testing

A 100% dye penetrant test shall be carried out by the Contractor on all field welds except where radiographic testing is undertaken.

The dye-penetrant test shall be carried out in accordance with BS 4416 and as detailed below:

a) The Contractor shall obtain the approval of the Engineer for the group of dye-penetrant and developer that he proposes to use for the test;

b) As pipe laying progresses, field welds shall be subjected to the test soon after each weld is completed;

c) In order to obtain a surface that is dry, clean, and free from scale, dirt and grease, the Contractor may grind but he shall not grit blast the surface;

d) The temperature of the surface to which the developer and the penetrant are applied shall not be below 16˚C or above 52˚C;

e) Observations for indications shall be made not less than 15 minutes and not more than 60 minutes after the application of the penetrant;

f) Any surfaces on which non-relevant indications are observed shall be explored by visual methods and, if considered necessary by the Engineer, such surfaces shall be cleaned and retested; and

g) Welds that show no relevant trace of dye on the developer will be accepted.

C3.3.2.9.5.1.2.4 ZUT 7003.5.1.2.4 Visual testing

All field welds shall be inspected visually throughout their entire length by the Contractor for signs of possible faults. Full records of the testing of each joint shall be kept by the Contractor and his findings reported to the Engineer. The Contractor shall allow the Engineer and/or the Inspectorate to also inspect up to 10% of the number of field welds visually.

C3.3.2.9.5.1.2.5 ZUT 7003.5.1.2.5 Testing of fillet welds

In addition to the dye penetrant tests, each fillet weld on pipes of DN 600 and over shall be air and bubble tested by pumping air into the annular space between the welds to a pressure of at least double the specified working pressure. While this pressure is maintained, all welds and connections shall be tested with soap or primer. Defects found during testing shall be repaired by the Contractor, and testing continued all at the Contractor's expense until a satisfactory result is obtained.

The test tapping point shall then be plugged in an approved manner.

C3.3.2.9.5.1.2.6 ZUT 7003.5.1.2.6 General

The pipeline shall be hydrostatically tested on completion of pipe laying and after installation of all valves and fittings. Test sections shall be blanked off by making use of end-caps. Installed isolating valves within the test section shall not be used as end-caps.

The Contractor shall submit to the Engineer a detailed method statement describing the timing, methodology and scheduling of each hydrostatic pressure test to be undertaken. No test shall proceed before approval of such method statement by the Engineer.

If sections of a pipeline are encased in concrete, or where concrete anchor blocks or other structural concrete structures had been provided, the Contractor shall allow for a minimum concrete setting period of 28 days prior to the hydrostatic test being executed.

The Contractor shall supply water from an approved source for hydraulic testing of the pipeline. Pipelines designed for potable use shall be hydraulically tested and disinfected using potable water. Water used for one filling of the pipeline for hydraulic testing, one filling for disinfection and one filling after draining the disinfection water will be provided by the Employer to the Contractor, free of charge, at the connection points stated in the project specifications. Items have been provided in the Bill of Quantities to cover the cost of receiving and conveying water from the supply point to the test section of pipeline. Additional water supplied by the Employer owing to unsuccessful disinfection and/or hydraulic testing will be charged to the Contractor.

C3.3.2.9.5.1.2.7 ZUT 7003.5.1.2.7 Test pressure and time of test

After the pipe trench has been backfilled the pipeline shall be tested in sections between end caps, blank flanges, or other isolating devices, at the pressures appropriate to the pipeline section under test. The Engineer may require that blank flanges or “spades” be inserted and that the pipeline be tested in reduced lengths and, in addition, at the point of maximum pressure.

Unless otherwise specified, shown on the drawings, or approved by the Engineer, the average test pressure for field testing shall be 1,25 times the pressure rating of the pipe.

Where the pipeline is tested in sections, the Contractor will have the discretion to determine the sections in which the pipeline may be tested provided that:

a) The test sections shall be determined, taking any differences in elevation along the pipeline into account, such that the:
   i) maximum field test pressure at any point along the section is not higher than 1,5 times the pressure rating of the pipe or the maximum field test pressure permitted by the pipe manufacturer; and
   ii) minimum field test pressure at any point along the section is not less than the greater of:
      1) the pressure rating of the pipe, or
      2) 1,25 times the maximum working pressure at these points.

b) The first km (+200m,-100m) of pipeline laid is successfully tested before the subsequent section may proceed.

c) The Contractor shall make due allowance in the construction programme and in the tendered rates for the entire testing operation including for the provision of temporary end stops (flanges or bullnoses) and any other costs associated with testing the pipeline in intermediate sections.

Once filled, the pipe shall be left for 24 hours to permit maximum saturation. The section to be tested shall then be pressurised to the specified pressure and left for a further 24 hours, during which period, the pressure drop (if any) and the quantity of water required to be pumped in to restore the test pressure shall be measured and recorded. In addition, all flexible and flanged joints shall be visually inspected and there shall be no sign of leakage.

At all times when there is water in the pipeline, and particularly during filling, testing and draining of the pipeline, all air valves shall be in operation and their individually isolating valves shall be open.

C3.3.2.9.5.1.2.8 ZUT 7003.5.1.2.8 Visible leaks

a) Except as allowed in b) the specified test pressure shall be maintained for a period of at least 24 hours (or such longer period as is necessary for inspection of the pipeline) during which period all pipes, pipe specials, joints, and fittings shall be carefully inspected for leaks. All visible leaks shall be made good and any pipe, pipe special, or fitting found to be defective shall be removed and replaced at the expense of the Contractor and such replacement material shall, after installation, be tested at the expense of the Contractor.

b) In the case of pipes of DN 400 and under, the test period may be reduced proportionally to the nominal diameter of the pipe, provided that in no case shall the test period be less than 1 hour.

C3.3.2.9.5.1.2.9 ZUT 7003.5.1.2.9 Permissible leakage rates

The test pressure shall be maintained for a further period of 1 hour after the completion of the test period specified in Clause 5.1.3.3, during which time the volume of water required to be pumped into the pipeline for maintenance of the pressure shall be measured.

The permissible leakage for welded and flanged steel pipelines is zero (0) litres.

C3.3.2.9.5.1.2.10 ZUT 7003.5.1.2.10 Initial filling of pipeline

The entire process for filling the pipeline at any time during testing or disinfection shall be carried out under the supervision of the Engineer. Under no circumstances will the Contractor be allowed to carry out filling
of the pipeline without the supervision of the Engineer, neither shall the Contractor permit any other persons to carry out such filling without the written permission of the Engineer.

Unless otherwise specified or approved in writing by the Engineer, filling of the pipeline for hydraulic testing shall be carried out at a velocity in the main pipeline not exceeding 0.5 m/s.

Any damage to the pipeline caused by non-compliance with this clause shall be rectified at the Contractor's expense.

C3.3.2.9.5.1.2.11 ZUT 7003.5.1.2.11 Connections after testing

The connections of the new pipework to the existing pipework shall only be carried out after the pipeline testing has been completed and accepted by the Engineer. For this reason, testing must be carried out against a blank flange or bullnose end cap at these locations.

C3.3.2.9.5.1.2.12 ZUT 7003.5.1.2.12 Remedial measures

In the event that a pipe section fails a test, the Contractor shall carry out all remedial measures necessary to obtain a successful test of each individual section and the entire pipeline, at his/her own expense. Such remedial measures shall in no way compromise the requirements stipulated in the specifications.

C3.3.2.9.5.1.2.13 ZUT 7003.5.1.2.13 Draining of the pipeline

The pipeline may have to be drained to carry out remedial measures and it must be drained before the disinfection process commences. The pipeline shall be drained via the scour valves in a manner that does not cause erosion of the streambeds or negatively impact on the environment in any way. All such drainage of the pipeline shall be carried out under the supervision of the Engineer.

C3.3.2.9.5.1.3 ZUT 7003.5.1.3 Commissioning

The pipeline will be considered to have been commissioned and practically complete once all the associated structures are sufficiently complete to carry out their structural and hydraulic function and the hydraulic test and disinfection of the entire pipeline has been successfully completed.

C3.3.2.9.5.1.4 ZUT 7003.5.1.4 Water tightness testing for chambers

Refer to the SANS 1200 G or 1200 GA, as applicable.

C3.3.2.9.5.1.5 ZUT 7003.5.1.5 Tests on epoxy linings

Once all work in the pipeline has been completed bar the hydrostatic testing and backfilling, the pipeline shall be cleaned by sweeping with a soft broom and rinsing. Access to this section shall be restricted from this point forward and will only be allowed on the written consent of the Engineer.

Holiday detection testing is to be undertaken by the Contractor on the lining in order to ensure that it remained intact during the transport, handling, placing and backfilling processes. Holiday testing may also be undertaken by the Independent Inspectorate. The testing and repair procedures shall be in accordance with the requirements stipulated in Specification ZUT 0003.

C3.3.2.9.5.1.6 ZUT 7003.5.1.6 Pipe coating integrity surveys

The Contractor shall perform the pipe coating integrity survey as defined in the cathodic protection specifications.

C3.3.2.9.5.2 ZUT 7003.5.2 TOLERANCES

C3.3.2.9.5.2.1 ZUT 7003.5.2.1 General

No deviation will be permitted from the minimum pipe cover specified or shown on the Drawings.

C3.3.2.9.5.2.2 ZUT 7003.5.2.2 Control points

For the purposes of this Clause, valves and pipe specials set on the centre line of the pipeline and designated changes in gradient shall be regarded as control points and shall be located with a permissible vertical deviation of ± 100 mm on the centre line. The same deviation will be permissible laterally except where the pipeline is laid at a designated distance from a fence line, kerb line, or boundary, in which case the permissible deviation shall be ± 20 mm.

Unless otherwise directed and subject to a permissible deviation (measured along the centre line) of ± 2 m, scour valves shall be located at the lowest points in pipelines and air valves at the highest points.

C3.3.2.9.5.2.3 ZUT 7003.5.2.3 Alignment

PLAN (horizontal alignment): Unless otherwise directed, the permissible deviation from the defined alignment of the pipeline, when measured on the top centre of the pipeline, shall be ± 100 mm or ± 10% of the nominal diameter of the pipe, whichever is the larger, and the permissible deviation per pipe length shall be ± 20 mm.

LEVEL (vertical alignment): The permissible deviation from the designated level at any point on the invert of the pipeline shall be ± 50 mm or ± 10% of the nominal diameter of the pipe, whichever is the larger.

C3.3.2.9.5.2.4 ZUT 7003.5.2.4 Manholes, valve chambers, etc.

Manholes, valve chambers and the like shall be constructed centrally on the control points and, with the exception of tolerances that affect access to bolts, nuts, etc., with a permissible deviation of ± 50mm on all clearance dimensions. The clearance dimension between the outside of each nut and bolt-head and the inside face of the wall of a structure or any other fitting shall be at least the specified value.

C3.3.2.9.6 ZUT 7003.6 TOLERANCES

Refer to Clauses 4 and 5.

C3.3.2.9.7 ZUT 7003.7 TESTING

Refer to Clause 5.

C3.3.2.9.8 ZUT 7003.8 MEASUREMENT AND PAYMENT

C3.3.2.9.8.1 ZUT 7003.8.1 BASIC PRINCIPLES

C3.3.2.9.8.1.1 ZUT 7003.8.1.1 General

Excavation and backfilling of trenches, and laying of medium-pressure pipelines, will be measured separately under SANS 1200 DB and Clause 8.2 of this Specification.

C3.3.2.9.8.1.2 ZUT 7003.8.1.2 Night-caps

No extra payment will be made for night-caps. The supply and use of night-caps will be held to be included in the unit rate tendered for pipe laying.

C3.3.2.9.8.1.3 ZUT 7003.8.1.3 Permanent closure pipes

C3.3.2.9.8.1.3.1 ZUT 7003.8.1.3.1 Butt welding

Where closures are butt welded to other pipes, the cost of cutting the pipe, preparing the end for welding and welding as specified in SANS 719, repairing the lining and coating as specified in Specification ZUT 0003 will be held to be included in the unit rate for laying of pipes.

C3.3.2.9.8.1.3.2 ZUT 7003.8.1.3.2 Slip-on couplings

Where closures are jointed to either access pipes, fittings or specials by means of slip-on couplings, no additional payment will be made for extra cutting of the pipe, preparing the end for welding, welding on the loose collar (approved 150 x 20 mm mild steel, machined round to suit coupling) or making good the lining.

Unless separately billed, the supply, transport and handling of the collar and slip-on coupling will be held to be included in the unit rate for the supply of pipes, fittings and specials.

C3.3.2.9.8.1.4 ZUT 7003.8.1.4 Extra welds

Payment for all extra welds shall be covered by variation orders showing the location of the welds according to stake value and other necessary details. Such variation orders shall be signed by the Engineer's Representative and the Contractor's Representative in the field on the day the work is done. No payment will be made for test welds not covered by variation orders as stated above.

C3.3.2.9.8.2 ZUT 7003.8.2 BILLED ITEMS

C3.3.2.9.8.2.1 ZUT 7003.8.2.1 Lay and bed steel pipes and specials complete with couplings

a) Pipes……..…….Unit: metre (m)

b) Specials……..…Unit: number

Pipes will be measured linearly as laid in the trench. No deduction will be made for specials and valves. Separate payment will be made for each type, size and class of pipe laid.

Specials will be measured separately by number of each type.

The unit rates tendered in the Bill of Quantities for laying of pipes and specials shall cover the cost of the following:

a) Inspecting, accepting, taking delivery, providing storage, taking delivery from storage on site, transporting, handling, inspecting, stringing alongside trench, forming joint (“fox”) holes, laying, jointing, cutting, scarfing, cutting mitre deflections up to 10 degrees (5 degrees per side), bevelling, maintaining line and level, jacking for ovality if necessary, provision and use of shield for heat treatment and welding if required;

b) maintenance of cleanliness including all night caps and temporary blank flanges, etc., necessary to keep the inside of the pipe dry;

c) removal, where necessary, and making good of lining and coating over the joints;

d) radiographic examination of field welds and holiday testing of the lining, visual and dye penetrant testing;

e) testing of welders and issuing of the necessary certificates;

f) making good all linings and coatings;

g) hydrostatic testing, testing equipment and anything required to do this work, including temporary end caps and blank flanges;

h) sterilizing the pipeline where used for potable water;

i) bolts, nuts, washers, gaskets and insulating material;

j) supply and installation of steel and or concrete pipe supports (not necessarily shown on drawings);

k) building in of specials (Refer to Item 8.2.11)

No extra payment over and above the rates tendered in the Bill of Quantities will be made in respect of additional cutting and jointing of pipes required to locate valves, specials, etc., exactly.

No separate payment will be made for the supply and fitting, chipping of lining, cutting, trimming, bevelling and making good on Site of any additional couplings and jointing materials which may be required for the connection of shortened pipe closures, unless specific provision is made in the Bill of Quantities.

The unit rate tendered for laying of steel pipes and specials shall cover the cost of the laying, jointing, etc., as specified and, in addition, for final painting and surface preparation when applicable. No extra-over payment shall be made for protecting metal couplings with petrolatum wrappings as per Specification ZUT 0003.

Notwithstanding the use of night-caps the Contractor shall at his own expense make good all damage to pipe linings and fittings caused by the ingress of dirty water, silt, sand, debris, vermin, insects and other foreign matter. The Contractor shall at his own expense and to the satisfaction of the Engineer clean the interior of the pipeline of such contaminants.

A maximum payment of 85 % of the tendered rate may be made for the completed section of pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 10% of the tendered rate will be made upon successful completion of the pressure testing for the relevant section of pipeline. The final 5% of the tendered rate will be made upon completion of disinfection of the pipeline.

C3.3.2.9.8.2.2 ZUT 7003.8.2.2 Extra-over for mitre deflections

Unit:……...number (No.)

Where additional mitre deflections (up to 10 degrees) are ordered by the Engineer, these will be measured by number.

The rate shall cover the all the costs associated with mitre deflections detailed in Item 8.2.1 (a) to (f).

C3.3.2.9.8.2.3 ZUT 7003.8.2.3 Installation of valves and meters

Unit:……...number (No.)

The unit rate for installation of valves and meters shall cover the cost of taking delivery of these items from storage on site, inspecting each item for visible signs of damage, transporting to the laying site, off-loading, installing and, except where separately billed, of testing and commissioning of the valves and meters in position in accordance with the manufacturer's instructions and to the satisfaction of the Engineer.
No extra payment over and above the rate will be made in respect of any additional cutting, turning and jointing of pipes required for the location of a valve, meter, etc. where a precise position is given on the drawings.

The tendered rate shall also cover all jointing materials and, except where separately billed, support pedestals. The rate tendered for installation of valves and meters shall also include the cost of necessary oiling and greasing of moving parts and for minor routine initial maintenance work such as tightening up leaking glands.

The unit rates shall include for the cost of making good and the repair of paintwork and final painting as specified.

C3.3.2.9.8.2.4 ZUT 7003.8.2.4 Recover old pipeline

Unit:…….metre (m)

The total length of the pipeline ordered to be recovered will be measured by length for each stated depth range. No deductions will be made for valves, specials, and the like.

The rate shall cover the cost of the excavation and removal of pipes, valves, and fittings from the trench, the handling and transportation to the Contractor's store on site, the cleaning and listing of the salvaged recovered materials, and the backfilling of the trench.

C3.3.2.9.8.2.5 ZUT 7003.8.2.5 Test and relay recovered pipe

C3.3.2.9.8.2.5.1 ZUT 7003.8.2.5.1 Test recovered pipes on site before relaying

Unit:……...number (No.)

The rate shall cover the cost of the provision of suitable testing equipment and the carrying out of the specified test.

C3.3.2.9.8.2.5.2 ZUT 7003.8.2.5.2 Relay pipeline

Unit:……..metre (m)

The rate shall cover the cost of transporting, handling, laying, and bedding, as well as the provision of new rubber rings or insertions, as the case may be. Couplings and bolts that have to be replaced will be paid for at daywork rates unless a suitable item such as 8.2.4.3 below has been provided in the Bill or, in the opinion of the Engineer, the need for their replacement arose from the fault or negligence of the Contractor.

C3.3.2.9.8.2.5.3 ZUT 7003.8.2.5.3 Joints and couplings for recovered pipeline (Provisional)

Unit:……number (No.)

The rate shall cover the provision of complete sets, each comprising a new rubber ring or insertion, as the case may be, as well as all elements of the coupling and bolts that need replacement.

C3.3.2.9.8.2.6 ZUT 7003.8.2.6 Anchor/thrust blocks

a) Dimensions stated or given on drawing – Unit: ……..No. or Sum

OR

b) Where, at the tender stage, no detailed drawings or dimensions are given or where only typical drawings are given:
Concrete – Unit: m3
Formwork – Unit: m2
Reinforcement – Unit: ton

Except where measured by number or sum, anchor/thrust blocks will be measured as the volume of concrete, areas of formwork, and mass of reinforcement, as relevant, placed to dimensions ordered or given on the drawings and schedules of reinforcement. The relevant terms of Clause 8 of SANS 1200 G or SANS 1200 GA, as applicable, shall apply.

Where measured by number or sum, the rate or sum shall cover the cost of excavation and trimming, formwork, reinforcement (if any), and screeding of top surfaces.

C3.3.2.9.8.2.7 ZUT 7003.8.2.7 Concrete casing

Unit:……..……m^3

The concrete will be measured net by volume to the specified width and depth in excess of the external volume of the pipe (i.e. the volume of the pipe will be deducted).

The rate shall cover the cost of formwork (including stop ends at flexible joints), reinforcement (if any) and concrete.

C3.3.2.9.8.2.8 ZUT 7003.8.2.8 Valve chambers

Unit:……...number (No.)

Valve chambers will be measured as complete units.

The rate shall cover additional excavation (see Subclauses 8.2.2 and 8.2.3 of SANS 1200 DB), materials, plant, and labour necessary for the complete construction including the installation of covers, ladders and ancillaries shown on the drawing.

C3.3.2.9.8.2.9 ZUT 7003.8.2.9 Manholes

Unit:……...number (No.)

Manholes will be measured as complete units for which separate items will be scheduled for each type of manhole and depth categories.

The rate shall cover additional excavation, materials, plant, and labour necessary for the complete construction including the installation of the covers, ladders and ancillaries shown on the drawing.

C3.3.2.9.8.2.10 ZUT 7003.8.2.10 Temporary closure pipes (Provisional)

Unit :…….. number (No.)

Temporary closure pipes will be measured as provisional items by number only where ordered by the Engineer.

The unit rate shall cover the cost of the supply, installation, removal and making good of the pipe.

Excavation, backfilling and supply of bedding material will be measured and paid for separately as specified in SANS 1200 DB and SANS 1200 LB.

C3.3.2.9.8.2.11 ZUT 7003.8.2.11 Items cast or built into concrete

Unit: ……...number (No.)

The building in (or casting into concrete) of the pipes and pipe specials will be measured by the number of each item built in.

The unit rate shall cover the installation of the pipe or pipe special as well as all additional costs of formwork, concreting and fixing of pipes and specials which are not covered by the normal tendered rates for formwork and concrete.

C3.3.2.9.8.2.12 ZUT 7003.8.2.12 Pipe lining integrity tests

Unit: ……..lump sum (Sum) or metre (m)

Payment for tests on linings will include for all labour, the cost of supplying fuel and production related wearing parts (bucket teeth, cutters etc.) for equipment utilised, and materials to perform all tests and repair work as defined in Specification ZUT 0003. Payment for the pipeline section tested and repaired will be certified for payment only on written acceptance of successful testing and repair work as defined in Clause 5.1.6.

C3.3.2.9.8.2.13 ZUT 7003.8.2.13 Concrete/steel valve and pipe supports

Unit: ……..number (No.)

Except where billed separately, payment for the supply and installation of concrete or steel supports to valves, meters, pipe specials, etc. shall be included in the rates tendered for the installation of these items.

Where billed separately, the rate for supports shall cover all material, plant and labour required for the supply and installation of the support, including all anchor bolts and jointing material. In the case of steel supports, the cost of the corrosion protection shall be included in the rate tendered for the support.

Annexures

APPENDIX A. APPLICABLE STANDARDS

API 1104 : Standard for welding of pipe lines and related facilities.

SANS 719 : Electric welded low carbon steel pipes for aqueous fluids (Ordinary duty)

SANS 10044-3 : The fusion welding of steel (including stainless steel):
Tests for approval of welding procedures and production welds.

SANS 1200 G : Concrete (structural)

SANS 1200 GA : Concrete (small works)

SANS 1200 L : Medium-pressure pipelines

SAECC/1

Specification ZUT 7001 : Design and manufacture of medium-pressure steel specials

Specification ZUT 0003 : General corrosion protection for pipelines, water and wastewater works

C3.3.2.10 ZUT 7004 VALVES FOR WATER AND WASTEWATER INSTALLATIONS

C3.3.2.10.1 ZUT 7004.1 SCOPE

ZUT 7004 deals with the design, manufacture, installation and commissioning of all valves and ancillaries for the control of raw water or sewage. It furthermore covers the flange machining standards, dimensions, the range and type of gaskets, corrosion protection and jointing to be used for flange joints.

The installation shall be as shown on any applicable drawings provided with the tender documents.

The scope of work for which the Contractor is responsible is specified elsewhere.

C3.3.2.10.2 ZUT 7004.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification.

b) Data Sheets.

c) SANS 936/937, SANS 191, SANS 664, SANS 665, SANS 1849, and SANS 1123

d) ZUT 0001: General Mechanical Requirements.

e) ZUT 0002: Operating and Maintenance Manual.

f) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

g) ZUT 7015: Metal Seated Wedge Gate Valves.

h) ZUT 7016: Resilient Seal Gate Valves.

i) ZUT 7017: Slanted Seat Check Valves.

j) ZUT 7022: Air Release Valves.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.10.3 ZUT 7004.3 DEFINITIONS

For the purpose of this Section the following definitions apply:

a) "**Face to face dimension**" means the distance between the two planes perpendicular to the body axis located at the extremities of the body and ports.

b) "**Nominal pressure (PN)**" is a numerical designation, which is a convenient round number for reference purposes. It is designated by PN followed by the maximum allowable working pressure, of which the flange is intended to be a component, will be subjected under normal working conditions. This definition is in accordance with ISO 7268. All pressure units throughout this specification will be recorded in kilopascals (kPa).

c) "**Nominal size (DN)**" is a numerical designation of size that is common to all components in a piping system other than components designated by outside diameters. It is a convenient round number for reference purposes and is only loosely related to

manufacturing dimensions in millimetres. Nominal size is designated by DN followed by the size in millimetres. This definition is in accordance with ISO 6708.

d) "**Tight shut off valve**" means a valve that has no leakage past the sealing faces in its closed position under test conditions.

e) "**Low leakage rated valve**" means a valve that has an agreed maximum leakage rate past the sealing faces when the valve is in the closed position.

f) "**Regulating valve**" means a valve intended for regulating pressure and flow, and which may have a clearance between the sealing faces when the valve is in the closed position.

g) "**Pressure rating**" is the maximum allowable working pressure of an installation of which the flange is intended to be a component.

C3.3.2.10.4 ZUT 7004.4 MATERIAL SYMBOLS

Where appropriate the following abbreviations shall refer to the material designated:

- austenitic cast iron AI
- spheroidal graphite cast iron SG
- gunmetal GM
- aluminium bronze AB
- phosphor bronze PB
- mild (carbon) steel MS
- stainless steel SS
- nickel copper NC
- integral seat IS
- resilient seat RS
- weld deposited seat WDS
- cast steel CS
- polyterafluoroethylene PTFE

C3.3.2.10.5 ZUT 7004.5 GENERAL DESIGN REQUIREMENTS

C3.3.2.10.5.1 ZUT 7004.5.1 PRECEDENCE

The Project Specification has precedence over this Particular Specification. Any conflict between the technical requirements stated in the Project Specification and the technical requirements of this Specification shall be referred to the Engineer for clarification.

C3.3.2.10.5.2 ZUT 7004.5.2 DEVIATIONS

The Client will not permit any substitution or deviation from the requirements of this Specification without prior approval. Any substitution or deviation from the original Specification shall be submitted to the Engineer for approval. Deviation shall only be considered during the tender stage of the project.

C3.3.2.10.5.3 ZUT 7004.5.3 OPERATING CONDITIONS AND CLIMATE

Valves selected for this Contract shall be designed for various hydraulic conditions and be capable of opening and closing under these conditions. Valves shall be suitable of operating at water temperatures up to 50 °C and the quality of the water shall be assumed to be highly corrosive.

C3.3.2.10.5.4 ZUT 7004.5.4 NOMINAL PRESSURE

Each valve is assigned a nominal pressure (PN) in kPa and shall be tested in accordance with this specified pressure.

C3.3.2.10.5.5 ZUT 7004.5.5 MINIMUM PRESSURE RATING

1000 kPa is considered to be the lowest acceptable pressure rating for any valve and associated equipment irrespective of lower system pressures.

C3.3.2.10.5.6 ZUT 7004.5.6 DESIGN LIFE

All valves and appurtenant fittings shall be designed for a useful life of forty-five (45) years under the operating conditions specified in the Project Specification. The manufacturer would be prepared to guarantee its satisfactory performance for 5 years, if called upon to do so.

C3.3.2.10.5.7 ZUT 7004.5.7 GUARANTEE

All valves shall be guaranteed against faulty design, materials and workmanship for a period of 5 years, from date of issue of the Taking Over Certificate and shall terminate with the issue of the Performance Certificate by the Engineer.

During this period the Contractor shall attend to and rectify at his own cost any defects that can be attributed to faulty design, materials and workmanship. Normal wear and tear, especially applicable to rim seal butterfly valves, but not to vulcanised rubber-lined butterfly valves, shall be excluded.

In order to avoid expiry of the guarantee while these valves are still in storage prior to installation, the Client will request the reinstatement of the guarantee at final commissioning of the Plant.

To promote reinstatement, the Contractor shall, provide the requirements for storage of the valves, prior to installation, in order for him to honour the implementation of the guarantee at a later stage. The Contractor shall inspect and approve the storage area prior to delivery of the valves.

C3.3.2.10.5.8 ZUT 7004.5.8 END CONNECTIONS

All valves shall be double flanged or double spigotted or double socketed end connections as specified in the schedules.

All holes of double flanged valves shall be drilled perpendicular to the face. Cast flanges shall either be machined or spot faced on the bolt head/nut bearing faces.

Sufficient clearance shall be allowed between the body and flange to enable flange bolts to be removed or tightened. Tapped holes shall be permissible only where stiffening ribs or shaft bosses interfere with bolts.

Flanges shall conform to SANS 1123. Flanges shall be thickened at points where tapped holes are necessary. Flanges shall have raised joint faces machined in accordance with the above standard and fitted with ring gaskets.

C3.3.2.10.5.9 ZUT 7004.5.9 FASTENERS AND JOINTING MATERIAL

Valves shall be supplied complete with bolt units, consisting of a standard length bolt, nut and two washers. The stud unit, where applicable, shall be supplied with a standard length stud, nut and washer. Washers shall be fitted under all bolt/screw heads and nuts.

The manufacturer shall specify a fastening sequence for bolts (if applicable) and the torque settings (in Nm) for all bolts. These torque settings and fastening sequences shall be included in the Operation and Maintenance Manual.

In addition each valve shall be supplied with 3mm non-asbestos type gaskets or insulating gaskets complete with explosion-proof spark gap arrestors as indicated on the drawings.

Depending on the valve location in a piping system and the atmospheric conditions, the following specifications will apply:

- Black bolted units: SANS 1700
- Precision bolted units: SANS 136
- Galvanised bolted units: SANS 121 (ISO 1461)
- Stainless steel bolted units: DIN 931 complete with insulating kit (on all stainless steel and 3CR12 piping and specials and where specified).
- Stainless steel set screws: DIN 933

Where shown on the Drawings flange insulating kits shall be supplied with the correct size bolts and nuts together with two insulating washers, and insulating sleeve for each bolt. All insulating gaskets shall be of the full-face type as to prevent foreign material from collecting and creating a bridge, thus shorting out the isolation.

For all valve components, i.e. bonnet covers, glands etc., drilled holes for bolts shall be perpendicular to the flange face.

All bolts and stud units shall be the same length, appropriately sized and where applicable be corrosion protected.

C3.3.2.10.5.10 ZUT 7004.5.10 VALVE SUPPORTS AND LIFTING LUGS

Valves of DN400 and larger shall have supports integrally cast with the valve body. These supports shall be designed for direct grouting or bolting to the plinths where required.

Valves over DN300 or 75 kg mass shall either have two removable eye bolts of the required strength securely attached to the valve body or lifting eyes forming an integral part of the valve body to facilitate easy handling during transport and installation.

C3.3.2.10.6 ZUT 7004.6 CONSTRUCTION

C3.3.2.10.6.1 ZUT 7004.6.1 BODIES

Bodies shall be of sturdy construction, capable of functioning satisfactorily under abnormal operating conditions without distortion of the body or malfunction of component parts and shall be shaped to give minimum change in waterway.

Designs of bodies and components shall be free of pockets that cause eddies or accumulate debris.

Where applicable, access openings and covers shall be well designed and the creation of stress risers shall be prevented. Any gussets applicable to the design of the valve should form an integral part of the casting.

C3.3.2.10.6.2 ZUT 7004.6.2 DOORS AND DISCS

Doors and discs shall, were applicable, be cast or fabricated as a unit with integrally cast hinge lugs.

Doors and discs shall operate freely. Their travel shall however be restricted by the provision of substantial stops, fitted with specified facings to minimize wear and damage to the corrosion protection.

C3.3.2.10.6.3 ZUT 7004.6.3 SEALING FACES

Sealing faces shall be either replaceable stainless rings securely fixed with stainless steel fasteners or stainless steel deposit welded as specified in the Project Specification.

Faces shall be accurately machined and micro finished promoting seal life.

C3.3.2.10.6.4 ZUT 7004.6.4 BEARINGS

Main bearings shall, were applicable, be external and accessible without emptying or removal of the valve body from the line.

Bearings shall be designed to take any unbalanced thrusts on doors or discs.

Bearings shall retain a low co-efficient of friction. Any possibility of bearings becoming tight during service due to ageing shall be eliminated.

Where possible, bearings shall be water lubricated with a proven record of reliable operation of not less than five (5) years.

Details of the type and construction of bearings shall be as specified in the relevant Valve Specification.

Where shafts protrude through the valve at the non-drive end (NDE) they shall be sealed with bolted stainless steel, grade 316, bearing cover plates. Screwed taper plug covers are not acceptable.

Sleeve type bearings shall be fully corrosion resistant and shall be fitted in the hubs in the valve body. Steel back bearings shall not be accepted.

C3.3.2.10.6.5 ZUT 7004.6.5 BEARING AND SHAFT SEALS

Bearing and shaft seals shall be of the "O" ring or radial cup type with machined weep holes or grooves for drainage at the gearbox mounting flange.

C3.3.2.10.6.6 ZUT 7004.6.6 HAND WHEELS

All manually operated valves shall be supplied complete with cast hand wheels of sturdy construction, which shall have the wording, “OPEN” and “CLOSE” together with directional arrows legibly cast in recesses on the upper surface of the rim.
Closure of valves shall be through the clock-wise rotation of hand wheels. Valves shall be capable of being opened or closed under an unbalanced pressure equal to the Nominal Pressure. The effort required on hand wheels to open or close valves under these conditions shall not exceed the following:

VALVE SIZE	SEATING/UNSEATING	INTERMITTENT
Up to and including DN300	500 N	180 N
Above DN300	600 N	220 N

Hand wheels shall be manufactured to ensure a close fit between the hand wheel and the mating spindle head and shall be firmly fixed to the spindle head. Loose fitting hand wheels are not acceptable. Shear pins or torque clutches shall be fitted to prevent damage. Hand wheel diameters shall not exceed the dimensions as shown in the table below:

PRESSURE RATING (kPa)	VALVE SIZE (DN)	HAND WHEEL DIAMETER (mm)
1000	DN100 to DN350	250mm (max.)
	DN400 to DN500	400mm (max.)
	DN600 and larger	500mm (max.)
1600	DN100 to DN350	250mm (max.)
	DN400 to DN500	400mm (max.)
	DN600 and larger	500mm (max.)
2500	DN100 to DN350	250mm (max.)
	DN400 to DN500	400mm (max.)
	DN600 and larger	500mm (max.)
4000	DN100 to DN350	250mm (max.)
	DN400 to DN500	400mm (max.)
	DN600 and larger	500mm (max.)

C3.3.2.10.6.7 ZUT 7004.6.7 LUBRICATING POINTS

All lubricating points for grease gun lubrication shall be fitted with 1/8" BSP stainless steel button head type grease nipples. Nipples shall be painted red for easy identification. Electro-plated nipples will under no circumstances be accepted.

C3.3.2.10.6.8 ZUT 7004.6.8 MARKING

C3.3.2.10.6.8.1 ZUT 7004.6.8.1 Body Marking

All valve bodies shall be permanently and indelibly marked (cast in minimum 15 mm lettering size on castings or welded on fabricated valves) as follows:

- Manufacturer's name;
- Nominal size (DN in mm);
- Nominal pressure (PN in bar);
- Arrow to indicate the direction of flow; and

All the above markings shall be legible after painting.

C3.3.2.10.6.8.2 ZUT 7004.6.8.2 Flange marking

In addition to the above, one of the flanges of the valve shall be clearly marked with a single set of machined notches. (3mm wide x 3mm deep across the width of the flange and painted red).

For wafer type valves, the width and depth of the notch shall be identical to that of the flanged valves. The length of the notch however shall be 12mm long.

- One notch - 1 000 kPa operating pressure

- Two notches - 1 600 kPa operating pressure
- Three notches- 2 500 kPa operating pressure
- Four notches - 4 000 kPa operating pressure
- Five notches - 6 400 kPa operating pressure

C3.3.2.10.6.8.3 ZUT 7004.6.8.3 Gate and body marks

One face of the gate shall be marked, corresponding to a similar mark on the body, to ensure correct replacement after dismantling. The marks shall be visible and clear after coating. The details of the marking shall be shown on the drawings.

C3.3.2.10.6.8.4 ZUT 7004.6.8.4 Identification Plate Markings

Identification plate markings shall be hard-stamped, printed or engraved on a stainless steel nameplate fitted to the valve with stainless steel cap or drive screws. If necessary a boss/raised face shall be cast integrally with the body to fit the nameplates.

Information listed on a name plate shall be as follows:

- Manufacturer's name or trade mark;
- Nominal size (DN) in millimetres;
- Contract number;
- Nominal pressure (PN) in kPa;
- Serial number;
- Date of manufacture; and
- Mass of valve in kg.

C3.3.2.10.6.9 ZUT 7004.6.9 POSITION INDICATORS

Valves of DN 300 and larger shall be fitted with accurate position indicators unless otherwise specified in the Project Specification.

Position indicating plates shall be embossed to clearly show the fully open, ¾, ½, ¼, and closed positions.

The indicator system shall be accurately installed and calibrated to give true linear indication of the valve opening. Calibration of the indicator scale shall be done in-situ to show actual valve position recorded against the actual valve operation.

All pulleys, brackets, pins, cables, counterweights, sleeves, indicator gears and fasteners shall be of stainless steel 304 or better.

Where specified, valves shall be supplied with electrical limit switches for fully open and fully closed positions plus any other I/O requirements as shown on the Drawings and I/O schedule. Limit switches will be connected to 24 V DC PLC input cards by the Contractor or his sub-contractor. The valve manufacturer shall make provision for all cable and wire connections to these limit switches.

Electronic position indicators (proximity switches) for fully open and fully closed position indication are required on all butterfly valves as specified.

C3.3.2.10.7 ZUT 7004.7 TESTING & INSPECTION

C3.3.2.10.7.1 ZUT 7004.7.1 GENERAL

Inspection and quality control shall be in accordance with ISO 9000.

Further specific requirements for quality control and testing of valves given in the following paragraphs:

C3.3.2.10.7.2 ZUT 7004.7.2 PRESSURE TEST REQUIREMENTS

Valves shall be pressure tested by the manufacturer to prove the structural integrity of the body and that the fully assembled valves are capable of functioning satisfactorily under the specified operating conditions. Valid calibration certificates of testing equipment to be used for pressure testing of the valves by the manufacturer should be made available to the Engineer.

C3.3.2.10.7.2.1 ZUT 7004.7.2.1 Pressure Testing

Test flanges shall be used. Tie-bolts or other forms of restraint applied across the blank flanges for the testing of flanged valves will not be permitted except in the case of wafer type valves.

Note:

- Valve undergoing pressure testing shall not be subject to shock loading.
- Valves and connections shall be purged of air prior to pressure testing.

C3.3.2.10.7.2.2 ZUT 7004.7.2.2 Test Fluid

The test fluid for all pressure tests shall be either water with the addition of a corrosion inhibitor, or another non corrosive liquid with a viscosity at ambient temperature equal to or less than that of water.

C3.3.2.10.7.3 ZUT 7004.7.3 TEST PROCEDURES

C3.3.2.10.7.3.1 ZUT 7004.7.3.1 General

Test pressures shall be maintained for not less than five (5) minutes or as otherwise specified by the Engineer and the valves shall be watertight in all respects.

Structural and seat tests shall be executed on both sides of double seated valves i.e. gate valves.

All valves, fully assembled, shall be pressure tested by the manufacturer in accordance with Table 1.

Table 1
APPLICABILITY OF HYDROSTATIC PRESSURE TESTS

TEST	VALVE TYPE	
	TIGHT SHUT-OFF	LOW LEAKAGE
a) Structural • Body • Disc Strength	✓ ✓	✓ ✓
b) Seat/Seal	✓	N/A

C3.3.2.10.7.3.2 ZUT 7004.7.3.2 Structural Tests

Body Test

This shall be a hydrostatic pressure test at a pressure of 1.5 times the maximum permissible working pressure at ambient temperature.

Testing of the valve bodies shall be carried out without the disc assembled and before valves are coated or lined with materials that are capable of sealing against leakages. Both ends of the body shall be blanked off so that the valve is subjected to the full pressure stresses in all directions induced by the test pressure.

The valve shall be in an open or partially open position during the test. There shall be no visually detectable leakage and/or signs of sweating through the shell of the valve during the test period.

Disc/Gate Test

This shall be a hydrostatic pressure test at a pressure of 1.5 times the maximum permissible working pressure at ambient temperature.

The valve shall be closed in the normal manner and the test pressure applied to one side of the disc with the other side open to atmosphere. There shall be no visible evidence of structural damage to or deformation of the disc or leakage through the disc or gate during the test duration.

Seepage past gland seals during structural tests shall not be cause for rejection, provided that the gland seals are watertight when the internal test pressure is reduced to 1.1 x the maximum permissible working pressure at ambient temperature.

Seat/Seal Test

This shall be a hydrostatic pressure test at a pressure of 1.1 times the maximum permissible working pressure at ambient temperature.

Each assembled valve with corrosion protection completed shall be subjected to open-ended tests for drop tightness at the permissible working pressures at ambient temperature. Valves shall be drop tight over the complete range of pressures. Valves with symmetrical seating and double acting valves shall be tested in both directions.

The maximum permissible leakage shall be as given in Table 2.

Table 2
TEST PRESSURE LEAKAGE RATES

VALVE TYPE	LEAKAGE RATE
Tight shut-off (all valves except wedge gate valves)	Rate 3 * : No visible leakage for duration of test.
Low leakage (wedge gate valves only)	Rate 1 : 0.7 ml/min x DN

*Leakage rates are as defined in BS 5146: Part 2

C3.3.2.10.7.3.3 ZUT 7004.7.3.3 Test Certificate

When a test certificate is issued it shall contain a statement by the manufacturer confirming that the valves have been tested in accordance with this standard and stating the actual pressures and medium used in the test.

C3.3.2.10.7.3.4 ZUT 7004.7.3.4 Anti-static

Valves designated as anti-static shall have electrical continuity between shaft, disc and body when tested in accordance with A.2 of BS 5146: Part 1.

C3.3.2.10.7.3.5 ZUT 7004.7.3.5 Functional Test Requirement

The manufacturer shall do a functional test on each valve. This shall consist of taking the valve through one complete cycle, from fully closed to fully open and back. The manufacturer shall take particular note that the valve position indicator is correctly calibrated.

C3.3.2.10.8 ZUT 7004.8 FASTENERS

Fasteners shall comply with the clause “Fasteners” in ZUT 0001.

C3.3.2.10.9 ZUT 7004.9 HANDLING AND TRANSPORT

All handling and transport of valves shall be done in accordance with the requirements of standard as set out in section of General Mechanical.

In addition the ends of valves and fittings shall be securely blanked off with temporary sturdy plywood blank flanges in order to protect the corrosion protection (lining).

Bolts and other small parts shall be sewn up in strong bags and crated. The bags shall be tagged using metallic tags and indicate the following information:

- Manufacturer's identification and contract number,
- Part numbers,
- Description,
- Sizes and
- Quantities.

Each bag shall have the delivery address listed on a separate metallic tag.

The use of ropes, wire or chains for lifting valves without suitable padding is strictly forbidden. For transport or storage purposes, balks of timber beams shall be used to support the valves on any surface and separate them from each other.

Precautions shall be taken to support and chock the valves to prevent movement when loading onto vehicles. Valves or components of valves shall be firmly lashed or chained with padded lashing supported on sawdust bags. The area of padded surfaces shall be adequate to prevent damage to coatings.

The Site Engineer shall be notified of the delivery date and of any requirements regarding off loading and storage at site.

For Site delivery, the transportation, off-loading of equipment by crane and supervision during off-loading shall be the responsibility of the Contractor. The final inspection and acceptance of equipment supplied will be undertaken on site after off-loading has been completed. Any damage that occurs during the handling, assembly and storage of equipment at the Manufacturer or Contractor's works, including transportation to site, shall be repaired by the Contractor at his own cost, in accordance with the valve specification and to the satisfaction of the Engineer.

C3.3.2.10.10 ZUT 7004.10 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

If the equipment is manufactured and assembled in South Africa, the Contractor shall make all arrangements and carry all costs for the Engineer to inspect equipment and fabrications in the workshop prior to dispatch to Site. Fabrications shall be inspected prior to corrosion protection.

If the equipment is manufactured and assembled outside South Africa, the Contractor shall make all arrangements and carry all costs for an Engineer approved inspection authority to inspect the equipment in the workshop prior to dispatch. The inspection shall include a full report on compliance of the equipment with this specification and this report shall be submitted to the Engineer prior to dispatch of the unit from the workshop.

C3.3.2.10.11 ZUT 7004.11 OPERATING AND MAINTENANCE MANUAL

This section shall comply with the requirements as specified under ZUT 0002.

C3.3.2.10.12 ZUT 7004.12 MEASUREMENT & PAYMENT

C3.3.2.10.12.1 ZUT 7004.12.2 Supply and Deliver to Site……..Unit: Number (No.)

The rates tendered shall include full compensation for the supply and delivery of the Plant to Site including supply of raw materials and bought-out items and associated operating Plant items; fabrication, manufacture and assembly; quality assurance and quality control; inspection and Factory Acceptance Testing (including attendance on inspections and tests witnessed by the Engineer); type and routine tests; application of finishes (painting and corrosion protection); trial erection and dismantling; preparation and packing for transport; transport from place of manufacture to the Site; insurance, harbour dues etc., during transport; loading and unloading; storage under appropriate conditions from date of delivery until commencement of erection; and any other work as specified. Payment will be made per unit. Payment will only be effected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer.

C3.3.2.10.12.2 ZUT 7004.12.2 Installation of Plant……..Unit: Number (No.)

The rates tendered shall include for full compensation for the installation of the Plant on Site including the provision of all labour, transport, materials and Temporary Works necessary to install the complete Works; on-site quality assurance and quality control, inspection, testing (including attendance at tests witnessed by the Engineer); the installation of all auxiliary Plant items; necessary for the operation of the installation until taken over by the Employer; the putting into service of the complete installation of the Plant; and any other work as specified.

The rate shall also include for all commissioning testing and the provision of equipment therefore including all disruptions to installation caused by such testing. Payment will be made per unit. Payment will only be effected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer.

C3.3.2.11 ZUT 7015 VALVES FOR WATER AND WASTEWATER INSTALLATIONS

C3.3.2.11.1 ZUT 7015.1 SCOPE

ZUT 7015 specifies the standard requirements for metal seated wedge gate valves of a type suitable for raw water and wastewater duties.

The installation shall be as shown on any applicable drawings provided with the tender documents.

The scope of work for which the Contractor is responsible is specified elsewhere.

C3.3.2.11.2 ZUT 7015.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification.
b) Data Sheets.
c) ZUT 0001: General Mechanical Requirements.
d) ZUT 0002: Operating and Maintenance Manuals.
e) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.
f) ZUT 7004: Valves for Water and Wastewater Installations.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.11.3 ZUT 7015.3 PERFORMANCE REQUIREMENTS

Valves shall be of the rising spindle type unless otherwise scheduled.

Valves shall be drop tight for all specified duties.

Gate spindle seals shall not leak.

Valves shall operate without snatch.

Handwheels shall not require a peripheral force greater than 250 Newtons (i.e. the sum of the forces on both sides shall not be greater than 250 Newtons) at the full differential pressure rating of the valve.

C3.3.2.11.4 ZUT 7015.4 OPERATION AND CONTROL

Actuated valves shall be provided with manual operation override. Electric actuators shall, additionally, be provided with manual start and stop functions on the actuator.

Valves and their method of actuation shall be designed to open and close at a differential pressure equal to the full pressure rating of the valve.

C3.3.2.11.5 ZUT 7015.5 DESIGN AND CONSTRUCTION

Wedge gate valves shall have metal seats and shall be of the double flanged configuration.

The manufacturer's name, size and working pressure shall be cast on the valve body or otherwise permanently indicated on the valve.

The bore shall be straight through.

Position indication shall be provided.
Open and close direction shall be indicated.

Fixing lugs for end of travel limit switches shall be provided.
Valves of size DN 250 and larger shall be provided with a bypass which shall incorporate an isolating wedge gate valve.

Valves of size DN 350 and larger shall be provided with an air release and the body shall be provided with channel guides for gate travel. The wedge shall be provided with shoes which slide within the channel guides. Guides and shoes shall guide the gate along the complete travel distance.

Valves of DN 250 and larger shall be provided with gearboxes. Ingress protection shall be to IP 55 or higher.

The body shall incorporate storage feet.

The body shall incorporate a drain with a stainless steel plug.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

C3.3.2.11.6 ZUT 7015.6 FASTENERS

All fasteners on the body of the valve shall be of EN Grade 1.4401 (316), or better.

Fasteners shall comply with the clause “Fasteners” in ZUT 0001 – General Mechanical Requirements.

C3.3.2.11.7 ZUT 7015.7 MATERIALS AND CORROSION PROTECTION

Bodies shall be of ductile iron or of cast steel.

Handwheels shall be cast.

The body seat ring shall be of stainless steel or non-ferrous metal (SS preferred for sewage applications).

The wedge seat ring shall be of stainless steel or non-ferrous metal (SS preferred for sewage applications).

The valve stem shall be of stainless steel.

Guides and shoes shall be of a copper based alloy or of engineering plastic or of stainless steel.

Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating to a dry film thickness of at least 200 micron. Specialist applied Rilsan coatings will also be acceptable.

Stainless steel valves shall remain uncoated unless colour coding of the body is required.

Corrosion Protection shall comply with ZUT 0003 - Painting and Corrosion Protection for Water and Wastewater Works.

C3.3.2.11.8 ZUT 7015.8 INSTALLATION

Equipment shall be mounted firm and level.
Installation work shall comply with the clause “Installation” in ZUT 0001 – General Mechanical Requirements.

C3.3.2.11.9 ZUT 7015.9 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

If the equipment is manufactured and assembled in South Africa, the Contractor shall make all arrangements and carry all costs for the Engineer to inspect valves of DN 250 and larger in the workshop during witness testing and prior to dispatch to Site.

If the equipment is manufactured and assembled outside South Africa, the Contractor shall make all arrangements and carry all costs for an Engineer approved inspection authority to inspect the equipment in the workshop prior to dispatch. The inspection shall include a full report on compliance of the equipment with this specification and this report shall be submitted to the Engineer prior to dispatch of the unit from the workshop.

C3.3.2.11.10 ZUT 7015.10 TESTING REQUIREMENTS

The following witness testing shall be done during the factory inspection:

a) The valve body shall be pressure tested to 1,5 times the valve pressure rating.

b) The valve seating shall be drop tight tested to 1,0 times the pressure rating.

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.11.11 ZUT 7015.11 GENERAL

The equipment shall have been successfully used in similar applications in South Africa.

C3.3.2.11.12 ZUT 7015.12 MEASUREMENT & PAYMENT

Measurement and payment covered under ZUT 7004.

C3.3.2.12 ZUT 7016 RESILIENT SEAL GATE VALVE

C3.3.2.12.1 ZUT 7016.1 SCOPE

ZUT 7016 specifies the standard requirements for resilient seal gate valves of the type with rubber coated gate.

The numbers and sizing of equipment to be provided are specified in the Amendments and Datasheets.

The installation shall be as shown on any applicable drawings provided with the tender documents.

C3.3.2.12.2 ZUT 7016.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification.

b) Data Sheets.

c) ZUT 0001: General Mechanical Requirements.

d) ZUT 0002: Operating and Maintenance Manuals.

e) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

f) ZUT 7004: Valves for Water and Wastewater Installations.

C3.3.2.12.3 ZUT 7016.3 GENERAL

Gate valves shall be double flanged and be of the resilient seal gate type, the gates of which shall be completely clear of the waterway in the fully open position. Valves shall be of the rising spindle type unless otherwise scheduled.

Valves shall be capable of withstanding the nominal pressure (PN) and specified test pressures from both sides and seal drop tight in both directions at the specified range of differential pressures across the gate.

The valve shall be capable of performing reliably at any point in the specified range.

The valve shall open and close smoothly at a pressure difference across the gate equal to the valves' rated pressure.

The gate liner shall, in accordance with SANS 665-3, be so firmly bonded, vulcanised and accurately moulded that, when the valve is tested, the resilient material shall not become torn, loose or detached. Also in accordance with SANS 665-3, the gate shall ensure drop tightness over the full pressure range of the valve and the lining shall have the capacity to accept foreign matter up to 1 mm in particle size.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

Valves above DN 150 shall have the manufacturer's name, size and working pressure cast on the valve body.

C3.3.2.12.4 ZUT 7016.4 OPERATION AND CONTROL

The gate valve shall be able to open and close satisfactorily under the specified flow rate and differential pressure. Valves shall close turning the hand wheel in a clockwise direction.

Manually operated valves shall be provided with handwheels of a size and construction which permit easy opening of the gate when subjected to a differential pressure equal to the rated pressure difference across the gate.

Valves shall be provided with an indication of the closing and/or the opening direction.

Actuated valves shall be provided with manual override.

C3.3.2.12.5 ZUT 7016.5 DESIGN AND CONSTRUCTION

C3.3.2.12.5.1 ZUT 7016.5.1 BODY

The valve body shall incorporate a straight unobstructed body passage without pockets and shall have inclined seats and prominent gate guides to eliminate deposits in the valve body.

The guides shall be as deep and as long as possible, but not protruding into the flow path to offer support in all gate positions of the gate.

The rubber coated gate shoes shall accurately fit the body guide profile to allow smooth operation of the gate with minimal shudder.

C3.3.2.12.5.2 ZUT 7016.5.2 GATE

The gate shall be accurately moulded and completely encapsulated in natural or an approved neoprene rubber and accurately moulded to ensure complete corrosion protection and drop tightness over the valve pressure range. The rubber coated gate shall be designed to offer an equal distribution of sealing pressure in all directions with a capacity to accept foreign matter up to 1mm in particle size.

C3.3.2.12.5.3 ZUT 7016.5.3 SPINDLE AND THRUST BEARING

A corrosion resistant spindle seal arrangement shall include a scraper ring to prevent the ingress of foreign matter. A spindle thrust collar shall be installed between thrust bearings or anti-friction materials to ensure low operating forces.

All gate valves shall be fitted with a back seal to permit the replacement of the spindle seals under pressure where appropriate.

C3.3.2.12.5.4 ZUT 7016.5.4 POSITION INDICATOR

All valves of DN300 and larger shall be fitted with a mechanical linear indicator system mounted on the valve spindle to show the position of the gate as scheduled.

C3.3.2.12.6 ZUT 7016.6 MATERIALS

The body and gate shall be of ductile iron (SANS 936).

Cast iron sliding surfaces are not acceptable.

The spindle shall be of EN Grade 1.4401 (316) Stainless Steel, or better.

The spindle nut shall be Bronze (gunmetal).

Handwheels shall be of cast metal.

Manually operated gearboxes shall be provided with a stainless steel grease nipple.

Valves shall comply with SANS 665 where applicable.

C3.3.2.12.7 ZUT 7016.7 FASTENERS

Fasteners on the valve shall be of EN Grade 1.4401 (316) stainless steel.

Flange fasteners shall comply with the specification for the pipeline's flange fasteners.

Fasteners shall comply with the clause "Fasteners" in ZUT 0001 – General Mechanical Requirements.

C3.3.2.12.8 ZUT 7016.8 CORROSION PROTECTION

The specific application shall be taken into account in the corrosion protection of valves under General Corrosion Protection ZUT 0003.

The gate liner shall be of vulcanised EPDM.

Fasteners shall be of EN Grade 1.4401 (316), or better or shall be sealed against ingress by a fully sealed arrangement. This applies to all fasteners on the body of the valve and its gearbox. Flange bolts are specified elsewhere.

Cast iron valve components, including valve bodies, shall be protected internally and externally with a coating in accordance with either sub-clause "Fusion Bonded Epoxy" or sub-clause "Hot Applied Thermoplastic" and shall comply with ZUT 0003. Dry film coating thickness shall not be less than 200 micron.

Metal plating of ferrous materials is not an acceptable corrosion protection system.

C3.3.2.12.9 ZUT 7016.9 INSTALLATION

Valves shall be mounted firm and level.

The weight of the valve shall be fully supported. Spindles shall be vertical unless approved otherwise by the Engineer.

The handwheel shall be easily accessible to the operator.

Installation work shall comply with the clause "Installation" in ZUT 0001 – General Mechanical Requirements and ZUT 7004 – General Valve specifications.

C3.3.2.12.10 ZUT 7016.10 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

If the equipment is manufactured and assembled in South Africa, the Contractor shall make all arrangements and carry all costs for the Engineer to inspect equipment in the workshop prior to dispatch to Site.

If the equipment is manufactured and assembled outside South Africa, the Contractor shall make all arrangements and carry all costs for an Engineer approved inspection authority to inspect the equipment in the workshop prior to dispatch. The inspection shall include a full report on

compliance of the equipment with this specification and this report shall be submitted to the Engineer prior to dispatch of the unit from the workshop.

C3.3.2.12.11 ZUT 7016.11 TESTING REQUIREMENTS

The Contractor shall arrange for the Engineer to witness the testing of valves of sizes DN 250 and larger and all travel and accommodation costs shall be the responsibility of the Contractor.

The valve shall be tested according to specifications ZUT 7004.

The correct operation of the valve shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.12.12 ZUT 7016.12 OPERATING AND MAINTENANCE MANUAL

This section shall comply with the requirements as specified under ZUT 0002.

C3.3.2.12.13 ZUT 7016.13 MEASUREMENT & PAYMENT

Measurement and payment covered under ZUT 7004.

C3.3.2.13 ZUT 7017 SINGLE DOOR CHECK VALVE

C3.3.2.13.1 ZUT 7017.1 INTRODUCTION

Zut 7017 specifies the standard requirements for single door check valves; with pressure ratings between 10 bar and 25 bar, for water applications in sizes up to DN 1200, and for wastewater and sludge applications in sizes up to DN 800; to be provided by the Contractor.

C3.3.2.13.2 ZUT 7017.2 SCOPE OF WORKS

a) See project specification.
b) The installation shall be configured as shown on applicable drawings.

C3.3.2.13.3 ZUT 7017.3 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments, Additions and Detailed Requirements (Zut 7017).
b) Zut 0001: General Mechanical Requirements.
c) Zut 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.13.4 ZUT 7017.4 EQUIPMENT ELIGIBILITY

The valve provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

C3.3.2.13.5 ZUT 7017.5 PERFORMANCE REQUIREMENTS

Valves shall seal drop tight at the PN rating.

The body shall withstand the test pressure.

The valve shall be sized to open fully at the lowest specified flow rate of the system.

The valve shall close before the flow direction can reverse (unless external control and/or damping is specified).

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

C3.3.2.13.6 ZUT 7017.6 CONSTRUCTION AND DESIGN

C3.3.2.13.6.1 ZUT 7017.6.1 GENERAL REQUIREMENTS

Valves shall be double flanged.

Flanges shall comply with BS EN 1092 for the PN rating of the valve unless required to match flanges with a different specification.

The door position shall be indicated.

In accordance with SANS 1551-1, each valve shall be provided with indelible markings which include the manufacturer's name, PN rating, DN size and the direction of flow.

Valves of DN 150 and larger shall incorporate a bypass of DN 25 or larger. The bypass shall incorporate a flanged metal seated wedge gate valve for isolation.

Valves larger than DN 500 shall be provided with damping at closure. The damping shall be provided by external hydraulic oil dashpot or similar.

C3.3.2.13.6.2 ZUT 7017.6.2 SIZE AND RATING

The nominal flow speed at the minimum design flow rate shall not be less than 1,3 m/s.

The pressure rating for the valve shall match the rating for the pipework. The valve's pressure rating shall not, however, be lower than PN 10.

C3.3.2.13.6.3 ZUT 7017.6.3 PIPEWORK CONFIGURATION

The configuration of the valve and its pipework shall ensure that the flow requirements of the valve are accommodated.

At least three pipe diameters of straight pipe shall be provided immediately upstream of the valve. The valve shall be able to open and close without interference from physical obstruction such as an isolation valve, a bend, mortar lining, etc.

The force of the valve closing shall be securely restrained under the worst hydraulic condition expected. It is preferred that a support is provided for the valve itself but it is also acceptable that this thrust force is restrained via properly anchored pipework.

Orientation of the valve shall comply with the manufacturer's recommendation.

Check valves shall be separated from downstream isolation valves by a straight pipe for a distance of at least 1,5 times the diameter.

C3.3.2.13.6.4 ZUT 7017.6.4 SINGLE DOOR CHECK VALVES FOR WATER

Single door check valves for sizes up to DN 1200 for water which is not expected to contain suspended solids shall be of the slanted seat, tilting door configuration ("Tilting Disc" type).

The valve shall have a side lever and adjustable weight for gravity-assisted closing (unless external damping and/or control is specified for the valve).

Damping shall slow down the movement of the door as it approaches the closed position.

C3.3.2.13.6.5 ZUT 7017.6.5 SINGLE DOOR CHECK VALVES FOR WASTEWATER

Single door check valves for wastewater, for wastewater sludge and for water which is expected to contain foreign matter shall be of the type which allows the door to move fully out of the flow so that solid matter does not catch on it ("Swing Check" type).

The seal shall be of a suitable resilient material.

A side lever and adjustable weight shall provide gravity-assisted closing.

The body shall incorporate a bolted cover to provide access to the disc for cleaning without having to dismantle or remove the valve.

C3.3.2.14 ZUT 7022 AIR VALVES FOR AIR RELEASE AND VACUUM BREAK ON PIPELINES

C3.3.2.14.1 ZUT 7022.1 SCOPE

ZUT 7022 specifies the standard requirements for air valves which are used for air release and vacuum break for pipelines.

The numbers and sizing of equipment to be provided are stated in the Amendments and Additions and the installation shall be as shown on any accompanying drawings.

C3.3.2.14.2 ZUT 7022.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification.

b) Data Sheets.

c) ZUT 0001: General Mechanical Requirements.

d) ZUT 0002: Operating and Maintenance Manuals.

e) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

f) ZUT 7004: Valves for Water and Wastewater Installations.

C3.3.2.14.3 ZUT 7022.3 PERFORMANCE REQUIREMENTS

Valves shall perform in accordance with the air discharge, air inlet and slam-free conditions specified in the Amendments and Additions.

In vacuum break mode, valves shall react immediately in order to prevent the pressure falling to a level which would be unacceptable in terms of the design of the pipeline.

Valves shall be capable of discharging high volumes of air through a large orifice under pressure during filling of the pipeline.

Valves shall be capable of releasing small quantities of accumulated air at all line pressures up to and including the rated working pressure of the valve.

The large discharge orifice shall close at a differential pressure of between 4 and 6 kPa in order to minimise transient pressure effects. The valve shall continue to release air at a lower rate.

Valves shall seal drop tight at all line pressures between 0,45 bar and the rated pressure.

C3.3.2.14.4 ZUT 7022.4 OPERATION AND CONTROL

Valves shall operate autonomously; i.e. a valve shall not require a servo mechanism to control its operation and shall not require an external power supply.

C3.3.2.14.5 ZUT 7022.5 DESIGN AND CONSTRUCTION

C3.3.2.14.5.1 ZUT 7022.5.1 GENERAL

Air release valves for water pipework shall be of the non-slam type, Vent-O-Mat RBX, or ARI or equivalent.

Air release valves for wastewater pipework shall be of the non-slam type Vent-O-Mat RGX, ARI or equivalent. Valves for wastewater and related duties shall be specifically designed for the application.

The manufacturer's name, pressure rating, nominal size and the serial number shall be permanently displayed on the valve, preferably cast into the valve body.

Isolating valve shall be provided and installed so that the air valve can be isolated during full line pressure. The isolating valves shall be as per data sheet and shall have the same pressure rating as specified for the air valve.

The large intake and exhaust orifice of air valves shall be equal to the nominal size of the valve e.g. a 100mm valve shall have a 100mm inlet and outlet orifice. The valve shall incorporate an integral anti-shock (non-slam) orifice mechanism which shall operate automatically to limit transient pressure rise or water hammer induced by closure. An inherent feature of the valve design must be to ensure that the float does not close before all the air has been released.

C3.3.2.14.5.2 ZUT 7022.5.2 HYDRAULIC DESIGN

Valve design and selection shall ensure that pipe collapse does not occur under a "full bore" rupture condition and, additionally, shall comply with the following criteria:

- Air valves on pipe sizes up to DN 600 shall be designed to ensure that the internal pressure does not fall below minus 8 kPa (i.e. a pressure below atmospheric pressure) under a full-bore rupture condition.

- Air valves for pipe sizes larger than DN 600 shall be selected on the basis of a rupture condition which shall be agreed with the Engineer.

The criteria for the valve performance shall have been confirmed by a recognized independent authority.

C3.3.2.14.5.3 ZUT 7022.5.3 CONSTRUCTION

Valves shall be flanged. The flange shall comply with the flange specification for the pipeline.

It shall be possible to remove the valve's working parts without unbolting the bottom flange from the pipeline. Floats and seats shall not, however, require maintenance under normal conditions.

A stainless steel screen shall prevent foreign matter from entering and blocking the air ports.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

C3.3.2.14.6 ZUT 7022.6 FASTENERS

Fasteners on the valve shall be of stainless steel.

Flange fasteners shall comply with the flange fastener specification for the pipeline.

C3.3.2.14.7 ZUT 7022.7 MATERIALS AND CORROSION PROTECTION

Carbon steel and ductile iron shall be protected with fusion bonded epoxy or Rilsan or equivalent to a dry film thickness of at least 200 micron in accordance with ZUT 0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.
Floats shall be of HDPE or similar.

Seals shall be nitrile rubber or otherwise approved by the Engineer.

C3.3.2.14.8 ZUT 7022.8 INSTALLATION

Each air valve shall be provided with an upstand tee which shall form an accumulator pocket to capture the air bubbles entrained with the water flow. The upstand shall have a diameter of at least half the pipeline diameter and the upstand height shall be equal to its own diameter or greater. The upstand shall be flanged and shall be provided with a blank flange. The blank flange shall incorporate a flanged riser which is sized for mounting the air valve onto.

Care shall be taken where air valves are mounted on sloping pipes that the air valves are mounted firm and level.

Installation work shall comply with the clause “Installation” in ZUT 0001 – General Mechanical Requirements.

C3.3.2.14.9 ZUT 7022.9 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

C3.3.2.14.10 ZUT 7022.10 TESTING REQUIREMENTS

The valve body shall be pressure tested to 1,5 times the rated pressure of the valve for two minutes and there shall be no visible leaks.

Valves shall be tested for drop tight sealing at the rated pressure and also at a pressure of 0,45 bar above atmosphere.

A certificate indicating these test results and including the valve’s serial number shall be provided to the Engineer.

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.14.11 ZUT 7022.11 GENERAL

The equipment shall have been successfully used in similar applications in South Africa.

Valves shall be protected against damage during transport.

C3.3.2.14.12 ZUT 7022.12 OPERATING AND MAINTENANCE MANUAL

This section shall comply with the requirements as specified under ZUT 0002.

C3.3.2.14.13 ZUT 7022.13 MEASUREMENT & PAYMENT

Measurement and payment covered under ZUT 7004.

C3.3.2.15 ZUT 7023 COUPLINGS AND FLANGE ADAPTERS

C3.3.2.15.1 ZUT 7023.1 SCOPE

ZUT 7023 specifies the standard requirements for pipework couplings and flange adaptors.

C3.3.2.15.2 ZUT 7023.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments.

b) Data Sheets.

c) ZUT 0001: General Mechanical Requirements.

d) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.15.3 ZUT 7023.3 GENERAL

Equipment which has not previously been in common use in South Africa shall not be acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

C3.3.2.15.4 ZUT 7023.4 PERFORMANCE REQUIREMENTS

The units shall withstand the pipework pressure rating and shall provide a flexible joint between the two items being connected.

C3.3.2.15.5 ZUT 7023.5 DESIGN AND CONSTRUCTION

Pipe couplings shall be provided where misalignment or dismantling must be allowed for and for possible pipe movement from settlement or other cause. The coupling shall have the same or higher pressure rating than the pipework in which it is installed.

Where the type of coupling is not indicated on the drawing, pipe couplings may be of the mechanical type (VJ coupling or flange adaptor), of the stainless steel bellows type or of the rubber bellows type.

Mechanical couplings shall be of the rubber ring compression type (i.e. VJ type flange adaptors or VJ type couplings) and shall be provided in pairs in order to accommodate axial misalignment and/or settlement. Where harnesses are required, these shall incorporate three tie bars or more. Stainless steel and 3CR12 pipework shall be provided with stainless steel couplings or, where approved by the Engineer, ductile iron couplings protected with fusion bonded epoxy. Low carbon steel pipework shall be provided with low carbon steel or ductile iron couplings protected by fusion bonded epoxy. All fasteners, including studs welded to flanges, shall be of stainless steel.

Suitably rated **rubber bellows** type couplings with metal backing flanges are acceptable for pipe diameters of DN 300 and below. The bellows shall be provided with two backing flanges drilled to match their mating flanges. Bellows for low carbon steel pipework shall be provided with hot dip galvanised flanges (i.e. not zinc plated). Bellows for 3CR12 or stainless steel pipework shall be provided with matching flange material.

Stainless steel bellows type couplings shall be of EN Grade 1.4401 (316), or better, and shall incorporate stainless steel fasteners. The coupling shall incorporate two stainless steel flanges.

C3.3.2.15.6 ZUT 7023.6 FABRICATION

Fabrication shall comply with the clause “Fabrication of Steels” and welding shall comply with the clause “Welding” in ZUT 0001.

Fabrications will generally be inspected by the Engineer after fabrication is complete.

C3.3.2.15.7 ZUT 7023.7 FASTENERS

Fasteners shall comply with the clause “Fasteners” in ZUT 0001.

C3.3.2.15.8 ZUT 7023.8 CORROSION PROTECTION

Corrosion Protection shall comply with ZUT 0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.

C3.3.2.15.9 ZUT 7023.9 INSTALLATION

Installation work shall comply with the clause “Installation” in ZUT 0001.

C3.3.2.15.10 ZUT 7023.10 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

C3.3.2.15.11 ZUT 7023.11 TESTING REQUIREMENTS

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.15.12 ZUT 7023.12 MEASUREMENT AND PAYMENT

Measurement and Payment is covered under ZUT7004.

C3.3.2.16 ZUT 7024 PIPEWORK SUPPORTS

C3.3.2.16.1 ZUT 7024.1 SCOPE

ZUT 7024 specifies the standard requirements for pipework supports.

The installation shall be as shown on any applicable drawings provided with the tender documents.

The scope of work for which the Contractor is responsible is specified elsewhere.

C3.3.2.16.2 ZUT 7024.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments.

b) ZUT 0001: General Mechanical Requirements.

c) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.16.3 ZUT 7024.3 PERFORMANCE REQUIREMENTS

Forces from pressure, inertial flow changes and check valves shall be properly restrained.

The supports shall restrain and support the pipework, valves and other heavy fittings and shall prevent loads and thrust forces from being transferred to pump flanges and other equipment which might be damaged or have shortened lifespans.

C3.3.2.16.4 ZUT 7024.4 DESIGN AND CONSTRUCTION

Pipe supports shall be designed and located so that when an item of mechanical equipment, such as a pump or blower, is removed, the associated pipework and equipment is still adequately supported.

Supports shall be provided close to all heavy items such as valves of size DN 300 and larger.

Pipework shall not place any external loads on items of mechanical equipment such as pumps, compressors, etc.

Adequate provision shall be made for expansion and contraction due to variations in temperature or pressure.

Proposed designs of pipe supports shall be submitted to the Engineer for approval prior to manufacture. The calculations for pipe supports designed to withstand the thrust from reducers, bends and check valves shall also be submitted to the Engineer for approval.

Pipe supports which only support the weight of horizontal pipework may be of the sliding type and shall be vertically adjustable.

Pipe supports which resist thrust forces shall incorporate doubler plates on the pipe which are contoured to match the pipe. Other reinforcing designs will also be acceptable. Such pipe supports shall be kept as short as feasible.

Low carbon steel supports shall be fabricated from heavy duty hot rolled steel sections. The complete assembly shall be hot-dip galvanised after all fabrication is completed. Welds shall be continuous “all round”; i.e. no crevices.

Stainless steel supports shall be fabricated of plate with a minimum thickness of 4,5 mm or shall be fully triangulated, boxed or closed sections. Welds shall be continuous “all round”; i.e. no crevices.

At least four anchor fasteners shall be provided for the foot of each pipe support. Anchor fasteners shall be of EN Grade 1.4401 (316) stainless steel.

For cantilevered pipe supports, the spacing between anchor fasteners on the foot shall be not less than one quarter of the cantilevered length. Gussets between the column and the foot are normally required and these shall be positioned so as to minimise the distance between the gusset and the bolt hole. This requirement does not apply to supports which only provide vertical support.

The maximum spacing between pipe supports for steel (including stainless steel) pipe of diameter, d [mm], shall be calculated as follows: Spacing (mm) = 1 000 + 10d. This applies to pipe only. Valves or other heavy fittings which shall be provided for separately as required. (Pipe support spacing distances for non-metallic pipework shall be half of the above.)

The maximum spacing between pipe supports for plastic pipe of diameter, d [mm], shall be calculated as follows: Spacing (mm) = (1 000 + 10d) / 2. This applies to pipe and not to valves or other heavy fittings which shall be provided for separately as required.

Where appropriate, 3 mm thick neoprene strips shall be placed between pipes and supports or clamps to protect the paintwork and to limit corrosion.

Where roller or sliding supports are used to accommodate movement, suitable wear blocks shall be fixed to the pipe to prevent damage.

Floor and wall mounted pipe supports shall be aligned using nuts above and below the foot. A space of at least 20 mm shall be left between the foot and the floor and this space shall be filled using non shrink grout once alignment has been completed. Grouting shall be done in accordance with the manufacturer’s instructions. Alternative designs and installations may be submitted by the Contractor.

Concrete surfaces under foot plates shall be scabbled before the support is placed and shall be blown clean using compressed air immediately before grouting.

Where the Engineer approves the use of concrete pipe supports to be built by a civil contractor under a separate contract, these will be constructed after installation of the pipework and temporary supports shall be provided by the Contractor in positions which will not interfere with the construction of the concrete supports.

C3.3.2.16.5 ZUT 7024.5 FABRICATION

Fabrication shall comply with the clause “Fabrication of Steels” and welding shall comply with the clause “Welding” in ZUT 0001.

Fabrications will generally be inspected by the Engineer after fabrication is complete.

C3.3.2.16.6 ZUT 7024.6 FASTENERS

Fasteners shall comply with the clause “Fasteners” in ZUT 0001.

Nuts for anchor fasteners shall both a spring washer and a flat or fender washer.

C3.3.2.16.7 ZUT 7024.7 CORROSION PROTECTION

Corrosion Protection shall comply with ZUT 0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.

C3.3.2.16.8 ZUT 7024.8 INSTALLATION

Installation work shall comply with the clause “Installation” in ZUT 0001.

C3.3.2.16.9 ZUT 7024.9 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

C3.3.2.16.10 ZUT 7024.10 MEASUREMENT AND PAYMENT

Measurement and Payment is covered under ZUT 7001 Design and Manufacturing of Medium-pressure Steel Specials.

C3.3.2.17 ZUT 7025 DIAPHRAGM CONTROL VALVES

C3.3.2.17.1 ZUT 7025.1 INTRODUCTION

Zut 7025 specifies the requirements for diaphragm control valves to be provided by the Contractor.

C3.3.2.17.2 ZUT 7025.2 SCOPE OF WORKS

See project specification.

The installation shall be configured as shown on applicable drawings.

C3.3.2.17.3 ZUT 7025.3 NORMATIVE REFERENCES

The following form part of the Contract Document:

- Amendments, Additions and Detailed Requirements (Zut 7025).
- Zut 0001: General Mechanical Requirements.
- Zut 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.
- SANS 1123: Pipe Flanges.
- SANS 12944-2: Paints and varnishes – Corrosion protection of steel structures by protective paint systems; Part 2: Classification of environments.
- National Occupational Health and Safety Act and Regulations.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.17.4 ZUT 7025.4 EQUIPMENT ELIGIBILITY

The make and model of valve provided shall have a successful record of use in similar applications locally and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are acceptable.

Valves which do not satisfy these requirements is not acceptable unless called for in the specifications or unless the Engineer agrees in writing.

C3.3.2.17.5 ZUT 7025.5 PERFORMANCE REQUIREMENTS

The equipment shall be capable of performing the specified duties under continuous operating conditions.

C3.3.2.17.6 ZUT 7025.6 OPERATION AND CONTROL

The unit shall be pilot controlled and shall use the water pressure in the system for actuation.

An upstream and a downstream pressure gauge shall be provided. The gauges shall comply with Zut 0001.

C3.3.2.17.7 ZUT 7025.7 DESIGN AND CONSTRUCTION

The valve shall be of globe configuration. It shall be double flanged and the flanges shall comply with SANS 1123.

The disc control surface shall be of multi V-port configuration.

The disc diaphragm shall be of material suitable for the fluid without chemical attack.

A filter for the pilot shall be provided and it shall be possible to clean this filter while the valve is in operation and under pressure.

Indication of diaphragm position shall be provided.

Uncoated internal parts shall be of EN Grade 1.4401 (316) stainless steel (or better) or shall be of a suitable non-ferrous metal.

C3.3.2.17.8 ZUT 7025.8 MATERIALS AND COATINGS

C3.3.2.17.8.1 ZUT 7025.8.1 GENERAL

Components shall be designed for corrosion resistance to the high corrosivity category (C4) of SANS 12944-2.

Corrosion protection shall comply with Zut 0003.

Materials shall comply with Zut 0001.

C3.3.2.17.8.2 ZUT 7025.8.2 EQUIPMENT

Equipment shall comply with the table below.

ITEMS	MATERIAL	COATING
Body	Ductile iron	Rilsan coat, applied by an agent approved by the coating manufacturer, or; Fusion bonded epoxy to a dry film thickness of at least 200 micron.
	Cast steel	As for ductile iron
Diaphragm	Suitable for the fluid (without chemical attack).	N/A
Internal moving part	Stainless steel.	N/A
	Non-ferrous metal.	N/A
Pipework for pilot system	Stainless steel with stainless steel fittings.	N/A
Fasteners on valve	EN Grade 1.4401 (316)	N/A
Flange fasteners	As for mating pipework.	As for mating pipework

Auxiliary metal components	EN Grade 1.4401 (316)	Pickle and passivate
Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning. Carbon steel parts are not acceptable. G54		

C3.3.2.17.9 ZUT 7025.9 FASTENERS

Fasteners shall comply with Zut 0001.

C3.3.2.17.10 ZUT 7025.10 SPARES

The spares to be provided are specified elsewhere.

C3.3.2.17.11 ZUT 7025.11 INSTALLATION

Installation work shall comply with Zut 0001.

The valve shall be mounted firm and level. Valves of DN 250 and larger shall be provided with at least one dedicated support.

C3.3.2.17.12 ZUT 7025.12 SAFETY

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

C3.3.2.17.13 ZUT 7025.13 INSPECTIONS

C3.3.2.17.13.1 ZUT 7025.13.1 WORKSHOP/FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect the valves for acceptance prior to despatch to Site and prior to payment being made. If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

C3.3.2.17.13.2 ZUT 7025.13.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site for acceptance prior to commissioning.

C3.3.2.17.13.3 ZUT 7025.13.3 INSPECTION DURING DEFECTS NOTIFICATION PERIOD

The Contractor shall inspect the operation of the Works three months after the start of the Defects Notification Period and shall provide a condition report on all equipment to the Engineer.

C3.3.2.17.14 ZUT 7025.14 TESTING REQUIREMENTS

Valves shall be tested after the coating systems have been applied.

Valve bodies shall be pressure tested to 1,5 times the nominal pressure rating.

The seat shall be tested to 1,1 times the nominal pressure rating. The valve shall be drop tight.

The valve functionality; i.e. compliance with the requirements of the operation and control system; shall be demonstrated to the Engineer prior to the commissioning of the Works. If it will not be possible to demonstrate the valve functionality on Site after installation, then this shall be demonstrated to the Engineer before the valve is transported to Site.

C3.3.2.18 ZUT 7028 LEVEL CONTROL VALVE

C3.3.2.18.1 ZUT 7028.1 SCOPE

ZUT 7028 specifies the standard requirements for level control valves of the type with floating ball.

The numbers and sizing of equipment to be provided are specified in the Amendments and Datasheets and the installation shall be as shown on any accompanying drawings.

The installation shall be as shown on any applicable drawings provided with the tender documents.

C3.3.2.18.2 ZUT 7028.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments to this Specification.

b) Data Sheets.

c) ZUT 0001: General Mechanical Requirements.

d) ZUT 0002: Operating and Maintenance Manuals.

e) ZUT 0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.

f) ZUT 7004: Valves for Water and Wastewater Installations.

C3.3.2.18.3 ZUT 7028.3 GENERAL

Level float control valves shall be flanged (raised face flanges) and be either of the hydraulic operated control valve or the mechanical float with arm type, the valve of which shall be completely self-controlled with no external power source required.

Valves shall be capable of withstanding the nominal upstream and downstream pressure (PN) and specified test pressures and seal drop at the specified range of water level within the reservoir.

The valve shall open and close smoothly at any point in the specified range.

Valves shall have the manufacturer's name, size and working pressure cast on the valve body.

BODY

Control valves shall have an open assembly feature, which permits the inspection of the control valve's internal operating mechanism, the seat, plunger, main shaft etc. without the removal of the valve from the pipeline. Stainless steel trimmed control valves including the main valve seat, plunger assembly and shaft with epoxy powder coated steel or cast iron accessories are preferred to bronze trim. Pinned stainless steel valve seats are preferred to epoxy glued seats.

INSTALLATION

The float mechanism shall preferably be installed in a float chamber in the reservoir in order to minimise the effect of waves on the opening/closing action. The inlet to the float chamber shall be proportional in size to the valve chamber. The opening should be large enough to prevent clogging by debris in the system.

Pressure gauges and recorders, where specified, must be permanently mounted up and down-stream of the valve.

CAVITATION RESISTANCE

Resistance to cavitation damage is essential and the maximum permissible flow rates through the valves at the respective maximum differential pressures across the control valve, should be quoted. Valves that offer built-in resistance against cavitation damage of the downstream equipment e.g. the valve, pipeline and control circuitry will receive preference.

PRESSURE REDUCTION

Mechanical break pressure devices, i.e. orifices, may be utilised to assist with pressure reduction, provided that this will not have an adverse effect on the discharge rate at the anticipated specified minimum dynamic inlet pressure and result in excessive noise and vibration.

C3.3.2.18.4 ZUT 7028.4 TYPE OF LEVEL CONTROL AND FLOAT VALVES

There are two prominent methods of achieving float/level control duty, by using either of the following:

C3.3.2.18.4.1 ZUT 7028.4.1 HYDRAULICALLY OPERATED FLOAT AND LEVEL CONTROL VALVE

Tree-way pilot valves activated by a small float mechanism shall control the opening and closing cycle duration. If hydraulic float control activators prove impractical, an alternative control pilot system incorporating electric solenoid activators may be considered.

C3.3.2.18.4.1.1 ZUT 7028.4.1.1 System pressures

The upstream pressure of this type of valve can vary from a full static head in a pipeline to the minimum residual static head during the maximum anticipated flow rate. The pilot valve system where applicable shall be capable of functioning efficiently under the full range of inlet pressures.

C3.3.2.18.4.1.2 ZUT 7028.4.1.2 Control characteristics

A linear velocity reduction is required to reduce pressure surges. Alternatively the closing cycle should be inversely proportional to increasing dynamic pressure by means of a pressure sensitive, adjustable automatic control pilot valve assembly. This assembly will induce a reduction in closing speed with increased dynamic inlet pressure preventing continued closing when the inlet pressure exceeds the system design pressure. Closing too slowly, however, will tend to result in excessive velocities at high pressure differentials across the valve seat causing rapid erosion of coating, cavitation damage and possible reservoir spillage.

Configurations including automatic surge suppression and surge relief will be considered an advantage. This type of valve is usually set to operate in an ON - OFF mode and not in a modulating configuration. Where more than one valve is used, the valve can be used to cascade, so that only one valve will operate during lower demands and will, in turn, activate other hydraulically operated float/level control valves in the system as the demand increases.

C3.3.2.18.4.1.3 ZUT 7028.4.1.3 Installation

The valve control system must be designed to be neatly mounted against the valve chamber or reservoir.

C3.3.2.18.4.1.4 ZUT 7028.4.1.4 Body

Diaphragm actuated control valves with single or double diaphragm control chambers will be acceptable, providing that the main shaft is double-guided with suitable renewable bearings preventing excessive wear, during flow velocities exceeding 3 meters per second.

C3.3.2.18.4.1.5 ZUT 7028.4.1.5 Control system

All pilot valves shall be supplied sealed, using sealing wire and lead seals, to prevent unauthorised tampering. All control and pilot valves shall be clearly and permanently labelled.

C3.3.2.18.4.1.6 ZUT 7028.4.1.6 Dirt traps

The control valve should be provided with a dirt trap or strainer system containing a removable 100 - 200 micron stainless steel cartridge and a suitable scour plug to flush accumulated debris, which may accumulate on the upstream side of the valve. The dirt trap should prevent obstruction of the normal functioning of pilot valves and the main valve seat. The free flow area of this unit should be larger than the actual control valve seat area.

C3.3.2.18.4.1.7 ZUT 7028.4.1.7 Maintenance

Pilot valve components subject to wear e.g. valve seats, pressure sensing membranes, shafts, hydraulic seals; resilient seats, etc. shall be readily available as replacement spare parts.

C3.3.2.18.4.1.8 ZUT 7028.4.1.8 Operating instructions

An approved operating instruction notice board made of engraved aluminium with painted lettering shall be supplied with the following indicated thereon:

1. Concise operating instructions;
2. The numbers of the valves and pilot valves;
3. The pilot valve piping

The notice board shall be mounted above the control system and piping.

C3.3.2.18.4.1.9 ZUT 7028.4.1.9 Commissioning

The contractor shall prepare for commissioning by making use of preliminary factory settings of the control and pilot valves. No commissioning shall be permitted unless the contractor is able to convince the Engineer that the required preparation backed by calculations, where necessary, has been made.

C3.3.2.18.4.2 ZUT 7028.4.2 MECHANICALLY OPERATED FLOAT VALVE

A mechanically operated valve mounted at the end of a pipeline relies solely on the action of a lever and float mechanism attached to the valve to operate effectively. The position of the float along the lever arm and associated linkage to the sealing mechanism is critical to ensure a linear pressure reduction in the valve during closure.

C3.3.2.18.4.2.1 ZUT 7028.4.2.1 Installation

The position of the float along the lever arm must ensure that the force exerted on the internal sealing faces of the valve is adequate to overcome the maximum upstream pressure of a given designed system. The prevailing water surface turbulence shall not influence the smooth operation of the valve.

C3.3.2.18.4.2.2 ZUT 7028.4.2.2 Valve design

The design of the valve shall prevent internal cavitation from occurring due to the dissipation of excess energy. The design of a mechanically operated valve shall facilitate a closure characteristic whereby deceleration of the closing rate occurs just before the valve closes to dampen out severe surges when there is a high dynamic differential pressure across the valve.

C3.3.2.18.5 ZUT 7028.5 MATERIALS

Valve components shall be constructed of the material specified in the applicable valve datasheets.

C3.3.2.18.6 ZUT 7028.6 FASTENERS

Fasteners on the valve shall be of EN Grade 1.4401 (316) stainless steel.

Flange fasteners shall comply with the specification for the pipeline's flange fasteners.

Fasteners shall comply with the clause "Fasteners" in ZUT 0001 – General Mechanical Requirements.

C3.3.2.18.7 ZUT 7028.7 CORROSION PROTECTION

The specific application shall be taken into account in the corrosion protection of valves under Corrosion Protection for Valves specification ZUT 7005.

C3.3.2.18.8 ZUT 7028.8 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

If the equipment is manufactured and assembled in South Africa, the Contractor shall make all arrangements and carry all costs for the Engineer to inspect equipment in the workshop prior to dispatch to Site.

If the equipment is manufactured and assembled outside South Africa, the Contractor shall make all arrangements and carry all costs for an Engineer approved inspection authority to inspect the equipment in the workshop prior to dispatch. The inspection shall include a full report on compliance of the equipment with this specification and this report shall be submitted to the Engineer prior to dispatch of the unit from the workshop.

C3.3.2.18.9 ZUT 7028.9 TESTING REQUIREMENTS

The Contractor shall arrange for the Engineer to witness the testing of valves of sizes DN 200 and larger and all travel and accommodation costs shall be the responsibility of the Contractor.

The valve shall be tested according to specifications ZUT 7004.

The correct operation of the valve shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.18.10 ZUT 7028.10 OPERATING AND MAINTENANCE MANUAL

This section shall comply with the requirements as specified under ZUT 0002.

C3.3.2.18.11 ZUT 7028.11 MEASUREMENT & PAYMENT

Measurement and payment covered under ZUT 7004.

C3.3.2.19 ZUT 8003 WATER METERS FOR PIPELINES, WATER AND WASTE WATER WORKS

C3.3.2.19.1 SCOPE

This specification covers the requirements for measuring and recording instruments for use with potable and raw water, raw sewage and effluent in pipelines of diameters from 50 mm to 2 000 mm under working pressures are generally up to 2 500 kPa. It includes associated integrating instruments but does not include domestic or hot water meters.
Interpretations of and variations to this specification are set out in Amendments to this Specification.

C3.3.2.19.2 NORMATIVE REFERENCES

C3.3.2.19.2.1 SUPPORTING SPECIFICATIONS

Where this specification is required for a project, the following specifications shall, inter alia, form part of the contract document:

a) Amendments to this Specification

b) ZUT 0001 : General Mechanical Requirements

c) ZUT 0003 : General Corrosion Protection of Pipelines for Water and Wastewater Works

C3.3.2.19.2.2 DEFINITIONS

For the purpose of this specification, the definitions given in 2.1.1(b) to (c) and the following shall apply:

a) **Control element**: the fastest moving visible graduated element

b) **Flow rate**: means the volume of water passing through the water meter per unit of time;

c) **Maximum flow rate**: means the highest flow rate at which the meter is required to operate in a satisfactory manner for short periods of time not exceeding half an hour per day, without deteriorating;

d) **Minimum flow rate**: means the lowest flow rate at which the meter is required to register within the maximum permitted error tolerance;

e) **Nominal pressure**: means the internal pressure corresponding to the maximum permissible working pressure;

f) **Permissible continuous flow rate**: means the highest flow rate at which the meter will operate continuously without deterioration of accuracy, or abnormal wear occurring;

g) **Transitional flow rate**: means the flow rate at which the maximum permissible error of the water meter changes in value;

h) **Turndown ratio**: means the ratio between the maximum and minimum flow rates; and

i) **Verification scale interval**: the scale interval of the control element;

C3.3.2.19.2.3 ABBREVIATIONS

For the purpose of this specification, the abbreviations given in 2.1.1(b) to (c) shall apply and the following shall have the meaning given:

DN : Nominal diameter in accordance with SABS 1123
DSI : Dall short insert
DFT : Dry film thickness

IP : A symbol which, followed by two characteristic numerals, signifies the degree of mechanical protection to ingress of foreign bodies and water as defined in SABS 1222
LCD : Liquid crystal display

C3.3.2.19.2.4 EXPLANATION OF TERMS

"Materials": In the context of this specification the term "materials" covers both the basic materials used in the manufacture and fabrication of the measuring and recording instruments, and the measuring and recording instruments themselves as finished products that are to be installed and commissioned.

C3.3.2.19.3 REQUIREMENTS

The detailed requirements of the different types of water meters are specified in Clause 4 of this Specification and shall be read in conjunction with the relevant clause of this clause. The requirements of Clause 4 shall take preference above the requirements of this clause if in conflict.

C3.3.2.19.3.1 GENERAL

Flanges and Gaskets

For all specifications and standards regarding the flanges and gaskets to be used refer to Specification – Mechanical General. All couplings and flanges shall be corrosion protected and wrapped according to Specification ZUT 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.

Unless otherwise specified in the Amendments to this Specification, flanged end connections shall comply with SABS 1123 for a nominal pressure corresponding to that of the water meter and the stated working pressure of the adjacent pipework.

The meter design shall provide for a reasonable clearance behind the rear face of flanges to allow access to e.g. bolts and nuts for installation and removal.

C3.3.2.19.3.1.1 Insulating Flanges

Insulating flanges and materials shall be arranged as set out in Code of Practise No. SAECC/1 or SANS 10121.

C3.3.2.19.3.1.2 Flanged connection

C3.3.2.19.3.2 INSTALLATION

C3.3.2.19.3.2.1 Mechanical

Meters shall be installed in accordance with Standard Code, International Organization for Legal Metrology (IOML), International Document No 4: Installation and Storage Conditions of Cold Water Meters.

C3.3.2.19.3.2.2 Earthing

Then watermains will consist of electrically insulated metal pipes the Contractor shall, where deemed necessary by him, install an efficient earthing system and lightning arrester capable of protecting the electronic equipment supplied and installed by him. Where the water meter is part of an electrical earthing system, the Contractor shall install a permanent shunt for the water meter and its associated fittings.

C3.3.2.19.3.2.3 Coordination with other Contractors

The civil contractor will install 100 mm conduits complete with draw wires to interconnect the various chambers to enable the Contractor to lay the necessary cables. The Contractor shall excavate the necessary trenches between the control chambers and as otherwise required.

The Engineer will advise the Contractor where applicable when the meters have been installed by the civil contractor and are ready for commissioning. Commissioning shall commence within 14 days of receipt of the Engineer's written instruction to commence.

C3.3.2.19.3.2.4 Surge filters

The Contractor shall be responsible for ensuring that adequate provisions are made for filtering out any power supply system irregularities (surges, harmonics, etc.) which may in any way affect the proper operation of any component of the metering and recording instrument systems.

C3.3.2.19.3.3 WATER METERS

C3.3.2.19.3.3.1 Performance specification

Meters shall be suitable for the accurate measurement of cold water. Meters shall be capable of measuring the flow linearly at Reynolds numbers of 4000 and above to within the accuracies specified elsewhere for each type of meter.

Unless otherwise specified in the Amendments to this Specification meters shall have a pulse type of output. The calibration factor shall not be affected by changes of water temperature between 4ºC and 35ºC or specified pressures operating range. The pipeline will flow 100% full at all times. The downstream back pressure on the meters may, under certain circumstances, be as little as 5 kPa. Unless stated to the contrary in the Detail Sheets, the meter accuracy shall not be affected by cavitation.

The output signals shall be:
− 4 - 20 mA current loop interface
− 0 - 5 V analog signal

The output signals shall be suitable for driving computers, electronic converters, digital counters, recorders, indicators, controllers and for transmitting signals through a telemetry system.

Electronic metering instruments shall have digital and linear output with a turndown ratio of not less than 100:1. Woltmann type meters shall have a turndown ratio of not less than 30:1.

Hydraulic instruments having a square root output shall have a turndown ratio of not less than 4:1.

C3.3.2.19.3.3.2 Materials

The responsibility for selecting materials compatible with the liquids or surroundings with which the equipment comes into contact rests with the Contractor. The materials used shall be at least equal to those specified in this specification.

C3.3.2.19.3.3.2.1 Plastics materials

Plastic components, when subjected to a temperature of 150ºC +5ºC in an air circulation oven for a period of 60 minutes +1 minute, shall show no sign of blistering or weld line splitting. Any damage around the injection point shall not penetrate to a depth of more than 50% of the thickness of the material at that point. Clear plastics material may be used for operating members only.

C3.3.2.19.3.3.2.2 Metallic materials

Metallic materials shall be as follows or equal approved by the Engineer:

a) Water meter body: a high grade meehanite cast iron,

b) Internal components in contact with the water: a stainless steel complying with the requirements appropriate to any of the grades of steel given in SABS 0202, Table 18, rows 1 17 inclusive.

C3.3.2.19.3.3.3 Transparent window

The indicating device of the water meter shall be protected by a transparent window (glass or other material). Further protection may be provided by a suitable cover.

The water meter shall be provided with means for the removal of condensation if the latter can occur on the underside of the window of the indicating device.

C3.3.2.19.3.3.4 Remote reading

Where specified in the Amendments to this Specification, the design of the meter shall be such that the totalizer can be read remotely, making use of a solid-state electronic (or otherwise approved) transmitter incorporating a sealed slot-sensing proximity switch. Signals shall be transmitted via a two wire system suitable for a 4 - 20 mA pulse/current output (or otherwise approved). The system shall also be capable of incorporating instruments of the type specified in Clause 3.4.

C3.3.2.19.3.3.5 Pressure

Unless otherwise specified in the Amendments to this Specification the meters shall be capable of withstanding a normal working pressure of at least the stated working pressure of the adjacent pipework and a field test pressure of at least 1.5 times the working pressure.

C3.3.2.19.3.3.6 Behaviour in case of backflow

Where meters may be subjected to an accidental reversal of flow, they shall be capable of withstanding the reversal of flow without any deterioration or change in their metrological characteristics and at the same time shall record such a reversal.

C3.3.2.19.3.3.7 Protective Devices

Water meters shall have protective devices which can be sealed in such a way that after sealing, both before and after the water meter has been correctly installed, there is no possibility of dismantling or altering the water meter or it's adjustment device without damaging the protective devices.

C3.3.2.19.3.3.8 Marking

Water meters shall be clearly and indelibly marked with the following information, either grouped or distributed on the casing, the indicator dial or an identification plate, (the water meter cover, being detachable, shall never be used for this purpose):

a) name or trade mark of the manufacturer;

b) metrological class, permissible continuous flow rate in cubic metres per hour and pressure loss in kPa;

c) year of manufacture and serial number;

d) one or two arrows indicating the direction of flow;

e) mark of type approval;

f) maximum working pressure, in kPa;

g) the letter V or H, if the meter can only be operational in the vertical or horizontal position; and

h) Environmental protection IP.....

C3.3.2.19.3.3.9 Waterproofing

Unless otherwise specified in Amendments to this Specification all parts of the meter and electronic equipment likely to be affected shall conform with IP 68 environmental protection requirements. The depth of submergence shall be 7 m for up to 60 days. Where there is no likelihood of the meter becoming submerged for any length of time or depth the class of protection may be reduced to IP 65 with the written approval of the Engineer.

The recorder, totalizer and electronic equipment will be located in a separate chamber above ground level and shall be housed in a weather proof case complying with IP 54.

C3.3.2.19.3.3.10 Replacement of parts

The Contractor shall state the effect that replacing of any vital part of the meter sensing equipment will have on the accuracy and calibration of the meter.

C3.3.2.19.3.3.11 Mains/Battery failure

The Contractor shall state what effect total loss of power will have on resumed operation of the meter, i.e. will balance/zero or totalizer reading be affected in any way.

C3.3.2.19.3.3.12 Routine maintenance

The Contractor shall state what regular servicing is necessary to ensure continuing accuracy of the metering equipment.

C3.3.2.19.3.3.13 Adjustment device

Meters may be fitted with an adjustment device with which it is possible to correct the relationship between the volume indicated and the volume actually passed. This device is obligatory for meters which make use of the action of the velocity of the water on the rotation of a moving part.

C3.3.2.19.3.3.14 Accelerating device

The use of an accelerating device for increasing the speed of the meter, when the flow rate is below the minimum flow rate, is prohibited.

C3.3.2.19.3.3.15 Corrosion protection

Corrosion protection shall be in accordance with Specification ZUT 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.

C3.3.2.19.3.4 INSTRUMENTS

C3.3.2.19.3.4.1 Recording instruments

All recording instruments shall be of approved type and shall conform with the requirements of BS 90.

C3.3.2.19.3.4.1.1 Receiving unit

The receiving unit shall be a user-programmable microprocessor controlled record/integrating totalizer suitable for operation on the power supply specified in Clause 3.5.1.

C3.3.2.19.3.4.1.2 Flow-rate indicator

A flow-rate indicator having a 4 digit LED display, with approximately 8 mm high characters, marked in Ml/d and reading from 0,00 to 99,99 Ml/d or 0 m³/h to 9999 m³/h as appropriate, shall be supplied with the meter.

C3.3.2.19.3.4.1.3 Totalizer

The electronics shall include an 8 digit non-resettable totalizer recording in cubic metres or Ml, as appropriate, field programmable for pulse ratio from 0,0001 to 10 counts per second, a vernier dial for calibrating the instruments to indicate flow in Ml/d, or m³/h as appropriate, a range switch and built-in calibration test switch. The meter shall allow for calibration testing with the primary element in the following process and the display shall indicate verification of the calibration. The meter shall have memory protection to ensure that the data is not lost should a power failure occur.

C3.3.2.19.3.4.2 Identification label

Each recording instrument shall be fitted with a legible engraved identification label.

C3.3.2.19.3.4.3 Cabinet

Instrument cabinets are required to house the flow convertor, indicators/integrators, surge protection, etc. of each flow meter system. The instrument cabinets shall have the following dimensions:

- Height – 645 mm;
- Width – 435 mm; and
- Depth – 250 mm.

The minimum IP rating of these instrument cabinets shall be IP66. The panels and doors of these instrument cabinets shall be constructed from reinforced glass fibre/impregnated polyester. The instrument cabinets shall be wall mounted with 4 stainless steel wall mounting lugs giving a space of at least 10 mm between the enclosure and the wall.
The instrument cabinets shall be fitted with a painted metal chassis of at least 2.5 mm thick. The instrument cabinet shall be fitted with a glazed door that allows viewing of the indicators and integrators. The window of the door shall be at least equal to 50% of the total area of the door part of the enclosure.

The door shall be removable and have concealed hinges and captive stainless steel hinge pins. The door shall have an in situ moulded polyurethane sealing gasket fitted to a groove and two closure points that are situated outside of the sealed area. It shall be fitted with at least one cylindrical barrel type lock and two keys shall be supplied with each cabinet. The mechanical resistance of the enclosure with the glazed door shall comply with IK08 (5 Joules to standards EN50102).

The instrument cabinet shall also be fitted with a full size internal door for mounting of the totalizers and integrators. The internal door shall be reversible. Each instrument cabinet shall be fitted with a M10 brass bolt, two brass nuts and two rubber washers that will act as an equi-potential bar. All surge protection in the enclosure shall be grounded onto this bolt.

C3.3.2.19.3.5 POWER SUPPLY

C3.3.2.19.3.5.1 Electricity Supply

Unless otherwise specified in the Amendments to this Specification, the power supply shall be 220 V, 50 Hz, Single phase, a.c.

C3.3.2.19.3.5.2 Battery system

Where specified in the Amendments to this Specification, or otherwise required, electrically operated meters shall be designed for operating on a standby battery system (preferably 24 V) so that the meters will continue totalizing in the event of a failure of the normal 220 V, 50 Hz, AC supply. The battery capacity shall be sufficient to operate the totalizer for a minimum of 7 days without requiring recharging.

The battery pack shall be of the totally enclosed pattern, mounted within a separate compartment of the control panel. It shall be designed for operation on the appropriate power supply and shall be of the fully-automatic maintenance-free type.

The unit shall have d.c outputs at voltages suitable for the duty or duties for which the battery pack is specified, viz:

− 24 V for flow-metering, recording and integrating.

Where necessary, d.c-a.c. inverters shall be supplied to provide standard sinusoidal voltage(s) at 50 Hz.

The rating of battery packs and inverters shall be suitable for driving the normal load (plus a 30% safety factor) for a period of 48 hours without recharging, unless otherwise specified.

Trickle charge and boost charge rates shall be provided in accordance with the battery manufacturer's recommendation and shall be automatically controlled according to battery condition, using a constant voltage current controlled (C.V.C.C) charger. In the event of the battery state-of-charge falling to a level where the battery can be permanently damaged the system shall cut out completely.

The unit shall incorporate the following features:-

- On/off switch
- Input and output fuses
- Indicator lamps "Power On"
- or LED'S "Battery charger input failed"
  "Battery charger output failed"
- Charge rate ammeter and test button
- Voltmeter with on-load test button
- Auto/Normal/Boost charge rate selector switch
- Reverse polarity protection

C3.3.2.19.3.6 STRAINERS

Unless otherwise specified in the Amendments to this Specification, all mechanical raw water meters shall be provided with an approved external wye-type strainer installed upstream of the measuring element. The clear opening of the strainer shall be at least 5 times the cross sectional

area of the meter and shall not pass spheres in excess of 0,25 mm diameter. It shall be possible to flush the strainer by means of an adequately sized valve.

C3.3.2.19.4 TYPES OF WATER METERS

The requirements as specified below shall be read in conjunction with the requirements of Clause 3: Where in conflict with Clause 3 and its sub-clauses the requirements hereunder shall take precedence.

C3.3.2.19.4.1 WOLTMANN, VOLUMETRIC AND TURBINE METERS

C3.3.2.19.4.1.1 Meter size

Meter size is designated by the nominal size of the meter flanges.

C3.3.2.19.4.1.2 Relationship between meter size and permissible continuous flow rate

Meters shall be rated in accordance with flange diameters and related permissible continuous flow rates as specified in Table 1.

Provided that the metrological requirements are met, a meter size one step smaller or larger than the relationship shown in Table 1 may be used. In such a case the meter shall be designated both by the nominal diameter of it's end connection and by the numerical value of it's permissible continuous flow rate.

TABLE 1: WATER METERS WITH FLANGED END CONNECTIONS

1	2	3
Meter size (nominal size of flange end connections) DN mm	**Permissible continuous flow rate**	
	Volumetric and turbine meters m³/h	**Woltmann meters m³/h**
50	15	20
65	20	30
80	30	80
100	50	110
150	100	200
200		290
250		400
300		600
400		1 000
500		1 500
600		2 300
800		4 000

C3.3.2.19.4.1.3 Raw water meters

Meters operating in raw water shall be constructed to withstand excessive wear resulting from grit in the water and to ensure trouble free operation. At least the following preliminary precautions shall be taken:

a) Bearings. The bearings shall consist of Ni-hard shafts running in sapphire bushes, or similar approved hard materials.

b) Propellers. The propellers shall be made from a special mixture of polypropylene reinforced with glass fibre or other approved material.

C3.3.2.19.4.1.4 Accuracy

The maximum permissible error in the lower zone from the minimum flow rate inclusive up to but excluding the transitional flow rate shall be +5%.

The maximum permissible error in the upper zone from the transitional flow rate inclusive up to and including the maximum flow rate shall be +2%.

C3.3.2.19.4.2 DALL-TYPE METERS

C3.3.2.19.4.2.1 General

Dall type water meters shall consist of

i. a Dall type short insert, or similar approved, suitable for insertion into the pipeline between flanges,

ii. differential pressure transmitter, and

iii. a receiving unit.

C3.3.2.19.4.2.2 Insert tube

The insert tube shall be of gunmetal to SABS 200: Code 1D suitable for mounting between flanges drilled in accordance with 3.2.7. Unless otherwise specified in the Amendments to this Specification, the insert tube shall be able to operate at working pressures of up to 1 000 kPa. Suitable isolating cocks shall be provided with the insert tube.

C3.3.2.19.4.2.3 Differential pressure transmitter

An electronic differential pressure sensor capable of accurate electronic transmission of the differential pressure shall be coupled to the DSI. The instrument shall be suitable for wall or post mounting.

The sensor shall be capable of withstanding working pressures of at least 1 000 kPa or as specified in the Amendments to this Specification and shall be contained within a waterproof housing conforming to protection, IP68 (see 3.2.13 and 3.3.5.3). (An acceptable sensor would be the Kent K-DC or equal approved).

A square root integrator shall be coupled to the transmitter to derive the total flow. An adjustable "drop-out" control shall be incorporated into the module totalizing on a residual "zero" input signal.

Input: 4-20 mA for two-wire operation, with non interacting external zero and span and external damping adjustments situated on the same side of the transmitter.

Output: Not less than 36 000 counts/hour.
Built in facilities shall be provided for automatic detection of loss of signal or system faults with visible or audible indication.

C3.3.2.19.4.2.4 Receiving unit

The receiving unit shall be as specified in Clause 3.4.1.1.

C3.3.2.19.4.2.5 Accuracy

The meter's system accuracy shall be better than +2,0% of reading at the maximum rate of flow stated in the Amendments to this Specification. (See 6.1.3).

C3.3.2.19.4.3 ORIFICE-TYPE WATER METERS

C3.3.2.19.4.3.1 General

Orifice-type water meters shall consist of:

i. an orifice plate for insertion between flanges into the pipeline,

ii. a differential pressure transmitter, and

iii. a receiving unit.

C3.3.2.19.4.3.2 Orifice plate

The orifice plate shall be of 304 stainless steel and be mounted in a carrier ring suitable for mounting between flanges which, unless otherwise specified in the Amendments to this Specification, shall be in accordance with Clause 0. The carrier ring shall be provided with:

i. a welded on tag on which the basic data is engraved,

ii. all necessary pressure tappings, and

iii. isolating valves.

C3.3.2.19.4.3.3 Differential pressure transmitter

The differential pressure transmitter shall be of the electronic type as specified in Clause 4.2.3.

C3.3.2.19.4.3.4 Receiving unit

The receiving unit shall be as specified in Clause 3.4.1.1.

C3.3.2.19.4.3.5 Accuracy

The meter's system accuracy shall be equal to or better than the following:

Rate of flow as stated in the Amendments to this Specification	**For max. to min. ratios 10:1 or less**	**For max. to min. ratios greater than 10:1**
At the maximum flow rate	± 2,0%	± 2,0%
At 50% of the maximum flow rate	± 2,0% of actual flow	± 2,5% of actual flow
At 25% of the maximum flow rate	± 4,0% of actual flow	± 5,0% of actual flow

C3.3.2.19.4.4 ELECTROMAGNETIC FLOW METERS

C3.3.2.19.4.4.1 General

Transmitters shall operate on the law of induction principle. They shall be compact and suitable for mounting in the field without additional protection.

The flowmeter shall be suitable for use in pipelines that are cathodically protected.

Supply shall include gaskets and earthing rings.

A primary head simulator shall be offered as an option.

Empty pipe detection shall be included.

C3.3.2.19.4.4.2 Operating Principle and Construction

The primary head shall meet the following requirements:

Connection flange rating : BS4504 NP 10

Connection flange material : Cr Nisteel} depending on application

Tube Material : (1,4301) } depending on application

Liner Material : EPDM or PTFE depending on application

Electrode Material : Hastelloy Tantalum depending on application

Meter Casing : Die Cast Aluminium

Power Supply : 24 V DC or 220 V AC

Enclosure Class : IP65

Ambient Temperature Range : -10°C to +50°C

Electrical Connections : 20 mm ISO conduit

Field excitation shall be pulsed D.C.

The signal converter shall meet the following requirements, subject to the application:

- The ingress protection rating of the converter shall be the same as for the primary element, typically IP65.
- Transmitter shall have microprocessor based electronics with local flow indication and ability to display and change, on-line, range and units.
- The low-flow cut-out shall be user configurable.
- Parameter and data storage shall be kept in non-volatile memory.
- Output shall be 4 to 20 mA, isolated. Where transmitters have dual ranges, each range shall have a separate output.
- The flow meter shall be the electromagnetic type comprising a sensor and either remote or integral microprocessor based converter unit. The system shall be inherently bi-directional with separate isolated analogue (4-20 mA) and pulse outputs (volt free) for forward and reverse flow.
- The flow meter shall have no moving parts to ensure that there is no damage from particulate matter e.g., stones, weed etc.
- The meter shall be suitable for 85 to 265 volts a.c. and 9 to 40 d.c. Volts 40 to 400Hz supply without the need for link setting or voltage selection.

- The system accuracy shall be better than +/- 0.2% of rate or 1mm/s whichever is the greater in irrespective of flow direction with a flow range of 0.01 m/s to 15 m/s full scale (i.e. 1500:1 turndown). Repeatability shall be better than ±0.05%.

- The meters shall be suitable for a maximum working temperature of 70 DegC at pressures up to 16 bars or as limited by the flange rating.

- The meter performance shall have been verified on a fully traceable test facility that is internationally accepted. Laboratory traceability packs shall be available on request.

- The meter shall be designed and manufactured under the ISO 9000 series of quality standards. It shall also have a meter body length to current ISO standard for magnetic meters to facilitate interchangeability of product.

- The wetted materials shall be compatible with, and suitable for, use on potable water. The liner shall be certified by an internationally recognized body such as AWWA or equal. Acceptable electrode material is stainless steel.

- The flow sensor shall be rated to IP68 and be suitable to indefinite submergence to a depth of up to 10m. The sensor shall also be suitable for installation in underground pipes without the need for a metering chamber, vault or pit (i.e., it shall be capable of direct burial). The manufacturer shall, on request, provide evidence of satisfactory operation of similar sensors for a minimum period of 5 years in buried installations.

- Cabling between the flow transmitter / converter shall be by one single cable providing both power to the flowmeter sensor and the return flow signal from the sensor to the flow meter transmitter / converter, thus reducing cabling costs and can be up to 250 meters in length.

- The transmitter / converter unit shall be protected to IP65 or better.

- Dual alphanumeric displays shall indicate user-defined flowrate and flow total units. The device shall incorporate a menu selection allowing range, unit's etc to be made. Data shall be stored in a non-volatile memory for a minimum retention of 10 years. The meter software shall incorporate multi password protection to prevent inadvertent or fraudulent programming or units of measurement changes.

- There shall be independent totaliser displays to give forward total, reverse total, net totals, time and date.

- The facility to verify the calibration of the flowmeter system in-situ by testing the transmitter, cable and sensor in-situ traceable to International standards can be provided and accompanied with a verification test certificate, thus facilitating direct burial and thereby substantially reducing the cost of installation.

- Condition monitoring by use if an in-situ calibration verification device may be used to actively carry out corrective or preventive maintenance of the flow meter system.

- The transmitter must be fitted with a communication interface with the intergral HART and Profibus protocols.

- The transmitter must be of a wall mounting type.

- Cabling between the flow transmitter/converter shall be suitably designed screened cable providing both power and measurement signal from the flowmeter sensor to the flow meter transmitter/ converter.

- The instrument must be configurable via the integral display keypad and via a portable computer.
- The performance of the flow meter must be immune to stray currents, cathodic currents and electromagnetic interference.
- The meter software must be capable of providing a datasheet of the meter configuration and setting.
- The meter system must through the software be capable of providing the historical information of the calibration setting, flow rates, peak, reverse average etc. These must be date stamped.
- The meter must be fitted with potential free relay contacts for power, instrument fault etc.

C3.3.2.19.4.4.3 Accuracy

The meter's system accuracy shall be better than +0.5% of reading or +0.05% of full scale, whichever is greater without the need for automatic cleaning nor remote removal of electrodes for cleaning. The signal: noise factor shall allow digital full scale mean velocity adjustment from 0-0,25 m/s to 0 - 10 m/s with media conductivities down to 1 micro siemens/cm (µS/cm) without affecting accuracy. Note: This shall include error in the converter.

Repeatability : The repeatability shall be within +0.05% of full scale - See 6.1.5.

Minimum electrical conductivity : 1 micro-siemens/cm (µS/cm). (Most aqueous based liquids have typically 200 - 800 micro-siemens/cm (200 - 800 µS/cm).

Min. nominal full scale velocity : 0 - 0,25 m/s

Max. nominal full scale velocity : 0 - 10 m/s

Calibration should be traceable to internationally accepted standards.

C3.3.2.19.4.4.4 Maintenance

The instrument shall be maintenance free.

C3.3.2.19.4.5 ULTRASONIC IN-LINE 3-BEAM FLOW METERS

C3.3.2.19.4.5.1 General

All 3-beam flow meters shall be microprocessor based in-line flow meters and shall be able to be programmed to read flow accurately passing through any pipe.

The meter shall have a low signal-to-noise ratio and shall be able to damper acoustic signals.

The instrument shall be able to measure bidirectional flow.

C3.3.2.19.4.5.2 Operating Principle

Two diagonally opposed ultrasonic sensors function as transmitter and receiver. The sound signal alternatively emitted from both is at once accelerated by the flow and slowed against the flow.

The difference in the time the signal requires to travel between the two diagonally opposite ultrasonic sensors is directly proportional to the mean flow rate from which the volumetric flow can then be calculated.

Using extra transducers to create several flow paths, flow profile aberrations can be compensated for. This greatly increases the accuracy of the instrument.

The meter shall be able to deal with water with a maximum solid content of 5%.

C3.3.2.19.4.5.3 Construction

The ultrasonic flow meter shall consist of two parts, namely a 3-beam in-line flow sensor and a flow convertor.

The protection class shall conform to IP67/NEMA 6.

The measuring functions shall show at least the actual instantaneous rate of flow as well as the totalized volume of flow.

The meter shall be corrosion protected as well as resistant to UV radiation.
The flow convertor shall be constructed of die-cast aluminium polyurethane coated material.

The output of the flow convertor shall be current, pulse and status output. The output shall be galvanically isolated.

The flow convertor shall be equipped with a high-contrast 3-Line with 20 characters as a minimum requirement, LCD with a high-resolution backlit for displaying the following:

- A pulse output non-resettable flow totalizer, totalizing in l/s, m^3/s, m^3/h, m^3 x 100, etc.;
- A current output flow rate indication in l/s, m^3/s, m^3/h, m^3 x 100, etc.; and
- A status output for alarm signalling to PLC/SCADA/DCS system.

The flow convertor shall also have a galvanically isolated 4-20 mA output linear to flow that shall be connected to a PLC/SCADA/DCS system. This 4-20 mA output signal shall act as a "Re-transmit" function and shall not influence the operation and functionality of the flow meter system.

The flow convertor shall provide an integral diagnostic feature to monitor all internal circuitry and identity errors. The level of such errors shall be identified as fatal, permanent or warning and be logged and stored. The minimum requirement is that the last 9 errors are to be stored in the memory of the flow convertor for a minimum period of 180 days.

A warning icon shall appear on the display when an error occurs. It shall be possible for the operator to view the error-code associated with the fault via a service menu on the display.

Access to the menu structure to effect changes to the settings shall be protected by a personal identification number (PIN) to prevent unauthorized tampering. Authorized personnel must however be allowed access to change the PIN if and when required.

In "Viewing Mode", the operator must be able to scroll through the settings and readings without allowing him to change any of the settings, unless he knows the PIN.

The requirements for the current, pulse and status output shall conform to the following minimum specifications:

- The pulse output or frequency output shall be user selectable;
- Analogue output: 4 – 20 mA. The time constant shall be adjustable between 0.1 and 30 seconds;

- Frequency output: Frequency: 0-10 kHz, 50% duty cycle, adjustable 500 Hz, 1 kHz, 5 kHz, 10 kHz with adjustable time constant selectable between 0.1 to 30 seconds;
- Pulse output: User selectable negative/positive pulse with adjustable pulse widths from 64 µs to 4.2 seconds with selectable volume unit/pulse; and
- Status output: Change-over type 42 VAC, 2 A or 24 V DC, 1 A selectable as error or control or for low or high flow limit switch with adjustable hysteresis.

C3.3.2.19.4.5.4 Installation

The signal cable must be able to carry the flow signal to a maximum distance of 500 metres without the need for additional signal repeaters or conditioners.

The isolation spark gaps to be installed on the pipeline in the manhole shall conform to Drawing number 1A-C6-066 and Section 28 – Mechanical General. These isolation spark gaps shall be connected via the earth bars onto the earth point as supplied by the pipeline Contractor.
The instrument installation shall include for all interconnections and sundry requirements between sensor and control/amplifier unit.

A removable EEPROM with flow sensor data stored in the EEPROM shall be provided with the flow sensor and shall contain the following:

- Serial Number;
- Sensor Size; and
- Calibration Factor.

Between the flow sensor and flow convertors, there shall be two separate lengths of 3-core, multi-strand, 1.0 mm2 individually insulated with an overall braided screened instrumentation cable.

The instrument cabinet fitted with the flow convertor, electrical surge protection and related Plant items shall be installed against the wall inside the flow meter chamber.

The installation shall include for all required interconnections and sundries between the flow sensor and flow convertor.

The flow meter must be installed on a straight and unobstructed length of pipe. The length of pipe upstream and downstream from the flow meter shall conform to the following minimum straight and unobstructed lengths required before any bend or obstruction occurs:

- Upstream of flow meter – A length greater or equal to 5 times the diameter of the pipe (5ND<L<10ND); and
- Downstream of flow meter – A length greater or equal to 3 times the diameter of the pipe (3ND<L<5ND).

The flow meter flanges shall be suitable for the rating of the operating pressure and related pipe work at the proposed location as indicated on the Drawings. The instrument shall be able to measure bidirectional flow.

C3.3.2.19.4.5.5 Accuracy

The accuracy of the meter shall be guaranteed equal or better than ± 0.5% of the measured value.

C3.3.2.19.4.6 ULTRASONIC CLAMP ON FLOW METERS

C3.3.2.19.4.6.1 General

Ultrasonic clamp-on flow meters shall be microprocessor based; non-contact flow meters and shall be able to be programmed to read liquid flow accurately passing through any pipe.

The Ultrasonic clamp-on flow meters shall be of the dual-sensor type.

The meter shall have a low signal-to-noise ratio and shall be able to damper acoustic signals.

The instrument shall be able to measure bidirectional flow.

C3.3.2.19.4.6.2 Operating Principle

A burst of ultrasonic pulses are transmitted from a transducer, which is not in contact with the water flow being measured. The transmitter (sensor A) transmits pulses through the water and is received by the receiver (sensor B) situated opposite.

The time delay between the transmitted and received signal is proportional to the flow between the transmitter/receiver. The transmission time of the signal is fixed. The medium is variable. From this relationship, the flow can be calculated.

To compensate for the temperature dependence of the ultrasonic signal, the air temperature shall be measured at the transducer and shall be taken into consideration when the flow difference is calculated between transmitter and medium.

The flow sensor shall be able to deal with process conditions with a solid content of 3% maximum.

C3.3.2.19.4.6.3 Construction

The ultrasonic flow meter shall be a robust industrial clamp-on meter, and shall consist of two parts, namely a clamp-on flow sensor and a flow convertor.

The protection class shall conform to IP67 / NEMA 6.

The measuring functions shall show at least the actual instantaneous rate of flow as well as the totalized volume of flow.

The meter shall be corrosion protected as well as be resistant to UV radiation.

The flow convertor shall be constructed of die-cast aluminium polyurethane coated material.

The output of the flow convertor shall be current, pulse and status output. The output shall be galvanically isolated.

The flow convertor shall have different interface languages available to the user, and shall be equipped with a high-contrast, high-resolution display, a non-resettable flow totalizer, totalizing in cubic metres, a galvanically isolated 4-20 mA output linear to flow and an isolated pulsed output for remote flow totalizing.

C3.3.2.19.4.6.4 Installation

The ultrasonic transducer shall be supplied complete with mounting bracket and frame. The mounting frame shall be rigid and made from stainless steel. The transducer shall be mounted in such a way that it is free from all handrails, walkways, etc. Passing traffic and the operation of other machines in the vicinity of the transducer shall have no influence on the transducer.

The installation shall include for all required interconnections and sundries between the sensor and control unit.

The flow meter must be installed on a straight and unobstructed length of pipe. The length of pipe upstream and downstream from the flow meter shall conform to the following minimum straight and unobstructed lengths required before any bend or obstruction occurs:

- Upstream of flow meter – A length greater or equal to 10 times the diameter of the pipe; and
- Downstream of flow meter – A length greater or equal to 5 times the diameter of the pipe.

C3.3.2.19.4.6.5 Accuracy

The accuracy of the meter shall be guaranteed equal or better than ± 0.5% of the measured value.

C3.3.2.19.4.7 ULTRASONIC OPEN CHANNEL FLOW METERS AND LEVEL METERS

C3.3.2.19.4.7.1 General

All ultrasonic open channel flow meter shall be microprocessor based, non-contact level meters and be able to be programmed to read flow accurately passing through any type of flume or over any type of weir, or to read level/volume accurately in an irregularly shaped container.

When measuring flow through a flume, the measured flow shall be based on the level in the approach section to the flume.

Before calibrating the flow/level/volume rates, the Contractor is to take accurate measurements with the help of a laser (accurate to 1mm) of the relevant civil structure used for installation. The exact structure size must be used for programming the controller, especially when new instruments are installed on existing flumes/weirs.

C3.3.2.19.4.7.2 Operating principle

A burst of ultrasonic pulses are transmitted from a transducer head, which is not in contact with the medium. These pulses are reflected of the top surface of the medium and received by the same transducer. The time delay between the transmitted and received signal is proportional to the level between the transmitter/receiver, which is fixed, and the medium, which is variable, since the level can be calculated. To compensate for the temperature dependence of the ultrasonic signal, the air temperature shall be measured at the transducer and shall be taken into consideration when the level difference is calculated between transmitter and medium.

C3.3.2.19.4.7.3 Construction

The ultrasonic transducer shall include a built-in temperature sensor and shall have a minimum enclosure rating of IP 65. The transducer shall be corrosion protected as well as immune against UV radiation.

The level calculation shall be temperature compensated.

For flow application, the instrument shall provide for the following standard primary flow elements:

- Venturi flumes
- V-notched weirs

- Parshall flumes
- Broad crested weirs
- Any special obstruction with a known relationship between height of medium and flow rate. (For this purpose a ten point lock-up table with linear interpolation is deemed satisfactory.)

For flow applications, the instrument shall be equipped with a local flow rate indicator and an 8 digit controller. If the controller is fed from the microprocessor, it shall be supplied with a minimum of 24 hour battery backup to prevent data loss in the event of power failure.

In addition to the above, for flow meter applications, a galvanically isolated pulsed output shall be provided to the remote controller.

A galvanically isolated 4-20 mA output, linear to flow or level shall be provided for remote indication and processing.
Where no stilling well is provided as part of the measuring structure, a suitably dimensioned stilling well shall be supplied as part of the instrument.
The control unit shall be supplied complete with battery backup to prevent against loss of set-up data in the event of a power failure.

C3.3.2.19.4.7.4 Installation

The ultrasonic transducer shall be supplied complete with mounting bracket and frame. The mounting frame shall be rigid and made from stainless steel. The transducer shall be mounted in such a way that it is free from all handrails, walkways, etc. Passing traffic and the operation of other machines in the vicinity of the transducer shall have no influence on the transducer.

Where required in the opinion of the engineer, a suitably dimensioned stilling well shall be supplied and installed.

The Contractor shall conform to the manufacturer's recommended instructions for the positioning and mounting requirements for the installation of the insertion flow meter.
The installation shall include for all required interconnections and sundries between the sensor and control unit.

C3.3.2.19.4.7.5 Accuracy

The accuracy of the level measurement shall be better than 0,25% of full scale.

C3.3.2.19.5 COMPLIANCE WITH REQUIREMENTS

C3.3.2.19.5.1 GENERAL

All instruments shall be tested as appropriate to verify their accuracy and reliability. In addition to the following, the applicable clauses of Specification ZUT 0001: General Mechanical Requirements shall apply.

C3.3.2.19.5.2 FACTORY CALIBRATION OF METERS

C3.3.2.19.5.2.1 Hydraulic tests

Before the calibration tests are conducted, the meter shall be hydraulically tested to twice its guaranteed working pressure (e.g. 1,0 MPa, 1,6 MPa or 2,5 MPa as applicable). Watertightness under test shall be guaranteed.

C3.3.2.19.5.2.2 Calibration

Factory calibration tests shall be carried out on the actual metering equipment (as specified) supplied, and a calibration certificate submitted stating the accuracy and repeatability for various flows within the useful range of the meter shall be submitted.

Magflow meters shall be calibrated in accordance with BS 5792 or other approved international standard.

C3.3.2.19.5.3 SITE CALIBRATION OF METERS

Where specified in the Amendments to this Specification, meters shall be site calibrated by the Contractor using, where practicable, existing reservoirs as measuring tanks to verify their accuracy. This work shall be done at periods convenient to the Employer. The Contractor shall liaise with the Employer to establish an acceptable time and also to arrange for the outlet valves to the reservoirs to be shut off.
Prior to commissioning, the Contractor shall submit to the Engineer, for approval, a programme detailing the method and duration of the proposed calibration tests and, after the tests, shall present to the Engineer a full report, with tabulated measurements, meter readings, recorder charts, etc., covering the actual tests. Within the month before the completion of the maintenance period, the Contractor shall repeat the site calibration tests and prove the consistency of the meters in service. A full record of servicing and any calibration adjustments carried out during the maintenance period shall be kept, and submitted to the Engineer.

C3.3.2.19.5.4 PAINTWORK

The paintwork shall be tested in accordance with Specification ZUT 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.

C3.3.2.19.6 PAYMENT

C3.3.2.19.6.1 SUPPLY AND DELIVERY

The terms of Clause 8 of Specification ZUT 0001: General Mechanical Requirements shall apply.

C3.3.2.19.6.1.1 Water meters

Water meters will be measured by number.

The rate for the water meters shall cover the cost of the supply and delivery to the Employer's stores or as specified in the Amendments to this Specification of the meters complete with bodies (and stainless steel "hot point" extension tubes to facilitate removal of the meter sensors under full flow conditions, where applicable), as well as supply and delivery to the Employer of installation and operating and maintenance instructions, detailed dimensioned drawings, and where applicable, wiring diagrams as specified in Subclause 5.2 of Specification ZUT 0001: General Mechanical Requirements.

The price shall also cover the cost of reducers, if required in terms of 3.3.5.2, and factory calibration of the meters as specified in 7.2.

C3.3.2.19.6.1.2 Recording and measuring instruments

Recording and measuring instruments will be measured by number.

The rate for the recording and measuring instruments shall cover the cost of the supply and delivery to Site of flow rate digital indicators and chart recorders, totalizer, batteries, as appropriate, etc., the necessary interconnecting wiring, 25 fan-fold or alternatively 100 circular charts per instrument, all mounting brackets, and instructions to enable others to maintain the equipment while in storage, as well as supply and deliver to the Engineer's office of installation and operating instructions and

detailed dimension drawings as specified in Subclause 5.2 of Specification ZUT 0001: General Mechanical Requirements.

C3.3.2.19.6.1.3 Cabling (See 3.3.5.5)

The screened and armoured cabling specified in 3.3.5.5 will be measured by length.

Where the installations is done by the Contractor the length shall be taken to be the actual net length installed as measured on Site. Where the installation is done by others the length will be that ordered by the Engineer. The rate shall include for the supply and delivery to Site of the cabling including all the terminal glands required, as well as for secure packaging to ensure that the cabling is not damaged prior to installations.

C3.3.2.19.6.2 INSTALLATION

Installation of equipment will be measured by number or sum.

The rate for the installation shall cover the cost of installing, testing and commissioning (unless separately scheduled) of all equipment as well as the supply and installation of all wiring, cabling (other than cabling measured under 8.1.3), and incidental parts required for the connecting up to the power supply and to ensure the proper functioning of the equipment.
Where installation, testing and commissioning are scheduled separately, Clause 8 of Specification ZUT 0001: General Mechanical Requirements shall apply.

C3.3.2.19.6.3 COMMISSIONING

Clause 8 of Specification ZUT 0001: General Mechanical Requirements shall apply where commissioning is scheduled separately.

C3.3.2.20 ZUT 8004 ELECTROMAGNETIC FLOW METERS

C3.3.2.20.1 SCOPE

ZUT 8004 specifies the standard requirements for full bore, flanged electromagnetic flow meters. The installation shall be as shown on any applicable drawings provided with the tender documents.

C3.3.2.20.2 NORMATIVE REFERENCES

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

a) Amendments.

b) ZUT 0001: General Mechanical Requirements.

c) ZUT 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.

d) ZUT 7023: Couplings and Flange Adaptors.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

C3.3.2.20.3 GENERAL

Flow meters which have not previously been in common use in South Africa shall not be acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

A magnetic flow meter shall include the sensor, the remotely mounted transmitter, the display unit, cabling, supports, grounding rings (if applicable) plus one flange adaptor on the upstream side and one flange adaptor on the downstream side.

The sensor shall be a full-bore, in-line, double flanged unit. The transmitter shall provide local flow indication and 4-20 mA output.

Two flange adaptors shall be provided for connection of the meter into the pipe. These shall comply with the requirements of ZUT 7023.

C3.3.2.20.4 PERFORMANCE REQUIREMENTS

Design accuracy of the unit shall be ± 1 % of flow, or better, for the range specified.

C3.3.2.20.5 OPERATION AND CONTROL

Indication of flow shall be in "Mℓ /d" and in "ℓ /s" unless otherwise specified.

Flow integration shall be provided.

Indication shall be provided at the unit as well as remotely.

Recording, trending and graphic display shall be provided if a SCADA system and/or an HMI are part of the Contract Works.

C3.3.2.20.6 DESIGN AND CONSTRUCTION

The pressure rating of the sensor shall be the same as the pipework in which it is installed but shall not be lower than PN10.
The sensor shall have IP 68 protection and the transmitter shall have IP 67 protection.

The meter shall have a polyurethane lined, stainless steel tube. Rubber linings are acceptable for treated water applications.

For applications other than for treated water, the sensor's electrodes shall be provided with electrode cleaning. Automatic, timed cleaning shall be provided. (Titanium or Hastelloy C electrodes can, apparently, not be used with the electrode cleaning feature which requires the stainless steel option).

Flanges shall comply with SANS 1123 for the pressure rating or, if required, shall match an existing installation.

The unit shall be suitable for mains supply unless battery supply is specified.

C3.3.2.20.7 CORROSION PROTECTION

The external corrosion protection system for the meter sensor shall be suitable for buried applications and shall be to the approval of the Engineer.

Corrosion Protection shall comply with ZUT 0003.

C3.3.2.20.8 INSTALLATION

The equipment shall be correctly installed, connected, adjusted and calibrated by competent persons.

The meter shall be installed with a straight pipe length of at least 10 pipe diameters upstream of the sensor and a straight pipe length of at least 5 pipe diameters downstream of the meter unless the drawings indicate otherwise. If this is not possible, the design shall attempt to restore uniform turbulent flow and the complete meter installation shall comply with the manufacturer's instructions.

The meter and cabling shall be provided with protection against electromagnetic interference.

Grounding rings shall be supplied and installed if the application requires these.

Installation work shall comply with the requirements for installation in ZUT 0001.

C3.3.2.20.9 INSPECTIONS

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

C3.3.2.20.10 TESTING REQUIREMENTS

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

C3.3.2.20.11 DOCUMENTATION TO BE PROVIDED

The factory calibration certificate shall be included in the Manual.

C3.3.3 CONCRETE WORKS (STRUCTURAL) (SANS 2001 – CC1)

SD1 SCOPE

SD2 NORMATIVE REFERENCES

SD3 DEFINITIONS
SD3.1 GENERAL

SD4 REQUIREMENTS
SD4.1 GENERAL
SD4.2 MATERIALS
SD4.3 FORMWORK
SD4.4 REINFORCEMENT
SD4.5 HOLES, CHASES AND FIXING BLOCKS
SD4.6 EMBEDDED ITEMS
SD4.7 QUALITY OF CONCRETE
SD4.8 PRECAST CONCRETE
SD4.9 PRE-STRESSED CONCRETE
SD4.10 HANDLING AND ERECTION OF PRECAST CONCRETE UNITS

SD5 COMPLIANCE WITH THE REQUIREMENTS
SD5.1 TESTING
SD5.2 TOLERANCES

SD6 ADDITIONAL SD CLAUSES FOR WASTE WATER TREATMENT WORKS
SD6.1 AGGREGATES OF DOLOMITIC ORIGIN
SD6.2 SCREEDS FOR SETTLING TANKS
SD6.3 COATINGS
SD6.4 FLUMES
SD6.5 TOLERANCES
SD6.6 ADDITIONAL MEASUREMENT AND PAYMENT CLAUSES FOR WASTE WATER TREATMENT WORKS

SD7 NOT USED

SD8 MEASUREMENT AND PAYMENT
SD8.1 MEASUREMENT AND RATES
SD8.2 SCHEDULED FORMWORK ITEMS
SD8.3 SCHEDULED REINFORCEMENT ITEMS
SD8.4 SCHEDULED CONCRETE ITEMS
SD8.5 DESIGNATED JOINTS
SD8.6 MANUFACTURE (OR SUPPLY) AND ERECT PRECAST CONCRETE UNITS
SD8.7 GROUTING
SD8.8 HD BOLTS AND MISCELLANEOUS METAL WORK
SD8.9 COLOUR MITIGATION
SD8.10 TESTS FOR WATER TIGHTNESS
SD8.11 CLEANING AND STERILISING

SD9 MEASUREMENT AND PAYMENT FOR PRE-STRESSED CONCRETE
SD9.1 CIRCULAR PRE-STRESSED CONCRETE RESERVOIRS AND TANKS

The following variations and additions to the SANS 2100 Standardized Specifications referred to above apply to this Contract. The prefix SD indicates an amendment to SANS 2100. The letters and numbers following these prefixes respectively indicate the relevant Standardized Specification and clause numbers in SANS 2100 to which the variation or addition thereto applies.

C3.3.3.1 SD1 SCOPE

This Specification Data deals with the structural use of plain, reinforced, pre-stressed and precast concrete to be used in the Works and gives amendments and additions to the South African National Standard SANS 2001, Part CC1: Concrete Works (Structural) which shall form part of the Contract.

Generally, the Specification Data clauses and sub-clauses follow the same numbering system as the clauses and sub-clauses to which they refer in the Standard and to which they either amend or supplement. Where a Specification Data clause or sub-clause refers to some other clause or sub-clause in the Standard this is indicated in brackets following the heading. Where a Specification Data sub-clause is an addition and there is no appropriate clause in the Standard to which it can be linked, no clause reference is given following the heading.

Should any requirement of this Specification Data conflict with any requirement of the Standard, the requirement of this Specification Data shall prevail.

C3.3.3.2 SD2 NORMATIVE REFERENCES

All the applicable national and international standards as listed in Clause 2, Normative References of SANS 2001 CC1, shall apply to this Contract where appropriate.

In particular, SANS 10100-2 (SABS 0100-2) “The structural use of concrete, Part 2: Materials and execution of work,” provides useful recommendations and information.

C3.3.3.3 SD3 DEFINITIONS

C3.3.3.3.1 SD3.1 GENERAL

C3.3.3.3.1.1 SD3.1.1 Expansion Joint (Sub-clause 4.7.12.2)

“Expansion Joint” shall be a “filled joint” designed to allow for thermal or other expansive movements of the adjacent concrete.

C3.3.3.3.1.2 SD3.1.2 Contraction Joint (Sub-clause 4.7.12.2)

“Contraction Joint” shall be an “unfilled Joint” designed to allow for thermal or other contraction movements of the adjacent concrete.

C3.3.3.3.1.3 SD3.1.3 Construction Joint (Sub-clause 4.7.12.1)

“Construction Joint” shall be a joint required on account of constraints or convenience in the method of construction and that is not an expansion, contraction or other movement joint.

C3.3.3.3.1.4 SD3.1.4 Designated Joints (Sub-clause 4.7.12)

Expansion joints, contraction joints, formed construction joints and unformed construction joints which are sealed, will be considered to be “designated joints” provided that the joints are shown on the drawings or approved as such by the Engineer prior to concreting.

Other unformed construction joints that are required by the Contractor as a result of his construction constraints or for any other reason, whether or not shown on the drawings, shall not be considered to be “designated joints”.

C3.3.3.3.1.5 SD3.1.5 Strength Concrete (Clause 3.4.3)

The Contractor shall be responsible for the design of strength concrete and determining the proportions of all the constituent materials in order to produce concrete that complies with the strength requirements specified on the drawings as well as the specified requirements for durability, appropriate workability, a good surface finish and all other specified requirements.

The Engineer will specify the following on the drawings and Bill of Quantities for each section of the Works:

- The required grade and strength of the concrete
- The maximum nominal size of the coarse aggregate in mm.

C3.3.3.3.1.6 SD3.1.6 Notation for Grades of Strength Concrete Containing Extenders (Clauses 3.4.3 and 4.2.6)

Where a cement extender is specified, the grade of strength concrete containing the extender will be specified on the Drawings and Bill of Quantities by a compound number as follows:

A/B C (e.g. 30MPa/19mm F30)
Where

A = the 28-day characteristic strength (MPa)

B = the nominal maximum aggregate size e.g. 19 mm

C = the cement extender as a % of total cementitious material e.g.:

F30 = 30% of Fly Ash (FA)

C15 = 15% of Condensed Silica Fume (CSF)

G50 = 50% of Ground Granulated Blast-furnace Slag (GGBS)

C3.3.3.4 SD4 REQUIREMENTS

C3.3.3.4.1 SD4.1 GENERAL

C3.3.3.4.1.1 SD4.1.1 Brand Name Products

In addition to the requirements of this Specification Data, the conditions and the methods specified by manufacturers of specified or approved brand name products shall be strictly adhered to. This includes such aspects as substrate preparation, the application of primers, storage and shelf life.

The Contractor shall confirm and submit to the Engineer at least 28 days prior to the commencement of any specific section of the Works, samples, specifications and performance data, as applicable to all the products he intends to use.

C3.3.3.4.1.2 SD4.1.2 Plant for Concrete

Sound, modern, efficient, accurate plant shall be provided and maintained in good working order in accordance with SANS 10100-2 (SABS 0100-2) Sections 5.2 Batching plant and 5.3 Mixing plant.

C3.3.3.4.1.3 SD4.1.3 Cube Moulds and Water Bath (Sub-clause 5.1.1.3)

At least nine 150 mm cube moulds and an adequately sized and covered temperature-controlled water bath with a capacity of at least 300 cubes as approved for curing concrete cubes shall be available on site at all times. The water bath shall be located under cover. Thermostatically controlled heaters/coolers shall be provided to keep the temperature of the water in the bath between 220C and 250C. The Contractor shall be responsible for providing a sufficient number of cube moulds and an adequately sized water bath to suit the size of the project and the number of cubes that will be made and cured for 7 and 28 days.

C3.3.3.4.1.4 SD4.1.4 Slump Test Apparatus

Slump test apparatus as specified in SABS method 862 shall be provided in good condition.

C3.3.3.4.2 SD4.2 MATERIALS

C3.3.3.4.2.1 SD4.2.1 Cementitious Binders

C3.3.3.4.2.1.1 SD4.2.1.1 Cement

Unless otherwise specified, only CEM I 42.5 (Portland cement) or CEM II A-V 42.5 (Portland fly ash cement) in accordance with SANS 50197-1 may be used. CEM II A-V 42.5 may not contain more than 20% of siliceous fly ash.

C3.3.3.4.2.1.2 SD4.2.1.2 Cement Extenders

Cement extenders shall only be used where specified on the drawings and scheduled in the Bill of Quantities. An approved cement extender shall only be blended with CEM I 42.5 (Portland Cement) and this shall be done in the batch plant unless otherwise approved.

Any cement extender used shall comply with SANS 1491 Parts 1, 2 or 3 as appropriate for Ground Granulated Blast-Furnace Slag (GGBS), Fly Ash (FA) or Condensed Silica Fume (CSF) respectively, and shall carry the SANS mark, or similar approved.

C3.3.3.4.2.1.3 SD4.2.1.3 Proportions of Cement Extenders in Concrete

Where a cement extender is specified, the proportion by mass of the extender as proportion of the total mass of cementitious material shall be as follows for different extenders unless otherwise specified:

GGBS50%

FA 30%

CSF 15%

C3.3.3.4.2.1.4 SD4.2.1.4 Conformity of Cement

The test results conducted to evaluate the conformity of cement in terms of SANS 50197-1, Clause 9, shall be made available to the Engineer at least 28 days before the materials are used for concrete.

C3.3.3.4.2.2 SD4.2.2 Water

Mixing water for concrete shall comply with the requirements of EN 1008 and shall be tested for conformation.

C3.3.3.4.2.3 SD4.2.3 Aggregates

C3.3.3.4.2.3.1 SD4.2.3.1 Source of Aggregates

Fine aggregate (sand) shall be obtained from an approved commercial source. Coarse aggregate (stone) shall be obtained by crushing rock from hard excavations on Site or from an approved commercial source.

C3.3.3.4.2.3.2 SD4.2.3.2 Fineness of Fine Aggregate

The fineness modulus of sand delivered to the mixer shall lie between 1.7 and 2.8 and the standard deviation of fineness moduli of samples of sand that is delivered to the mixer during one shift shall be not more than 0.1.

C3.3.3.4.2.3.3 SD4.2.3.3 Aggregate Samples

At least 28 days before commencement of concrete work the Contractor shall supply, at his own cost, full details and representative samples to the Engineer of the aggregates he intends using, together with certificates from an approved laboratory indicating that the aggregates comply with the requirements of this Standard and Specification Data. Approximately 50 kg of each sample of aggregate shall be supplied.

After approval, these samples shall be taken as the standard for the agreed aggregates to be used in the Works. If at any time during the course of the Contract there is a deviation from the approved standard or the Engineer considers that there has been a deviation, the Contractor shall submit further tested samples of the new material to the Engineer for approval.

No concrete shall be placed in the Works until the Engineer has approved the materials the Contractor intends using.

C3.3.3.4.2.3.4 SD4.2.3.4 Tests on Aggregates (Sub-clause 4.2.3.5)

The following tests are required on aggregates to be used in the Contract:

a) Drying shrinkage on fine and coarse aggregates;

b) Flakiness index of the stone;

c) Tests for alkali-aggregate reaction, in accordance with SANS 6245, shall be carried out where in the opinion of the Engineer potentially reactive aggregates to be used and where none of the cement extenders listed in SD4.2.1.3 will be used in at least the proportions given.

C3.3.3.4.2.3.5 SD4.2.3.5 Prevention of Deleterious Alkali-Aggregate Reaction

The requirements of this clause shall not apply to concrete containing a cement extender in at least the proportions given in SD4.2.1.3.

Reference is made to “Fulton’s Concrete Technology, Chapter 10, Alkali-silica reaction.”

In accordance with this reference, the Contractor shall provide the Engineer with sufficient data to enable him to assess the degree of alkali-aggregate reactivity of the aggregates and cement to be used for concrete. For the aggregates, the type of rock and source will be required. For the cement, the percentage alkali content shall be given.

In accordance with the above reference, where potentially reactive aggregates are used for concrete, the Contractor shall ensure that the concrete is not subject to deleterious alkali-aggregate reaction by limiting the total equivalent sodium oxide content of the concrete to a maximum of 0.86 x the value given in kg/m³ in Table 10.1. (e.g. for Malmesbury Group, 0.86 x 2.1 = 1.8 kg/m³) This may be achieved by careful mix design and the use of cement with a low equivalent sodium oxide content or if necessary, blending with a cement extender.

For each delivery of cement the Contractor shall provide an acceptable test certificate indicating the actual equivalent sodium oxide content of the consignment.

Note 1: Potentially reactive aggregates have been identified in the following areas of South Africa: South Western Cape, Eastern Cape, KwaZulu-Natal, Gauteng and Free State.

Note 2: The equivalent sodium oxide content is measured as Na20 + 0,658 K20. For cement it is expressed as a percentage by mass, for concrete it is expressed in kg/m³.

C3.3.3.4.2.3.6 SD4.2.3.6 Storage of Aggregates

When aggregates of different chloride content are stored on site, their use in the various grades of concrete shall be strictly controlled.

C3.3.3.4.2.3.7 SD4.2.3.7 Use of Plums (Sub-clause 4.2.3.4 and 4.7.10.11)

The use of plums will not be permitted.

C3.3.3.4.2.4 SD4.2.4 Admixtures, Air-entrainment Agents and Curing Agents

Admixtures are permitted, provided that the results of trial tests which demonstrate their suitability and the following are made available to the Engineer for Approval:

i) The trade name of the admixture, its source and the manufacturer's recommended method of use;

ii) The chemical names of the main active ingredients in the admixture;

iii) Typical dosages and possible detrimental effects of under or over dosages;

iv) Whether compounds that are likely to cause corrosion of the reinforcement or deterioration of the concrete (such as those containing chloride, in any form, as an active ingredient) are present and, if so, the chloride content of the admixtures, expressed as a mass fraction of chloride ions or expressed as an equivalent mass fraction of anhydrous calcium chloride; and

v) The average expected air content of the freshly mixed concrete containing an admixture that causes air to be entrained when the admixture is used at the manufacturer's recommended dosage.

The amounts of admixture used shall be measured to an accuracy of 2 % or better. Daily calibration and cleaning of the measuring device is imperative. Persons responsible for batching shall be fully conversant with the effects of the admixture and the consequences of over or under-dosage.

Control of admixtures shall be in accordance with SANS 10100-2 (SABS 0100-2) Section 7.2.1.2.

C3.3.3.4.2.5 SD4.2.5 Reinforcement – No Specification Data applicable

C3.3.3.4.2.6 SD4.2.6 Grade of Concrete – No Specification Data applicable

C3.3.3.4.2.7 SD4.2.7 Grout – No Specification Data applicable

C3.3.3.4.2.8 SD4.2.8 Tendons (Clause 4.2.8)
C3.3.3.4.2.8.1 SD4.2.8.1 Characteristic Strength of the Steel (Sub-clause 4.2.8.2)

The required characteristic strength of the steel will be specified on the construction drawings.

C3.3.3.4.2.9 SD4.2.9 Anchorages and couplers – No Specification Data applicable

C3.3.3.4.2.10 SD4.2.10 Sheaths – No Specification Data applicable

C3.3.3.4.2.11 SD4.2.11 Joint Fillers, Sealants, Waterstops, Bearings and Accessories

The following prescribed products or brand name products, or equivalent materials subject to the written approval of the Engineer, shall be used:

C3.3.3.4.2.11.1 SD4.2.11.1 Joint Fillers

Joint filler material shall be “Sondor” closed cell expanded polyethylene of minimum density 35kg/m3 “Jointex”. The required thickness and density of the filler will be specified on the drawings. Densities of up to 110kg/m3 may be required.

Fillers shall be pre-cut to suit the application with a tear-out strip forming the specified recess for the sealant. If so required, the filler shall be glued into position with approved glue.

C3.3.3.4.2.11.2 SD4.2.11.2 Bond Breakers

The bond breaker between the blinding layer, no-fines concrete layer or soil and the underside of ground floor slabs or surface beds shall be minimum 250-micron polyethylene sheeting that complies with SANS 952, i.e. USB Green co ex 250 ®.

The bond breaker to the face of contraction joints shall be two coats of good quality lime wash.

The bond breaker at the bottom of a joint sealing recess, where the sealant is not backed by a joint filler or bond breaking cord, shall be self-adhesive PVC tape with the same width as the joint recess.

C3.3.3.4.2.11.3 SD4.2.11.3 Sealants (Sub-clause 4.2.11.1)

SikaFlex® Pro-3WF 1–part, moisture cured, high mechanical resistant polyurethane sealant, shall be used for all water retaining and water excluding structures including pump stations, valve chambers, and inlet and outlet structures.

SikaFlex® PRO-2HP 1-part, moisture cured, soft elastic polyurethane sealant, shall be used for building structures above ground floor level.

An approved primer fully compatible with and/or manufactured for the specified jointing and sealing material shall be applied to the prepared joint surfaces.

C3.3.3.4.2.11.4 SD4.2.11.4 Waterstops (Sub-clauses 4.2.11.1)

Waterstops shall be “Durajoint PVC or Durajoint Rubber” as manufactured by “ABE Construction Chemicals” and to the pattern and the material and widths shown on the drawings. They shall conform to Specifications CKS 388 or 389, for natural rubber or PVC respectively.

C3.3.3.4.2.11.5 SD4.2.11.5 Bandage Sealing Systems

a) “Sikadur-Combiflex” Bandage System

The “Sikadur-Combiflex” bandage System is manufactured by “Sika” and consists of a flexible Hypalon sealing tape/strip and “Sikadur -31 CF” epoxy adhesive. The width and thickness of the tape/strip will be specified on the drawings.

b) Cemflex Bandage System

The “Cemflex” bandage System is manufactured by “Sika” and consists of a strip of Cemflex fabric which must be saturated with a Cemflex slurry. The width of the strip will be specified on the drawings.

c) Laminated Butyl Rubber or Polymer Bandage System

3 mm thick laminated butyl rubber or 2 mm thick polymer strips shall be permanently fixed to the concrete with an approved epoxy adhesive where shown on the drawings. Aluminium backing strips shall be provided where specified.

C3.3.3.4.2.11.6 SD4.2.11.6 Swellable Joint Sealing Strips

Swellable joint sealing strips shall be "SikaSwell-P Profiles manufactured by "Sika". The width, thickness and type of profile will be shown on the drawings.

C3.3.3.4.2.11.7 SD4.2.11.7 Bearings (Sub-clause 4.2.11.1)

Where indicated on the Drawings, bearings shall consist of "Kilcher Bearings" of one of the following three types: "Resilient", "Limitgliss" or "Teflon Sliding bearings". All of these shall be supplied in a strip of expanded polyethylene of width equal to the seating or wall width. The required capacity of the bearing strip in t/m will be shown on the drawings

Where laminated elastometric bearings or bridge type bearings are required, full details will be given on the drawings.

C3.3.3.4.2.12 SD4.2.12 Epoxy-based bonding agent for screeds

Where indicated on the drawings, epoxy bonding agent for screeds shall be ABE Construction Chemicals, "epidermix 116".

C3.3.3.4.2.13 SD4.2.13 Surface hardener for concrete floors

Where indicated on the drawings, surface hardener for concrete floors shall be "Sikafloor-3 QuartzTop ZA" natural (not coloured). This may be applied to steel floated or power floated surfaces or granolithic screeds.

C3.3.3.4.2.14 SD4.2.14 Colour Mitigation

The Contractor shall supply and apply concrete colouring at the locations as specified on the Drawings or indicated by the Engineer.

The colouring material shall be landscape varnish which shall be aqueous containing salts and iron and manganese and other trace elements including copper and zinc. The material shall be manufactured as a concentrate that can be diluted with water to achieve the desired colour intensity. The material shall contain no caustic or alkaline chemicals.

The colouring material shall be "PERMEON" or equivalent approved.

C3.3.3.4.3 SD4.3 FORMWORK

C3.3.3.4.3.1 SD4.3.1 GENERAL

C3.3.3.4.3.1.1 SD4.3.1.1 Earth or Rock Cuts (Sub-clause 4.3.1.5)

Earth or rock cuts may be used as forms for vertical or sloping surfaces only if dictated by the Design and indicated on the Drawings or approved by the Engineer on Site.

Concrete used in pipe trenches for encasement may be cast against the side of the excavation.

Concrete for thrust / anchor blocks shall be cast directly against the side of the excavation as shown on the Drawings.

C3.3.3.4.3.1.2 SD4.3.1.2 Approval by Authority (Sub-clause 4.3.1.6)

Liaison with the authority controlling the service is required before commencing with the design of formwork over an existing service i.e. pipelines, roads, streets, railways, etc. The design shall be approved by the authority.

C3.3.3.4.3.1.3 SD4.3.1.3 Surface Finish of Formed Surfaces (Sub-clause 4.3.1.8)

Various formed surface finishes are described in detail in Table 1.

Unless otherwise specified on the drawings, the formed surfaces of sections of the work shall be as follows:

a) "rough" to all surfaces more than 150mm below finished ground level or concealed from view.

b) "smooth" to all other surfaces except where otherwise specified.

Special-smooth finish, special off-form finishes / exposed aggregate finishes shall be shown on the Drawings and, where they are required, scheduled in the Bill of Quantities.

C3.3.3.4.3.1.4 SD4.3.1.4 Special-smooth finish

This finish is obtained by first giving the surface a smooth finish with the joints between formwork panels forming an approved regular pattern suitable for the appearance of the structure. All projections shall then be removed, irregularities repaired, and the surface rubbed or otherwise treated until it is smooth with an even texture, appearance and colour.

If the finish of exposed surfaces does not comply with the requirements for uniformity of the texture and appearance, the Contractor shall, when instructed to do so by the Engineer, rub down the exposed surfaces of the entire structure or any part thereof as specified below, entirely at his own cost. All repairs must be completed before the rubbing commences.

Rubbing down shall be carried out strictly in accordance with Subclause 4.7.20.

C3.3.3.4.3.1.5 SD4.3.1.5 Chamfers and Fillets

All exposed external angles in concrete work shall have 20mm x 20mm chamfers unless otherwise specified on the Drawings or ordered by the Engineer, but the top edge of a slab that is to receive an applied finish shall not be chamfered.

Internal corners in concrete work need not have fillets unless such fillets have been specified on the Drawings or ordered by the Engineer.

C3.3.3.4.3.2 SD4.3.2 DESIGN AND CONSTRUCTION OF FORMWORK AND FALSEWORK

C3.3.3.4.3.2.1 SD4.3.2.1 Responsibility for Formwork and Falsework

The Contractor shall be entirely responsible for the design, construction, accuracy and safety of all formwork and falsework.

C3.3.3.4.3.2.2 SD4.3.2.2 Review of Formwork Design (Sub-clause 4.3.2.1.4)

Where approval is required in terms of Sub-clause 4.3.1.6, by a controlling authority, the design and drawings for formwork and falsework shall be submitted to the Engineer for review before being submitted to the authority for approval.

C3.3.3.4.3.3 SD4.3.3 FORMWORK ACCESSORIES

C3.3.3.4.3.3.1 SD4.3.3.1 Formwork Ties

a) Formwork ties for water retaining and water excluding structures

The use of sleeves for formwork ties through the walls of these structures will not be permitted. Cast in ties shall have some form of positive anchorage to prevent any rotation when loosening formwork. Tie cone recesses shall be effectively plugged as described in SD4.7.19.2.

b) Formwork ties for other structures

Formwork ties for other structures shall run through a sleeve in order for the ties to be completely removed after the formwork has been struck. The outer cover width of the sleeves shall be removed by drilling or any other appropriate method leaving a clean inner surface which shall be effectively caulked with mortar by approved means in accordance with Sub-Clause 4.5.3.

c) Formwork shall not be secured to reinforcing bars

C3.3.3.4.3.4 SD4.3.4 TEMPORARY OPENINGS - NO SPECIFICATION DATA APPLICABLE

C3.3.3.4.3.5 SD4.3.5 VOID FORMERS - NO SPECIFICATION DATA APPLICABLE

C3.3.3.4.3.6 SD4.3.6 PREPARATION OF FORMWORK - NO SPECIFICATION DATA APPLICABLE

C3.3.3.4.3.7 SD4.3.7 REUSE OF FORMWORK- NO SPECIFICATION DATA APPLICABLE

C3.3.3.4.3.8 SD4.3.8 REMOVAL OF FORMWORK

C3.3.3.4.3.8.1 SD4.3.8.1 Removal of Falsework and Supporting Formwork on Reinforced Concrete Structures (Sub-clause 4.3.8.3)

Where a continuously reinforced concrete structure will be constructed in stages, the Contractor shall submit to the Engineer for his review and approval, at least 28 days prior to the commencement of the work, full details of the manner in which the falsework and supporting framework will be removed.

The Contractor shall make provision for continued support of beams and slabs while the formwork is being removed and/or for back propping of beams and slabs. Reference shall also be made to SANS 10100-2 (SABS 0100-2) Section 9.5.3 “Reshoring”.

C3.3.3.4.3.8.2 SD4.3.8.2 Removal of Falsework and Supporting Formwork for Pre-stressed Concrete Structures (Sub-clause 4.3.8.4)

Where the falsework and supporting formwork in pre-stressed structures will be removed, prior to the full pre-stressing force relating to the particular stage of construction being applied, the Contractor shall submit to the Engineer for his review and approval, at least 28 days prior to the commencement of the work, full details of the manner in which the falsework and supporting framework will be removed.

C3.3.3.4.4 SD4.4 REINFORCEMENT

C3.3.3.4.4.1 SD4.4.1 Bending

C3.3.3.4.4.1.1 SD4.4.1.1 Hot Bending (Sub-clause 4.4.1.3)

Bars shall not be bent hot.

C3.3.3.4.4.2 SD4.4.2 Fixing

C3.3.3.4.4.2.1 SD4.4.2.1 Safety of the reinforcement (Sub-clause 4.4.2.2)

The Contractor shall be responsible for the safety of the reinforcement. In addition to the chairs and spacers specified, diagonal bars, robust temporary props or whatever else is necessary shall be provided to ensure the safety of the reinforcement under all loads and particularly those due to construction activities.

C3.3.3.4.4.2.2 SD4.4.2.2 Inspection by the Engineer

The Engineer will inspect the reinforcement after it has been fixed in place, the formwork has been cleaned, cover blocks have been positioned, and at least 24 hours before concreting is due to commence.

C3.3.3.4.4.2.3 SD4.4.2.3 Welding of Bars (Sub-clause 4.4.2.2 b)

Welding of bars will not be permitted.

C3.3.3.4.4.2.4 SD4.4.2.4 Spacers

Where concrete spacer blocks manufactured on Site are used, they shall be made and cured strictly in accordance with Sub-Clause 4.4.2.3 and the following NOTE. The wire ties in the blocks shall be galvanized. Concrete spacer blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Engineer, will be rejected and shall be removed from the Site.

C3.3.3.4.4.3 SD4.4.3 Cover

C3.3.3.4.4.3.1 SD4.4.3.1 Minimum cover

With due cognisance of Table 3, the minimum required cover of concrete over reinforcement will be specified on the reinforcement drawings for different structures and allowing for different exposure conditions in accordance with the design.

C3.3.3.4.4.3.2 SD4.4.3.2 Minimum cover to Pipes and Ducts

The minimum distance between pipes or ducts in the concrete and reinforcement shall nowhere be less than 40 mm or 5 mm plus the maximum size of the coarse aggregate, whichever is the largest.

C3.3.3.4.4.3.3 SD4.4.3.3 Exposure conditions (Table 3)

The various structures will not be classified in terms of exposure conditions. Instead the Engineer will specify the cover to reinforcement as per SD4.4.3.1 and durability requirements as per SD4.7.5.1.

C3.3.3.4.5 SD4.5 HOLES, CHASES AND FIXING BLOCKS

C3.3.3.4.5.1 SD4.5.1 Fixtures

Fixtures to be embedded in the concrete shall be embedded into the concrete as shown on the Drawings.

C3.3.2.4.5.2 SD4.5.2 Ferrules (Clause 4.5.3)

Refer also to SD4.3.3.1.

C3.3.3.4.6 SD4.6 EMBEDDED ITEMS

C3.3.3.4.6.1 SD4.6.1 General

Material used for forming temporary voids (box-outs) shall be completely removed. The faces of temporary voids shall be thoroughly cleaned and prepared as for a construction joint surface. Refer to SD4.7.12.1(b)

C3.3.3.4.6.2 SD4.6.2 Waterstops

C3.3.3.4.6.2.1 SD4.6.2.1 General

Only straight lengths of waterstop may be site butt welded/vulcanised using appropriate jigs and equipment. All other intersection pieces shall be factory made by the manufacturer.

Factory-made junction pieces shall be properly corner-mitred and jointed at intersections, shall be formed in accordance with the manufacturer's instructions to approval and shall have a tensile strength across the joint of not less than 75% of that of the original material. Junction pieces shall be made so that all ribs in the original cross-section are maintained continuously and the joints are dense, homogeneous, free of all porosity and each leg of the junction having a minimum length of 300 mm. Intersections of waterstops with dissimilar pattern (i.e. "rearguard centre bulb" type, with "internal dumbbell" type) shall be made using specially-made junction pieces which accommodate the transition between patterns. On Site joints shall also comply with these requirements.

The Contractor shall test, in the presence of the Engineer, joints made in waterstops of each type of material used.

C3.3.3.4.6.3 SD4.6.3 Pipes, conduits, and ducts

C3.3.3.4.6.3.1 SD4.6.3.1 Casting in of Pipes and Pipe Specials in Concrete

The Contractor shall be responsible for the installation, positioning, alignment, support and concreting in of all pipes and pipe specials regardless of whether or not these have been supplied by him and whether or not they have puddle flanges. He shall also be responsible for the watertightness of the completed structure around the pipe or special, where this is a requirement.

The Contractor shall submit to the Engineer for his review and approval, at least 28 days prior to the commencement of any specific section of the Works, a schedule indicating all the pipes and pipe specials he intends to cast in directly and the items for which he intends to provide box-outs. He shall also submit a detailed method statement describing precisely how the work will be done.

Where it is a requirement that a pipe or pipe special be anchored to resist longitudinal forces and it is provided with anchor flanges, details of the box-out and special reinforcement around the anchor flange(s) will be as shown on the Drawings and Bending Schedules. Reinforcement shown at box-outs shall not be cut and will generally have been detailed to run through the formwork, but not through the opening itself. Reinforcement shall be added around the anchor flanges to tie in with protruding reinforcement before the pipe or pipe special is concreted in.

Where it is not a requirement that a pipe or pipe special be anchored to resist longitudinal forces, the reinforcement shall not initially be cut and will generally have been detailed to run through the formwork and through the opening itself. Reinforcement shall only be cut and/or bent out of the way at a later stage to suit the item to be cast in. After installation of the item, the remaining reinforcement shall be bent back in position as directed by the Engineer.

During the installation, positioning and concreting in of any item in an opening the Contractor shall:

i) Remove all formwork remaining in the box-out;

ii) Make any alterations required to the position and shape of the opening;

iii) Thoroughly prepare the faces of the opening as for a construction joint surface in accordance with Sub-clause 4.7.12.1.3 and SD4.7.12.1(b) so as to obtain a satisfactory bond for the new concrete;

iv) Install, position, align and support the item to be cast in;

v) Bend back and/or fix reinforcement around the item as directed by the Engineer or as shown on the Drawings;

vi) Install formwork as required for the concreting in operation; and

vii) Carry out final surface preparation in accordance with Sub-clause 4.7.12.1.3 before concreting.

In order to achieve the necessary watertightness and structural soundness, the following shall be considered and provided by the Contractor and shall be described in his method statement:

i) Cast in waterstops, a bandage sealing system and/or a swellable sealing strip around the box-out;

ii) Wet-to-dry epoxy on the box-out faces;

iii) Grouting at the top of the box-out to fill any voids left;

iv) A specially designed shrinkage compensated concrete mix to fill the box-out.

C3.3.3.4.7 SD4.7 QUALITY OF CONCRETE

C3.3.3.4.7.1 SD4.7.1 General

C3.3.3.4.7.1.1 SD4.7.1.1 Design of Strength Concrete Mixes

The concrete mix designs for strength concrete shall be prepared in an approved laboratory such that the concrete meets the strength and all other specified criteria as well as ensuring good workability and surface finish without excessive bleeding. Special attention is drawn to the fact that the concrete for water retaining/excluding structures must be very dense and impervious.

The Contractor shall submit full details of all the mixes he proposes to use to the Engineer not less than 30 days prior to the intended use of the concrete in the Works.

No concrete shall be cast until the mix designs have been approved by the Engineer. The Engineer may call for revised mix designs at any stage during the Contract.

Once approval by the Engineer has been given for the use of a particular mix, the proportions of cement, extender, aggregate, water and admixtures shall not be changed without prior approval of the Engineer.

C3.3.3.4.7.1.2 SD4.7.1.2 Trial Mixes

Trial mixes for each of the concrete grades/ mix designs to be used in the Works shall be prepared under conditions acceptable to the Engineer. Six cubes shall be made from each mix and three of each tested for compressive strength at 7 and 28 days respectively.

The results of the compressive tests on these cubes shall be submitted to the Engineer for approval not less than 30 days prior to the intended use of the concrete in the Works.

C3.3.3.4.7.1.3 SD4.7.1.3 Maximum Cementitious Binder Content (Sub-clause 4.7.1.2)

The maximum content of CEM I 42.5 (Portland cement) shall be 400 kg/m3 of concrete.

The maximum cementitious content of a binder for concrete containing a cement extender shall be 450 kg/m3 of concrete.

C3.3.3.4.7.2 SD4.7.2 Consistency

C3.3.3.4.7.2.1 SD4.7.2.1 Slump

The slump of the concrete shall be as given in Table 4.

C3.3.3.4.7.3 SD4.7.3 Workability

C3.3.3.4.7.3.1 SD4.7.3.1 Pumping of Concrete (Sub-clause 4.7.3.2 and 4.7.10.15)

Pumping of concrete will be permitted.

C3.3.3.4.7.4 SD4.7.4 Chloride and Sulphate Content

C3.3.3.4.7.4.1 SD4.7.4.1 Chloride Content

The maximum chloride ion content shall be as given in Table 5; and

Efflorescence will not be acceptable on any exposed concrete surface.

C3.3.3.4.7.4.2 SD4.7.4.2 Sulphate Content

The total water-soluble sulphate content of a concrete mix shall not exceed a mass fraction of 4% of the cementitious binder content of the mix.

C3.3.3.4.7.5 SD4.7.5 Durability

C3.3.3.4.7.5.1 SD4.7.5.1 Requirements for Durability in Water-retaining/excluding structures

Any mix to be used in water-retaining or excluding structures shall have a water / cementitious ratio not exceeding 0.5 and a cement content of not less than 325kg/m3 of concrete. The proportions of the various aggregates shall be such as to produce a density of at least 2,400kg/m3.

C3.3.3.4.7.5.2 SD4.7.5.2 Concrete containing entrained air

Where concrete is required to contain entrained air as indicated on the drawings, the requirements of Sub-Clauses 4.7.5.1 and 4.7.5.2 shall apply.

C3.3.3.4.7.6 SD4.7.6 Prescribed-mix concrete- No Specification Data applicable

C3.3.3.4.7.7 SD4.7.7 Batching - No Specification Data applicable

C3.3.3.4.7.8 SD4.7.8 Mixing

C3.3.3.4.7.8.1 SD4.7.8.1 Mixing Period for Concrete Containing an Extender (Sub-Clause 4.7.8.1.1 e)

For concrete containing an extender in the proportions given in SD4.2.1.3 the minimum periods of mixing given in Sub-Clause 4.7.8.1.1 (e) shall be increased by 2 minutes.

C3.3.3.4.7.8.2 SD4.7.8.2 Ready-mixed Concrete

Ready-mixed concrete will be permitted and shall be mixed in accordance with the requirements of SANS 878.

C3.3.3.4.7.8.3 SD4.7.8.3 Mortar Skim on No-fines Concrete (Sub-clause 4.7.8.4)

Where a mortar skim is specified or shown on the drawings it shall be constructed as follows: Between 24h and 48h after the no-fines layer has been laid it shall be covered with a 1:4 cement: sand mortar layer 10mm thick. The mix shall be comparatively dry to ensure that it does not penetrate and block the cavities in the no-fines concrete. The surface shall be steel, or power floated to form a plane surface.

Curing shall be accordance with Sub-Clause 4.7.8.4.6.

C3.3.3.4.7.9 SD4.7.9 Transportation of concrete- *No Specification Data applicable*

C3.3.3.4.7.10 SD4.7.10 Placing

C3.3.3.4.7.10.1 SD4.7.10.1 General

The Engineer shall be given adequate notice of the intention to place concrete.

Concrete shall be placed continuously, or in layers of such thickness that no concrete will be placed on concrete that has so hardened as to cause planes of weakness.

C3.3.3.4.7.10.2 SD4.7.10.2 Under Water (Sub-clause 4.7.10.13)

Concrete may only be placed under water if dictated by the design and indicated on the Drawings, or as and approved by the Engineer on Site.

C3.3.3.4.7.11 SD4.7.11 Compaction

C3.3.3.4.7.11.1 SD4.7.11.1 Method (Sub-clause 4.7.11.3)

Compaction shall only be achieved by means of mechanical vibration.

C3.3.3.4.7.12 SD4.7.12 Joints

C3.3.3.4.7.12.1 SD4.7.12.1 Construction Joints

a) Location (Sub-clause 4.7.12.1.1)

Construction joints will be required and will be shown on the drawings.

The location of planned construction joints, not indicated on the Drawings, shall be submitted to the Engineer for review and approval.

Walls shall be cast in lifts of a height that permits each lift to be poured without interruption in one continuous operation during normal working hours.

b) Preparation of Construction Joint Surfaces (Sub-clause 4.7.12.1.3 and Table 7)

Special care shall be taken in the preparation of construction joints in accordance with the requirements of Table 7 and as follows:

As soon as practical but not before 15 hours after placing, the entire area of each construction joint shall be cleaned using whatever mechanical devices are required and/or compressed air and water (green cutting). All laitance and similar deposits shall be removed and the coarse aggregate in the hardened concrete shall be exposed over the entire area of the joint. Each joint shall be inspected by the Engineer before it is rendered inaccessible by the erection of further formwork.

Where construction joint preparation is not carried out as described above, for instance on formed joint surfaces, the surface shall be wet sand blasted or scabbled after the concrete has hardened sufficiently to prevent the displacement or loosening of the coarse aggregate, followed by wire brushing and washing with high pressure air and water jets. The roughness of a scabbled or wet sand blasted surface shall be similar to that achieved by green cutting. A bush hammered surface or a surface in which the large aggregate pieces have been removed by chipping will not be considered an acceptable alternative to scabbling.

When concreting is interrupted, concrete surfaces shall be protected from the sun as specified in Sub-clause 4.7.13.2(d) or by means of hessian kept damp until concreting is resumed.

For horizontal joints in water retaining/excluding structures the mortar layer specified in method 2 in Table 7 shall be 25 mm thick. The mortar shall be protected from drying out before the fresh concrete is placed against it.

C3.3.3.4.7.12.2 SD4.7.12.2 Expansion (Filled) and Contraction (Unfilled) Joints

Expansion and contraction joints shall be formed true to line in smooth formwork.

Joints in the joint filler material in expansion joints shall be neatly butted so as to exclude mortar from the joint. Edges of the filler strip against waterstops, concrete, formwork, projections, etc., shall also be closely fitted to exclude mortar, so that there is no resistance (other than the compression of the filler material) to the expansion movement for which the joint is designed.

Two coats of bondbreaker shall be applied to contraction joint surfaces.

C3.3.3.4.7.12.3 SD4.7.12.3 Installation of Waterstops in Joints

Waterstops shall be so held in formwork to eliminate air pockets forming underneath. Special precautions shall be taken to the approval of the Engineer, to ensure that all flexible waterstops are in perfect contact with well compacted void free concrete. The Contractor shall provide satisfactory supervision of such vital operations.

C3.3.3.4.7.12.4 SD4.7.12.4 Application of Joint Sealants

Rebates for sealants shall be formed to required dimensions and lines or cut true to line and size by skilled workmen with special tools, after floating the surface and before the final set of the cement has taken place. All rebates shall be adequately protected against damage until the completion of the work. Rebates for sealants shall be grit blasted or wire brushed on all faces to remove surface laitance and thoroughly cleaned with soft brushes and/or compressed air jets, and, if necessary, dried by blow-lamp or other approved means before priming. The rebates shall be inspected by the Engineer before filling.

Sealants and primers shall be applied strictly in accordance with the manufacturer's instructions. Flow, and non-slumping grades shall be used for horizontal and vertical joints respectively.

Immediately after the sealant is applied, the joint shall be protected against damage until completion of construction.

C3.3.3.4.7.12.5 SD4.7.12.5 Proprietary Bonding Compounds (Sub-clause 4.7.12.1.4)

Proprietary bonding compounds, including wet-to-dry epoxy, may be used between old and new concrete if approved by the Engineer. (See also SD4.2.11.8)

C3.3.3.4.7.12.6 SD4.7.12.6 Sealing of Joints (Sub-clause 4.7.12.4)

The sealing of joints shall be undertaken in accordance with the requirements of the details as shown on the Drawings. In addition to the requirements of this Section all the conditions and methods specified by the manufacturers of the specified or approved brand name products shall be strictly adhered to.

C3.3.3.4.7.13 SD4.7.13 Curing and Protection

C3.3.3.4.7.13.1 SD4.7.13.1 Additional Curing method (Sub-clause 4.7.13.2)

Retaining the formwork in place is a very effective curing method for applicable surfaces.

C3.3.3.4.7.13.2 SD4.7.13.2 Curing Compound (Sub-clause 4.7.13.2.e)

The use of membrane curing compounds will only be considered on vertical surfaces or steeply inclined surfaces (i.e. steeper than 45˚ to the horizontal) of cast in situ members of a structure.

Approval of their use and the compound to be used shall be to the approval of the Engineer. Wax based curing compounds will not be permitted.

The curing compound shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, when the concrete has taken its initial set. The compound shall preferably be applied by spraying and the rate of application shall be strictly in accordance with manufacturer's recommendations. A method of monitoring the area to which the curing compound has been applied, and the application rate, shall be approved by the Engineer and rigidly adhered to by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape.
The use of membrane curing compounds on surfaces that are to be coloured will not be permitted. In this instance, effective alternative means of curing shall be used.

C3.3.3.4.7.14 SD4.7.14 Adverse Weather Conditions

C3.3.3.4.7.14.1 SD4.7.14.1 Concreting in hot weather

High temperatures and loss of moisture due to hot drying winds may cause thermal and plastic shrinkage, cracking and a reduction of strength and durability. Appropriate action is specified in Sub-clause 4.7.14.1.

C3.3.3.4.7.14.2 SD4.7.14.2 Temperature Control for Sections thicker than 900mm

Such sections may be considered to be "Massive concrete" in terms of SANS 10100-2 (SABS 0100-2) Section 11.

Irrespective of the ambient temperature or wind conditions, the Contractor shall take all measures necessary to ensure that the temperature of concrete at the time of placing in the Works does not exceed 260C and that the loss of moisture during transporting and placing is reduced to the minimum possible.

During hot weather, such measures may include but are not necessarily limited to the following:

a) Shielding aggregates from direct sunshine.

b) Sun shields on mixing plants and transporting equipment. This could also include lagging to moving parts kept damp to cause cooling by evaporation.

c) Cooling the mixing water. If ice is used for this purpose it shall be in flake or hollow cylinder form. Lump ice shall not be allowed to enter the tank supplying the mixer drum.

d) Injecting liquid nitrogen into the mixer trucks.

e) Cooling of steel formwork and reinforcing steel by sprinkling with water.

f) Painting all equipment and sunshields white.

g) Blasting of chilled air through aggregate storage bays and hoppers.

h) Spraying the coarse aggregate with water.

i) Re-scheduling concreting to take place at night.

Areas in which concrete is to be placed shall be shielded from direct sunshine and rock or concrete surfaces shall be thoroughly wetted if instructed by the Engineer to reduce absorption of water from the concrete placed on or against them.

After concrete in any part of an area has been placed, the specified curing process shall be commenced as soon as possible. If any interval occurs between completion of placing and start of curing, the concrete shall be closely covered during the interval with polythene sheet to prevent loss of moisture.

To limit the risk of thermal cracking, the Contractor shall ensure that the temperature differential between the surface concrete and the interior concrete at any position does not exceed 200C at any time and that the maximum temperature of the concrete at any position does not exceed 600C at any time. To ensure compliance, the Contractor shall provide the necessary temperature measurement devices and take precautions appropriate to the circumstances as accepted by the Engineer which shall include the following:

a) Limiting the size of concrete pours.

b) Reducing the heat of hydration of the cement by use of an increased proportion of cement extender, if permitted by the Engineer.

c) Reducing the placing temperature of the concrete to less than the 260C specified above

d) Insulation of exposed concrete surfaces by insulating blankets.

e) Increasing the period before stripping of formwork. Steel forms shall be suitably insulated on the outside.

f) Increasing the period between placing successive lifts.

g) Preventing rapid dissipation of heat from surfaces by shielding from wind.

h) Avoiding the use of water sprays when such use would cause rapid cooling of the surface.

i) Shielding concrete surfaces from cold air temperatures, together with the use of heaters where appropriate.

j) Internal cooling using cast in ducts through which cooled water is passed.

The Contractor shall obtain the Engineer's agreement of all procedures which will be applied to control concrete temperatures.

C3.3.3.4.7.14.3 SD4.7.14.3 Prevention and Repair of Plastic Shrinkage Cracks

The Contractor shall take whatever measures are necessary to prevent plastic shrinkage cracking in the concrete. Particularly on dry windy days or hot sunny days the Contractor shall make provision for fine spraying of the concrete surface within one hour of casting, or immediately covering the concrete with black plastic sheeting. If shrinkage cracking occurs, it may be necessary to change the aggregates or the concrete mix proportions. In order to combat shrinkage cracking it may also be necessary to chance the time at which, or the manner in which, power floating in terms of SD4.7.15.6 is carried out.

If plastic shrinkage cracks occur, after screeding of the concrete, the cracks shall be closed up by re-vibrating the concrete with a poker vibrator, within about three hours of casting. Once the cracks have been closed, and after the completion of the specified or scheduled surface finish, the concrete shall be kept thoroughly wet, or covered with plastic sheeting for at least a further three hours.

C3.3.3.4.7.15 SD4.7.15 Finishing of Unformed Concrete Surfaces

C3.3.3.4.7.15.1 SD4.7.15.1 Exposed Surfaces

Exposed surfaces of concrete not cast against formwork shall be finished in accordance with Sub-clause 4.7.15.1.

C3.3.3.4.7.15.2 SD4.7.15.2 Non-skid Surfaces

Exposed surfaces requiring a non-skid finish will be indicated on the Drawings and/or in the Bill of Quantities.

C3.3.3.4.7.15.3 SD4.7.15.3 Screeded Finish (Sub-clause 4.7.15.1 a)

In addition to Sub-clause 4.7.15.1 (a) no mortar shall be added during the screeding operation, and noticeable surface irregularities caused by the displacement of coarse aggregate shall be made good by re-screeding after displaced aggregate has been removed or tamped.

C3.3.3.4.7.15.4 SD4.7.15.4 Wood-floated Finish (Sub-clause 4.7.15.1 b)

Where wood-floating is specified, the surface shall first be given a finish as specified in Sub-clause 4.7.15.1 (a) and, after the concrete has hardened sufficiently, the surface shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screeding marks.

C3.3.3.4.7.15.5 SD4.7.15.5 Steel-floated Finish (Sub-clause 4.7.15.1 c)

Where steel-floating is specified, the surface shall first be given a finish as specified in Sub-clause 4.7.15.1 (b). When the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded surface shall be finished through a combination of wood-floating, followed by steel floating under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

C3.3.3.4.7.15.6 SD4.7.15.6 Power Float Finish

Where power floating is specified, the surface shall be treated as specified in Sub-clause 4.7.15.1 (a). When the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance

from being worked to the surface, the screeded surface shall be power floated to produce a dense, smooth and uniform surface free of trowel marks. In corners and areas of restricted access the concrete surface shall be finished by steel floating in accordance with SD4.7.15.5.

The timing of power-floating is critical to its success. Power-floating shall not commence until the concrete can support the weight of a man with minimum indentation or when a footprint is barely perceptible and until the moisture sheen has disappeared. Thus several hours will have to elapse after concreting has been completed before this operation can commence. Night work may therefore be required.

C3.3.3.4.7.15.7 SD4.7.15.7 Broom-swept Finish (Sub-clause 4.7.15.2)

Where a broom-swept finish is specified, the surface shall be wood floated as specified in Sub-clause 4.7.15.1 (b) and thereafter swept with a stiff bristle broom to produce an approved non-skid surface.

C3.3.3.4.7.15.8 SD4.7.15.8 Preparation for and Laying of Granolithic Screeds

Before placing any granolithic screed, the base concrete shall be given a construction joint finish in accordance with SD4.7.12.1(b) and then soaked with water for at least 24 hours.

Before laying the screed, the concrete shall be thoroughly cleaned by scrubbing, and all standing water removed after soaking. A 1:2 cement / sand grout shall then be brushed on to the prepared surface, and the granolithic screed laid before the grout sets. The granolithic screed shall be of the driest feasible consistency with a slump not exceeding 50mm and shall be formed true to profile and shape as required and shown on the Drawings. Before fresh granolithic screed is placed against existing, adjacent granolithic screed the edge of the latter shall be prepared by chipping back to firm material, wire brushing the exposed surface and brushing it with grout as for the base concrete.

Granolithic screed shall be compacted to remove all air and shall be screeded and steel trowel finished to a degree of accuracy I unless otherwise specified.

The trowelling shall be carried out in the following stages:
1st – as soon as the granolithic screed has been compacted and screeded.
2nd – after 2 hours to close the surface and remove laitance.
3rd – after a further 4 hours.

These time intervals are appropriate to normal temperature conditions and shall be varied by the Contractor according to the temperature to ensure a smooth dense finish.

Granolithic screeds shall be diamond saw cut into panels not exceeding 2m in any direction. The saw cutting shall be carried out after an appropriate time interval to avoid cracking of the screed. Saw cut joints shall later be filled with an approved sealant.

Granolithic screed shall be cured as specified in Clause 4.7.13 but shall additionally be protected from direct sunlight and drying winds as it is being placed.

All screeding necessary to accommodate mechanical equipment shall be done under the equipment supplier's supervision and strictly in accordance with his instructions. Screeding shall commence as soon as the equipment supplier gives notice on completion of erection and shall be finished expeditiously.

The Contractor shall make good any damage to the mechanical equipment resulting from his personnel not following the supplier's instructions. Any spillage on the equipment shall be cleaned off immediately.

C3.3.3.4.7.15.9 SD4.7.15.9 Preparation for Laying of Screeds

The interface between concrete floors and screeds shall be regarded as construction joints and the surface of the floor shall be so prepared in accordance with SD4.7.12.1(b).

C3.3.3.4.7.15.10 SD4.7.15.10 Colour Mitigation – Application

Surfaces to be coloured shall be free of curing compounds, surface hardening or other material that may prevent direct contact with the colouring.

The colouring shall be applied directly to clean concrete surfaces at locations as specified or directed by the Engineer. Dark patches that may develop shall be controlled or avoided by custom blending of the basic technique, amending the dilution rate of the colour concentrate with water or a combination of these.

If required, the Contractor shall apply the colouring to a test section to be reviewed by the Engineer. Upon approval of both the test section and application procedures by the Engineer, the Contractor may proceed using the approved application procedures.
Rock colouring material shall be applied only by licensed applicators approved by the manufacturer. Variegated patinas that develop shall be controlled by custom blending of the rock colouring material and/or varying the application techniques.

C3.3.3.4.7.16 SD4.7.16 Watertight Concrete

Water retaining structures and water excluding structures will be so designated on the drawings. These will all be considered to be watertight concrete in terms of Sub-Clause 4.7.16. Special care shall be taken with all aspects of construction of these structures in order to ensure watertightness.

The tests in Sub-clauses 5.1.6.1 and 5.1.6.2 will be required for water retaining structures but not for water excluding structures.

However, should any section of the concrete Works show any sign of water leakage or penetration, irrespective of the source, that section shall be deemed to be defective and the necessary remedial work shall be carried out in accordance with Sub-clause 5.1.6.3.

C3.3.3.4.7.17 SD4.7.17 Concrete in Wet Ground

Provisions for concrete in wet ground shall be as shown on the drawings and not necessarily as indicated in Clause 4.7.17.

C3.3.3.4.7.18 SD4.7.18 Grouting

C3.3.3.4.7.18.1 SD4.7.18.1 Holding-down Bolts, Column Bases and Mechanical Equipment Bedplates

The mortar grout for holding-down bolts, column bases and mechanical equipment bedplates shall be a proprietary grout ready mixed in sealed packets as supplied by the manufacturer, and mixed and placed in accordance with the manufacturer's instructions.

The following prescribed products or brand name products, or equivalent materials subject to the written approval of the Engineer, shall be used:

SikaGrout® 212, high performance cementitious grout.

C3.3.3.4.7.19 SD4.7.19 Defects

C3.3.3.4.7.19.1 SD4.7.19.1 General

Defects shall be repaired as soon as possible after formwork has been removed and the Engineer has inspected the concrete. A statement of the method and materials to be used for each repair shall be

submitted to the Engineer for his approval before any work is carried out. The Engineer may prohibit the further placing of concrete in the particular structure concerned until he is satisfied that the repair has been satisfactorily executed.

An example of the methodology and materials required for an effective repair is given in ABE Construction Chemicals' data sheets "Preparation of Surfaces" and "Dura Spalling Repair". These give detailed descriptions for cleaning and surface preparation, cleaning of reinforcement, corrosion protection of reinforcement, wet-to-dry epoxy bonding agents, curing etc. Similar products are available from Sika. In making any repairs, a high level of workmanship will be required and only the very best materials shall be used.

C3.3.3.4.7.19.2 SD4.7.19.2 Repair (plugging) of Formwork Tie Cone Recesses

Where practical, tie cone recesses shall be plugged with well rammed, dry 3:1 mortar within 48 hours of casting the concrete. The surfaces of the recesses shall first be roughened by chipping and wire brushing.

Tie cone recesses which cannot be plugged within 48 hours of casting shall be roughened by scabbling and an approved wet-to-dry epoxy shall be applied before plugging the recesses with mortar.

The mortar plugs shall be effectively cured.

C3.3.3.4.7.20 SD4.7.20 Rubbing Down of Concrete Surfaces- No Specification Data applicable

C3.3.3.4.7.21 SD4.7.21 The Use of Sliding Formwork- No Specification Data applicable

C3.3.3.4.7.22 SD4.7.22 Records- No Specification Data applicable

C3.3.3.4.7.23 SD4.7.23 Demolition and Removal of Existing Structural Concrete- No Specification Data applicable

C3.3.3.4.7.24 SD4.7.24 Granolithic Screed

Granolithic screed shall consist of:

Cement	1 part by mass
Sand	1.25 parts by mass
Coarse aggregate	2 parts by mass

The coarse aggregate shall consist of granite or other approved chips which shall pass a 10 mm sieve and be retained on a 5mm sieve.

The consistency of the mix shall be as dry as practicable and the water /cement ratio shall be approximately 0.4.

C3.3.3.4.8 SD4.8 PRECAST CONCRETE

In addition to these clauses, useful recommendations and information is given in SANS 10100-2 (SABS 0100-2) Section 13.

C3.3.3.4.8.1 SD4.8.1 Casting Beds, Moulds and Formwork- *No Specification Data applicable*

C3.3.3.4.8.2 SD4.8.2 Concrete mixers- *No Specification Data applicable*

C3.3.3.4.8.3 SD4.8.3 Vibrating Equipment- *No Specification Data applicable*

C3.3.3.4.8.4 SD4.8.4 Handling, Lifting and Stacking- *No Specification Data applicable*

C3.3.3.4.8.5 SD4.8.5 Placing and Vibrating of Concrete- *No Specification Data applicable*

C3.3.3.4.8.6 SD4.8.6 Units that have Architectural Finishes

C3.3.3.4.8.6.1 SD4.8.6.1 Samples of Concrete

Samples of precast concrete units that have architectural finishes shall be prepared.

Samples of concrete units, not having architectural finishes shall also be prepared to establish quality before full-scale production is commenced.

C3.3.3.4.8.7 SD4.8.7 Reinforcement in Precast Concrete- No Specification Data applicable

C3.3.3.4.8.8 SD4.8.8 Curing of Precast Concrete Works- No Specification Data applicable

C3.3.3.4.9 SD4.9 PRE-STRESSED CONCRETE

A tendon, when tensioned, contains a considerable amount of stored energy, which, in the event of failure of the tendon, anchorage or jack, may be released violently. All possible precautions shall be taken (both during and after tensioning) to safeguard persons from injury caused by the sudden release of this energy.

C3.3.3.4.9.1 SD4.9.1 Apparatus- No Specification Data applicable

C3.3.3.4.9.2 SD4.9.2 Tendons

C3.3.3.4.9.2.1 SD4.9.2.1 Surface Condition

a) Solvents (Sub-clause 4.9.2.1.1)

Solvents may be used for cleaning.

C3.3.3.4.9.2.2 SD4.9.2.2 Straightness- No Specification Data applicable

C3.3.3.4.9.2.3 SD4.9.2.3 Cutting- No Specification Data applicable

C3.3.3.4.9.2.4 SD4.9.2.4 Positioning of Tendons and Sheaths- No Specification Data applicable

C3.3.3.4.9.2.5 SD4.9.2.5 Tensioning Procedure

a) Pre-stressing Force Diagram (Sub-clause 4.9.2.5.1)

Pre-stressing force diagrams will be shown on the Drawings.

b) Order of Loading and Magnitude (Sub-clause 4.9.2.5.8)

The order of loading and magnitude of the load for each component of the tendon shall be as indicated on the Drawings.

C3.3.3.4.9.3 SD4.9.3 Grouting of Sheaths

C3.3.3.4.9.3.1 SD4.9.3.1 General

Tests (Sub-clause 4.9.3.1.2)

Bleeding tests and grouting trials will be required.

C3.3.3.4.9.3.2 SD4.9.3.2 Sheaths (Sub-clause 4.9.3.2.1)

Sheaths shall be fitted at both ends with pipes with a diameter of at least 10 mm for the injection of grout. The ends of the injection pipe shall be fitted with a clamp valve or device capable of withstanding a pressure of at least 1,5 MPa without loss of grout.

C3.3.3.4.9.4 SD4.9.4 Permanent Protection and Bonding of External Tendons (Clause 4.9.4)

C3.3.3.4.9.4.1 SD4.9.4.1 Tests (Sub-clause 4.9.4.2)

Preliminary tests shall be undertaken on the proposed encasement materials.

C3.3.3.4.9.4.2 SD4.9.4.2 Protection (Sub-clause 4.9.4.3)

The protection and bonding of the tendons shall be affected within 7 days after final tensioning of the tendon(s).

C3.3.3.4.9.5 SD4.9.5 Pre-tensioning- No Specification Data applicable

C3.3.3.4.9.6 SD4.9.6 Circular Pre-stressed Concrete Reservoirs and Tanks

C3.3.3.4.9.6.1 SD4.9.6.1 Contractor's Responsibilities

The Contractor is responsible for submitting his proposals for the pre-stressing work. He shall satisfy the Engineer with regard to all details that may be required, shall provide all plant and equipment required, shall supply all materials and shall execute and complete the pre-stressing and associated work. Accordingly, the Contractor shall comply with the requirements of SD4.9.6.2 to SD4.9.6.5 below.

C3.3.3.4.9.6.2 SD4.9.6.2 Pre-stressing system and tendon layout

The reservoir wall is to be pre-stressed circumferentially as shown on the Engineer's drawings. The drawings show the required minimum pre-stressing force in the wall after all losses, but do not specify details of the pre-stressing system, or the sizes and arrangement of tendons.

Any proven and approved method of pre-stressing may be used, although wrapping type systems are not acceptable.

The Contractor shall determine the arrangement and sizes of tendons to provide the required pre-stressing force in accordance with the following criteria and details given on the drawings:

a) Losses of pre-stress shall be calculated according to SANS 10100-1 (SABS 0100-1).

b) The prestressing force, expressed as a percentage of minimum guaranteed ultimate tensile strength of the steel shall not be allowed to exceed the following values:

at any stage during the jacking process 80%

on completion of transfer 70%.

c) The maximum vertical spacing of tendons shall be: 400 mm at the base of the wall varying uniformly to 1 200 mm at the top of the wall.

d) All tendons shall be stressed from both ends.

C3.3.3.4.9.6.3 SD4.9.6.3 Reinforcement

The Contractor shall design and provide the spiral bursting reinforcement to anchorages to the Engineer's approval.

C3.3.3.4.9.6.4 SD4.9.6.4 Calculations, drawings and records

The Contractor shall, at least two months before he intends commencing with construction of the wall, submit the following to the Engineer for his approval, for the pre-stressing system adopted:

a) A set of detailed calculations in respect of the tendon force along the length of each tendon, the expected extension and the bursting forces, using a numbering system to identify each tendon,

b) Drawings detailing the number, layout and alignment of the tendons, the tendon supports, details of the bursting and other reinforcement, anchorage recesses, tensioning sequence, tensioning loads and extensions,

c) Requirements for controlling the tensioning operations, and,

d) Details of any technical data which are at variance with the information given on the Engineer's drawings.

Pre-stressing work shall not commence before the relevant calculations and drawings prepared by the Contractor have been approved by the Engineer. After this approval, no departure shall be permitted from the forces, stresses and extensions shown thereon without authorization by the Engineer.

In addition to complying with the requirements of Sub-clause 4.9.2.5.11, the Contractor shall, upon completion of the pre-stressing work, furnish a permanent record of each working drawing in the form of an A1 size drawing in electronic AutoCAD format.

C3.3.3.4.9.6.5 SD4.9.6.5 Friction Tests

For purposes of verifying the assumed losses of pre-stressing resulting from friction between the pre-stressing tendons and the sheathing which occurs during the jacking operation, the Contractor shall carry out friction tests on the first tendon and thereafter on every fifth tendon stressed or as may be directed by the Engineer. To this end the Contractor shall provide all necessary jacking and measuring devices and all labour required for carrying out and recording the friction tests.

C3.3.3.4.10 SD4.10 HANDLING AND ERECTION OF PRECAST CONCRETE UNITS

In addition to these clauses, useful recommendations and information is given in SANS 10100-2 (SABS 0100-2) Section 13.4.

Special care shall be taken to ensure the safety of personnel during this delicate phase.

C3.3.3.4.10.1 SD4.10.1 Handling and Transportation

C3.3.3.4.10.1.1 SD4.10.1.1 Lifting (Sub-clause 4.10.1.3)

The position of lifting and supporting points, the method of lifting, the type of equipment and the type of transport to be used shall be determined by the Contractor in liaison with the Engineer. The agreed system layout shall be submitted to the Engineer (for review, detailed design and reinforcement detailing) 28 days before the construction Drawings and Reinforcement Schedules are required by the Contractor.

C3.3.3.4.10.2 SD4.10.2 Assembly and Erection

At least 28 days before commencement of the work, the Contractor shall submit to the Engineer a Method Statement including proposed methods of assembly and erection for review and approval by the Engineer.

C3.3.3.4.10.3 SD4.10.3 Temporary Supports during Construction- No Specification Data applicable

C3.3.3.4.10.4 SD4.10.4 Forming Structural Connections

C3.3.3.4.10.4.1 SD4.10.4.1 Design

The design requirements for the structural connections will be indicated on the Drawings.

C3.3.3.5 SD5 COMPLIANCE WITH THE REQUIREMENTS

C3.3.3.5.1 SD5.1 TESTING

C3.3.3.5.1.1 SD5.1.1 General

a) Cube testing (Sub-clause 5.1.1.4)

Cubes shall be tested by an approved laboratory.

b) Ready-mix Production (Sub-clause 5.1.1.7)

The tests result from a ready-mix production facility, as part of its quality control system, will not be accepted. Only concrete cubes taken and stored on site will be accepted.

c) Alkali-aggregate Reaction (Sub-clause 5.1.1.8 and SD4.2.3.5)

The tests for potential reactivity of the aggregates shall be Petrography ASTM C 295 and Mortar-bar test SANS 6245 or ASTM C 1260 (AASHTO T 303).

C3.3.3.5.1.2 SD5.1.2 Acceptance of Strength Concrete (Clause 5.1.2)

C3.3.3.5.1.2.1 SD5.1.2.1 Assessment (Sub-clause 5.1.2.3)

The test results will be assessed statistically.

C3.3.3.5.1.3 SD5.1.3 Frequency of Sampling- No Specification Data applicable

C3.3.3.5.1.4 SD5.1.4 Individual Load Tests on Precast Units and Pre-stressed Units

The following load test values will be as indicated on the Drawings:

C3.3.3.5.1.4.1 SD5.1.4.1 Deflection (Sub-clause 5.1.4.2.1)

The maximum deflection.

C3.3.3.5.1.4.2 SD5.1.4.2 Load (Sub-clause 5.1.4.3)

The ultimate design load.

C3.3.3.5.1.4.3 SD5.1.4.3 Special Tests (Sub-clause 5.1.4.4)

Any special tests required.

C3.3.3.5.1.5 SD5.1.5 Tests on Pre-stressed Structures

C3.3.3.5.1.5.1 SD5.1.5.1 Tests Requirements (Sub-clause 5.1.5.1.1)

Particular requirements for pre-stressed structures will be indicated on the Drawings.

C3.3.3.5.1.5.2 SD5.1.5.2 Acceptance Criteria (Sub-clause 5.1.5.4 and Table 10)

The acceptance criteria for pre-stressed structures in extreme exposure conditions will be indicated on the Drawings.

C3.3.3.5.1.5.3 SD5.1.5.3 Class (Sub-clause 5.1.5.4 a)

The class of pre-stressed structures will be indicated on the Drawings.

C3.3.2.5.1.5.4 SD5.1.5.4 Deflection (Sub-clause 5.1.5.4 c)

The deflection measured immediately after application of the test load for deflection shall not exceed the values indicated on the Drawings.

C3.3.3.5.1.6 SD5.1.6 Tests for Watertightness

C3.3.3.5.1.6.1 SD5.1.6.1 Requirements

The following requirements amplify those in Clause 5.1.6.
Water for testing shall be provided by the Contractor and he shall be responsible for providing all necessary equipment that may be required for filling the structures.

The structure shall be filled with water at a uniform rate not exceeding 2.0m in 24 hours until the top water level has been reached. The water level will then be carefully noted and recorded by the Engineer in relation to a fixed benchmark and shall be maintained by the addition of further water for a stabilizing period to permit complete absorption of water by the concrete.

The stabilizing period shall be 7 days for a maximum design-crack width of 0.1mm or 21 days for 0.2mm or greater. After the stabilizing period, the level of the liquid surface shall be recorded at 24-hour intervals for a test period of 7 days. During this 7-day test period the total permissible drop in level, after allowing for evaporation, shall not exceed 1/500th of the average water depth of the full tank, or 10mm.

The evaporation shall be measured by the mean drop in level caused by the evaporation of the water in three flat containers floating in the water being recorded.

In the event of any leakage or dampness being evident at any stage of the filling or testing or in the event of the Engineer considering the final degree of watertightness to be unsatisfactory, the Contractor when ordered by the Engineer shall discontinue such filling or testing and shall, at his own expense, take approved steps immediately to rectify the leakage, until a satisfactory test is obtained, which shall prove to the Engineer that a sufficient degree of watertightness has been obtained.

The costs of emptying a water-retaining structure which cannot be drained shall be borne by the Contractor. The water shall be discharged in a manner approved by the Engineer and shall be such that the Employer can utilise the water if he so desires.

The water shall not be used as a medium for additives to effect remedial work or to stop leaks.

The costs of retesting the structure for watertightness shall be borne by the Contractor."

Water shall be used as the liquid for test purposes.

C3.3.3.5.1.7 SD5.1.7 Cleaning and Sterilising

C3.3.3.5.1.7.1 SD5.1.7.1 Requirements

The reservoir shall be sterilized as specified below, before testing, and, should repairs have been necessary, before retesting.

The walls, floor and underside of the reservoir roof shall first be thoroughly hosed down with water and swept with brushes until properly cleaned of all dirt and other foreign matter. All water shall be drained away.

The reservoir shall be filled with water to a depth of 150mm, chloride of lime solution being added as the water enters at a dosing rate of 150 grams of chloride of lime for every cubic metre of water entering the structure. The chloride of lime solution shall be mixed thoroughly with water. The walls shall then be thoroughly brushed down with the solution. On completion and when all personnel have vacated the structure, the internal access ladder shall be washed down with additional chlorinated water.

No personnel shall enter the reservoir during and after sterilizing unless wearing sterilized gumboots.

C3.3.3.5.2 SD5.2 TOLERANCES

C3.3.3.5.2.1 SD5.2.1 GENERAL

C3.3.3.5.2.1.1 SD5.2.1.1 Degree of Accuracy

Unless otherwise specified on the drawings or directed by the Engineer, the degree of accuracy for all work, including floated finishes, shall be II.

Every specified permissible deviation is binding in itself. The cumulative effect of permissible deviations will not be considered. The maximum permissible vertical deviation is subject to the other permissible deviations.

C3.3.3.5.2.1.2 SD5.2.1.2 Tolerances for Verticality

Replace in the permissible deviations for verticality in Table 11 as follows:

Table 11: Accuracy in concrete work

1	2	3	4
Item	**Permissible deviation (pd) mm**		
	Degree of accuracy		
	III	**II**	**I**
Elements or component above foundations			
5) Verticality, per metre of height,	5	3	2
Subject to a maximum of	50	30	10

Tolerances not stated (Table 11)

The tolerances for bow, camber and twist in slipform / precast concrete shall be as indicated on the Drawings.

C3.3.3.6 SD6 ADDITIONAL SD CLAUSES FOR WASTEWATER TREATMENT WORKS

C3.3.3.6.1 SD6.1 Aggregates of Dolomitic Origin

Where specified on the drawings and scheduled in the Bill of Quantities, aggregates for structural concrete shall be of dolomitic origin. The quantity of insoluble matter in respect of concrete made with these aggregates, determined according to the method described in SANS 677, Appendix C, shall not be more than 15%.

C3.3.3.6.2 SD6.2 Screeds for Settling Tanks

a) Surface of floor slab below screed

As stated in SD4.7.15.9, the top surface of the floor slab shall be regarded as a construction joint and prepared as such in accordance with SD4.7.12.1(b).

All joints shall be sealed in the manner shown on the drawings. All dust, debris, etc. must be removed immediately prior to the application of the bonding agent and screed.

b) Materials

Only CEM I 42.5 (Portland cement) shall be used.

Coarse aggregate maximum size: 10mm
28-day cube strength: 30MPa.
A plasticizer approved by the Engineer shall be used to reduce the water content of the mix to an absolute workable minimum. The mix design shall be submitted to the Engineer for approval.

c) Placing of screed

All surface water shall be removed after which Fosroc Nitobond EP slowset bonding agent or similar approved shall be applied strictly according to the manufacturer's specifications. The screed shall be placed according to the recommendations and/or specifications of the manufacturer of the bonding agent.

The screed shall be placed, spread and compacted in one layer and care shall be taken to obtain maximum compaction. After the screed has been compacted and before the surface is power floated, angle irons fixed to the mechanical equipment shall be used to finish off the screed to the correct levels.

Power floating shall not commence until such time as the screed surface has lost its sheen and barely shows footprints. All laitance on the surface of the screed resulting from compaction shall be struck off prior to power floating. Too much floating causing excessive cement-water paste to surface, shall be avoided.

Curing shall commence as soon as finishing operations have been completed and shall be continued for at least 7 days. The method of curing shall be by means of a peripheral pipe directly next to the inside face of the wall with water running down the slope of the floor to the centre cone. This shall be discussed with the Engineer. Any alternative curing method must be submitted to the Engineer for approval.

d) Joints

The joints in screeds shall be constructed according to the details shown on the drawings and must in all cases be aligned with the joints in the floor slab below.

e) Surface finish of screeds

The finishing-off of the screed shall be done in conjunction with the mechanical contractor to ensure that the surface fits the mechanical equipment. The maximum allowable deviation of the floor from the design level is ± 3 mm.

C3.3.3.6.3 SD6.3 COATINGS

Where indicated on the drawings, the following coatings shall be provided to structures:

C3.3.3.6.3.1 SD6.3.1 Algae-resistant coating on concrete surfaces

a) General

Concrete launder channels are attacked over a period of time by the acids generated in the purification processes. This leads to loss of cement with consequent increase in roughness by exposure of the aggregate. Phosphates in the water and the action of sunlight encourage the growth of algae. Removal of algae is a costly and continuous process; hence it is preferable to provide a smooth surface to minimise build-up of algae growth.

b) Surface preparation

For immersion or other heavy-duty applications, laitance shall be totally removed by water blast cleaning, with abrasive injection, or by mechanical scabbling of the surface, or by acid pickling, followed by very thorough washing with potable water.

For coatings of low water permeability, such as solvent borne epoxies, vinyls and chlorinated rubber, the moisture content of the concrete or plaster shall be not more than an indicated 5% when tested with an approved electrical conductivity meter, designed for use on concrete or plaster (such as the Delmhorst meter). The pins of the meter shall penetrate the concrete or plaster to a depth not less than 5 mm.

The first coat of the coating system may require thinning with the manufacturer's recommended solvent to assist penetration of the substrate.

The surface shall be dry before coatings are applied.

c) Application

Apply epoxy tar primer such as Ivory 310P, thinned when necessary in accordance with the manufacturer's instructions to obtain adequate penetration.

Apply a suitable scraper coat such as Ivory 319TAQ to obtain a smooth finish followed by a suitable solvent-free epoxy tar coating such as Ivory 310 to give a coating thickness of 250 micrometres and finally a vinyl anti-fouling paint at the coverage recommended by the manufacturer.

NOTE: Since an anti-fouling paint functions by leaking toxic materials into the water, it has a limited effective life, dependent on flow rate. The topcoat must therefore be renewed when its efficacy starts to diminish.

C3.3.3.6.3.2 SD6.3.2 Abrasion-resistant coating on concrete surfaces

a) General

Concrete structures subject to heavy abrasion and scouring action shall be coated with an abrasion-resistant coating based on solvent-free, two-component polyurethane hybrid.

For immersion or other heavy-duty applications, laitance shall be totally removed by water blast cleaning, with abrasive injection, by mechanical scabbling of the surface or by acid pickling followed by very thorough washing with potable water.

For coatings of low water permeability, such as solvent-borne epoxies, vinyls and chlorinated rubber, the moisture content of the concrete or plaster shall be not more than an indicated 5%

when tested with an approved electrical conductivity meter, designed for use on concrete or plaster (such as the Delmhorst meter). The pins of the meter shall penetrate the concrete or plaster to a depth not less than 5mm.

The first coat of the coating system may require thinning with the manufacturer's recommended solvent to assist penetration of the substrate.

The surface shall be dry to a depth of not less than 5mm.

Alternatively, when agreed by the supplier of the material, the surface may be treated with a chemical water scavenger, supplied by the manufacturer of the coating material.

The clean, dry surface shall be primed with the manufacturer's recommended primer for concrete, applied in accordance with the manufacturer's recommendations.

Blowholes in the concrete shall be filled by application of the manufacturer's scraper coat.

b) Materials

i) Primer

The primer shall be a suitable primer for concrete plus scraper coat supplied by the manufacturer of the coating material and shall be applied at the manufacturer's specified thickness and shall be overcoated within the specified overcoating time.

ii) Coating material

The coating material shall be a solvent-free, two-component polyurethane hybrid based on polyether type polyol and aromatic isocyanate. The cured coating shall comply with the following requirements:

The coating or lining thickness shall not be less than 3mm.

Tensile strength at 3mm thickness (ASTM D 638), not less than 15MPa

Adhesion to correctly primed steel at 1mm thickness (SABS Method 776), not less than 10MPa

Impact resistance direct at 1 mm thickness (ASTM G 14), not less than 8 joules

Dielectric strength not less than 10kV/mm

Elongation at break at 3mm thickness, not less than 25%

Compressibility, not less than 25MPa

Surface hardness of 5mm thick sample, not less than 60 nor greater than 80 Shore 'D'.

Water vapour permeability at 1mm thickness, not greater than 0,5g/24h/m²/mm

Cathodic disbonding when tested in accordance with ASTM G8 Method A, for 60 days, the disbonded area shall not exceed 500mm².

Where it is not practical to apply the coating using a two-component spray gun, the manufacturer's brushing grade may be used, provided that the completed coating meets all the requirements of the specification.

c) Requirements for the finished coating

The coating shall be smooth, glossy, free from bubbling, excessive orange peel or brushmarking and from excessive runs and sags.

The dry film thickness shall be not less than 3mm.

The edge of the coated area shall be neatly finished. No overspraying or splashes shall be permitted on surfaces adjacent to the coated surface.

The coated surface shall be free from electrical insulation defects when tested with a high voltage holiday detector, earthed to the concrete substrate by wet sponge contact and operated at 15kV potential.

d) Application

i) Prepare surface as specified above.
ii) Prime the surface with the coating manufacturer's primer for concrete.

iii) Within the minimum and maximum overcoating time interval specified for the primer by the manufacturer apply one coat or two coats by means of an airless spray machine fitted with metering pumps that dispenses the correct mix ratio at the spray head. The machine shall be maintained in a clean condition and in good working order. The Contractor may be required to demonstrate to the Engineer that the machine is delivering components in the correct mixing ratio.

C3.3.3.6.4 SD6.4 FLUMES

C3.3.3.6.4.1 SD6.4.1 Flume structure

The structure shall be rigid and watertight and capable of withstanding flood-flow conditions without damage from outflanking or from downstream erosion. The axis shall be in line with the direction of flow in the upstream channel, and the geometry shall conform with the dimensions given on the drawings.

The surfaces of the flume, particularly those of the entrance section and throat, shall be smooth. The flume shall be constructed of concrete with a smooth cement finish and shall be surfaced with a smooth non-corrosive material. The surface finish is of particular importance within the prismatic part of the throat, but the requirements may be relaxed beyond a distance along the profile 0.5 hmax upstream and downstream of the throat proper.

To minimize uncertainty in the discharge measurements, the tolerances specified under Sub-clause SD6.5.3 shall be satisfied in construction.

C3.3.3.6.4.2 SD6.4.2 Mechanical devices for flumes

C3.3.3.6.4.2.1 SD6.4.2.1 Linear scale plates and pointers

i) Linear scale plates to be installed at all Parshall flumes for measuring flow shall be manufactured from 2mm thick 304L stainless steel.

ii) All linear scale plates shall be calibrated in litres per second and shall have a width of 50mm and a length of 1,000mm. All numbers shall be punched onto the stainless-steel

plate and shall be filled with a suitable yellow paint to the satisfaction of the Engineer. The units of calibration shall be in litre/s in increments of 50 litre/s. The linear scale plates shall be fixed into position with the aid of stainless-steel chemical anchor bolts in a position as indicated on the drawings and flush with the concrete.

iii) Mechanical pointers for elevated linear scale plates shall be manufactured from grade 304 stainless steel. They shall be robust devices which facilitate the easy and accurate reading of linear scale plates."

C3.3.3.6.5 SD6.5 TOLERANCES

C3.3.3.6.5.1 SD6.5.1 Floors

The maximum permissible deviation from a 3m long straight line connecting two points on the surface of the finished settling tank floor is ± 3mm.

C3.3.3.6.5.2 SD6.5.2 Top of settling tank walls

The bridge-wheel tread path surface shall have a smooth finish constructed within a vertical tolerance of ± 2mm. This tolerance shall be measured by means of laser equipment. The top edges of the outer ring walls of the WAS thickeners shall be chamfered with fillet strips to form 25mm x 25mm chamfers:

C3.3.3.6.5.3 SD6.5.3 Flume structure

i) On the bottom width b of the throat, 0.2% of b with an absolute maximum of 0.01m;
ii) on point deviations from a plane surface in the throat, 0.1% of litre;

iii) on the width between vertical surfaces in the throat, 0.2% of this width with a maximum of 0.01m;
iv) on the average longitudinal and transverse slopes of the base of the throat, 0.1%;

v) on the slope of inclined surfaces in the throat, 0.1%;

vi) on the length of the throat, 1% of litre;

vii) on point deviations from a plane surface in the entrance transition to the throat, 0.1% of litre;

viii) on point deviations from a plane surface in the exit transition from the throat, 0.3% of litre;

ix) on deviations from a plane or curve on other vertical or inclined surfaces, 1%;

x) on deviation from a plane of the bed of the lined approach channel, 0.1% of litre.

The structure shall be measured on completion of construction, and average values of relevant dimensions and their standard deviations at 95% confidence limits shall be computed. The average values of dimensions shall be used for computation of the discharge of their standard deviations to obtain the overall uncertainty in the determination of discharge.

Construction tolerances of the concrete flume must allow for the final application of a 3mm thick abrasive resistant coating to be applied to the concrete surfaces, where this is specified.

A method statement for construction of the flume shall be submitted to the Engineer for approval at least 14 days prior to construction.

C3.3.3.6.6 SD6.6 ADDITIONAL MEASUREMENT AND PAYMENT CLAUSES FOR WASTEWATER TREATMENT WORKS

C3.3.3.6.6.1 SD6.6.1 Algae resistant and abrasion resistant coatings

a) Vinyl anti-fouling paint and undercoats to form an algae-resistant coating on (Description of structural element stated):……Unit: m^2

b) Solvent-free abrasion-resistant coating and primer to a minimum thickness of 3mm on (Description of structural element stated):……...Unit: m^2

The unit of measurement shall be the square metre of surface protected against corrosion.

The tendered rates shall include full compensation for surface preparation for supplying and applying the materials as specified, for all labour, equipment and appurtenant materials necessary to carry out the work and for all waste and cleaning up after the work has been completed.

C3.3.3.6.6.2 SD6.6.2 Supply and delivery of Linear Scale plates to Parshall Flumes (excluding pointers)……..Unit: No

The rate shall include full compensation for the manufacture, corrosion protection, supply, handling, transport and delivery of the complete units.

C3.3.3.6.6.3 SD6.6.3 Installation, calibration, testing, commissioning, and maintenance of linear scale plates for Parshall Flumes (excluding pointers)……..Unit: No

The rate shall include full compensation for the installation, testing, calibration, commissioning, maintenance, the making good of damaged corrosion-protection areas, etc, and all other actions required for establishing an efficient working system."

C3.3.3.7 SD7 NOT USED

C3.3.3.8 SD8 MEASUREMENT AND PAYMENT

The rates tendered under this Section shall not include for the general obligations, Contractor's Plant and Equipment and work deemed to be covered by the items provided in Section A – General.

C3.3.3.8.1 SD8.1 Measurement and Rates

C3.3.3.8.1.1 SD8.1.1 Formwork

C3.3.3.8.1.1.1 SD8.1.1.1 General Formwork

Formwork, other than formwork covered below, will be measured as the net area of the face of the concrete to be supported during the placing of concrete. No deduction will be made for fillets and chamfers of size up to 50mm x 50mm or for openings of diameter up to 0.7m or of area up to 0.5m2.

C3.3.3.8.1.1.2 SD8.1.1.2 Narrow Widths

Formwork in continuous lengths of narrow widths and of fillets or chamfers over 50mm x 50mm will be measured by length, the width or range of widths being stated in the Bill of Quantities.

Boxing-out, the forming of holes, and other such operations will be measured by number, basic dimensions, perimeters, or drawing references, as stated in the Bill of Quantities.

C3.3.3.8.1.1.3 SD8.1.1.3 Separate items will be scheduled:

a) For each class of finish required on the formed concrete.

b) For the different angles of inclination of formwork given below:

DESCRIPTION OF FORMWORK	ANGLE OF INCLINATION FROM THE VERTICAL
Horizontal	Exceeding 85° and not exceeding 95°
Sloping	Exceeding 10° and not exceeding 85°
Battered	Not exceeding 10°
Vertical	0°

c) For each inclination of each type of structural element, such as walls and beams, and for different prop heights for beams and slabs, and for formwork to curved (singly and double curvature), curved in plan only, arched, domical, specially moulded, and other types of work.

d) For depths of openings required in the formed concrete, as follows:

Not exceeding 0.5 m;

Exceeding 0.5 m but not exceeding 1.0 m;

Exceeding 1.0 m but not exceeding 1.5 m;

Exceeding 1.5 m but not exceeding 2.0 m;

Exceeding 2.0 m;

Measured perpendicular to the surface; and

For large and small voids classified as follows:

DESCRIPTION	MAXIMUM CROSS-SECTION	
	CIRCULAR VOIDS, DIAMETER, m	OTHER VOIDS, AREA, m2
Large	Exceeding 0.35 and not exceeding 0.7	Exceeding 0.1 and not exceeding 0.5
Small	Not exceeding 0.35	Not exceeding 0.1

C3.3.3.8.1.1.4 SD8.1.1.4 Special Smooth Finish

Where a “special-smooth” or “smooth-special” finish is specified (See SD4.3.1.4 and Table 1) and scheduled which requires more extensive operations to be carried out after striking than are specified for a smooth finish, payment for formwork will become due when the finish has been achieved as specified.

C3.3.3.8.1.1.5 SD8.1.1.5 Special Finish

Where a special off-form finish (See Table 1) is specified and scheduled, payment for formwork will become due when the finish has been achieved as specified.

C3.3.3.8.1.1.6 SD8.1.1.6 The Unit Rate

The unit rate shall cover the cost of all parts of formwork in contact with the concrete (including forming fillets or splays up to 50mm x 50mm) and the necessary ties, bearers, struts, and other supports

(falsework) plus the labour and equipment necessary to erect the formwork to the required accuracy and with the specified surface finish and to strike such formwork. The unit rate shall also cover all costs associated with the design of the formwork and falsework and ensuring their safety, and for effectively plugging tie sleeves and tie cone recesses.

C3.3.3.8.1.1.7 SD8.1.1.7 Formwork to kickers

For formwork to kickers, all additional costs for formwork to edges up to 300mm high will be deemed to be included in the rates tendered for vertical formwork to sides of walls or columns and will not be measured separately in narrow widths.

C3.3.3.8.1.1.8 SD8.1.1.8 Edges of Blinding/ No-fines layer

No separate payment will be made for formwork to the edge of the blinding layer, no-fines layer or divider strip. The rates tendered for concrete to the blinding layer, no-fines layer shall cover the cost of such formwork.

C3.3.3.8.1.1.9 SD8.1.1.9 Formwork to top of sloping surfaces

Formwork to the top of sloping or conical surfaces will only be measured to surfaces of over 30° and up to 85° to the horizontal.

C3.3.3.8.1.1.10 SD8.1.1.10 Removal of soffit formwork

Soffit formwork to top slabs of reservoirs, pump stations, valve chambers, manholes sumps etc can either be removed through the manhole cover opening or the Contractor may use permanent formwork at his own cost.

C3.3.3.8.1.2 SD8.1.2 Reinforcement

C3.3.3.8.1.2.1 SD8.1.2.1 Steel for Normal Reinforced Concrete

Steel for normal reinforced concrete will be measured net by mass of all bars, including supporting steel detailed on the reinforcement bending schedules. The mass will be computed from the nominal bar size and the nominal mass per unit length. No allowance will be made for cutting, waste, spacer devices (materials other than steel bars), or binding wire.

Separate items will be scheduled for:

a) Mild steel bars of different sizes, which may be grouped.

b) High tensile steel bars of different sizes, which may be grouped.

c) Each steel section where rails or other steel sections are used; and

d) Steel to be fixed in different parts of the Works if this could materially influence the pricing of the work.

Steel reinforcement for precast concrete units will not be measured unless so scheduled. (See SD 8.6).

Welded mesh will be measured by area shown on the Drawings, no allowance being made for cutting, waste, laps, or deduction for end cover. The areas measured will be those of the concrete floor or slab reinforced by means of mesh. In the case of continuous units partly reinforced by mesh, the area will be computed from the outside dimensions of the area covered by mesh regardless of whether additional reinforcing steel is present in the same area.

Steel off-cuts resulting from the cutting and bending of reinforcement in accordance with the bending schedule shall be deemed to be the property of the Contractor.

C3.3.3.8.1.2.2 SD8.1.2.2 The Total Mass

The total mass of all mild and high tensile steel bars of different sizes will be scheduled.

Welded mesh will be scheduled separately for each type and mass per square metre of mesh.

C3.3.3.8.1.2.3 SD8.1.2.3 The Unit Rates

a) The unit rates for steel bars shall cover the cost of supply, cutting, bending, placing in position, and fixing of the reinforcing and supporting steel scheduled, and the provision of all spacer devices and binding wire, as well as the cost of tests in terms of SANS 920.

b) The unit rate for welded mesh shall cover the supply, cutting, and placing of mesh, and the cost of all waste due to laps.

C3.3.3.8.1.3 SD8.1.3 Concrete

C3.3.3.8.1.3.1 SD8.1.3.1 Measurement

a) Concrete will be measured net to the dimensions shown on the Drawings or to the dimensions cast, whichever are the smaller. However, structural elements that are undersized will be measured for payment only if they are accepted by the Engineer.

b) No allowance will be made for concrete required to make up overbreak in soft excavation, but payment will be made for additional concrete or formwork, ordered in writing by the Engineer to replace unsuitable material or overbreak in hard rock or in intermediate excavation (see (d) below).

c) Sub-foundation carpets and blinding layers will be measured to the plan size of the concrete structure resting on the carpet. Where the concrete is scheduled by volume it will be measured on the mean thickness as cast, provided that the Engineer is satisfied that the excavation has not at any point been taken deeper or wider than necessary (see (b) above).

d) Where concrete is placed directly against the sides or bottoms of excavations in hard rock or in intermediate excavation, an item may be included in the schedule of quantities for any additional concrete placed in overbreak. Such additional concrete will be measured on the basis of the superficial area of the sides or bottom, or both, as applicable, of the theoretical net excavation in rock that is overbroken and in contact with the concrete.

C3.3.3.8.1.3.2 SD8.1.3.2 Separate Items

Separate items will be scheduled, as applicable, for each type and each grade of concrete, for each type of cement and each type of aggregate, and for each unit of the Works or each element of a structure, where these could materially influence the pricing of the work and where the cost of placing concrete is affected by its position in the Works or by the conditions of placing, such as:

a) Slabs that are sloping, conical, or horizontal, and those of different thicknesses;

b) Concrete placed under water or between tides, the levels of demarcation being stated;

c) Small quantities each less than 0.5 m3 of formed concrete; and

d) Different surface finishes (other than striking-off and levelling) such as wood- floated or steel-floated finishes and granolithic or mortar screeds.

C3.3.3.8.1.3.3 SD8.1.3.3 The Unit Rates

a) The unit rates shall cover the cost of the design of the mix in the case of strength concrete, the provision of concrete, mixing, placing, compacting, unforeseen construction joints, striking-off or levelling as applicable, and curing and repairing of defects where necessary.

The unit rates shall also cover the cost of the following:

i) The design of concrete mixes by an approved laboratory, preparation of trial mixes and submission to the Engineer for approval. (see SD4.7.1.1 and SD 4.7.1.2).

ii) All costs associated with the use of a cement extender if specified, including:

- Supply, storage, handling on site and mixing in of the extender.
- Increased concrete mixing time as per SD4.7.8.1.
- Increased times before formwork may be removed as per Table 2.
- Increased curing times as per Table 8.

iii) All costs associated with the use of special aggregates (e.g. Dolomitic)

iv) Temperature control for sections thicker than 900 mm as per SD4.7.14.1.

v) Non-designated joints (see SD3.1.4).

vi) Screeded finish to unformed surfaces as specified in SD4.7.15.3 and Sub-clause 4.7.15.1 (a).

vii) All required tests (except the watertightness test).
viii) All other requirements of SANS 2001, Part CC1 and these Specification Data clauses were no payment items are provided in the Bill of Quantities.

b) Floor slabs, where placed on sub-foundation carpets or directly on the prepared ground surface, will be measured to the net thickness dimensioned on the Drawings.

c) Concrete in a column supporting a reinforced concrete beam or slab structure will be measured between the top surface of the foundation, beam, or slab on which the foot of the column is standing, and the underside of the beam or slab supported by the column.

d) No deduction or addition will be made for nosings, bolt holes, chamfers or splays of size up to 50mm x 50mm, grooves or chases not exceeding 0.015m3 each in volume, or holding-down bolts, rails, steel sections, and reinforcement cast in the concrete.

C3.3.3.8.2 SD8.2 SCHEDULED FORMWORK ITEMS

C3.3.3.8.2.1 SD8.2.1 Rough……Unit: square metre (m²)

The surfaces to be so formed will be identified in the Bill of Quantities.

C3.3.3.8.2.2 SD8.2.2 Smooth……..Unit: square metre (m²)

The surfaces to be so formed will be identified in the Bill of Quantities.

C3.3.3.8.2.3 SD8.2.3 Special smooth, repaired and rubbed……Unit: square metre (m²)

The surfaces to be so formed will be identified in the Bill of Quantities.

C3.3.3.8.2.4 SD8.2.4 Special off-form……..……..……Unit: square metre (m²)

The surfaces to be so formed will be identified in the Bill of Quantities.

C3.3.3.8.2.5 SD8.2.5 Narrow widths (up to mm wide)……..Unit: square metre (m²)

The constant width, if in excess of 300 mm, or the range of widths if up to 300 mm, or width and depth in the case of grooves or chases, or the width in the case of fillets or chamfers over 50 mm wide, will be stated in the Bill of Quantities.

C3.3.3.8.2.6 SD8.2.6 Box-out holes/ Form voids……Unit: square metre (m²)

Items will be scheduled as set out below:

a) Small, circular, of diameter up to and including 0.35 m

Over	**and**	**Up to and including**	
0.0 m deep		0.5 m deep	Unit: No.
0.5 m		1.0 m deep	Unit: No.
1.0 m		1.5 m deep	Unit: No.
1.5 m		2.0 m deep	Unit: No.
2.0 m		- deep	Unit: No.

b) Small, other than circular, areas up to and including 0.1m² Unit: No.
Depths as in a) above

c) Large, circular, of diameter over 0.35 m up to and including 0.7m Unit: No.
Depths as in a) above

d) Large, other than circular, areas over 5 m² and up to and including 15m² Unit: No.
Depths as in a) above

C3.3.3.8.3 SD8.3 SCHEDULED REINFORCEMENT ITEMS

C3.3.3.8.3.1 SD8.3.1 Steel bars……..……..Unit: t

The type of steel bar (mild, high-tensile, or other) will be stated and different sizes will be given. These may be grouped.

C3.3.3.8.3.2 SD8.3.2 High-tensile welded mesh……..……Unit: m²

The type reference will be stated.

C3.3.3.8.3.3 SD8.3.3 Rails or other steel sections used as reinforcement……Unit: t

C3.3.3.8.4 SD8.4 SCHEDULED CONCRETE ITEMS

C3.3.3.8.4.1 SD8.4.1 Prescribed mix concrete……..Unit: m³

The proportions and the positions or elements in the Works will be stated.

C3.3.3.8.4.2 SD8.4.2 Blinding layer in concrete……..Unit: m³

Either of the following will be stated:

a) Minimum thickness and proportions or grade ……..……..Unit: m^2

b) Proportions or grade ……..Unit: m^3

C3.3.3.8.4.3 SD8.4.3 Strength concrete, grade…….Unit: m^3

The characteristic strength followed by the size of stone and positions or elements in the Works will be stated. Where a cement extender is specified, the type and proportion of the extender will be indicated. Where a special aggregate (e.g. Dolomitic) is specified this will be stated.

C3.3.3.8.4.4 SD8.4.4 Unformed surface finishes

C3.3.3.8.4.4.1 SD8.4.4.1 Unformed surface finishes …….Unit: m^2

Where better than a "screeded finish" (SD4.7.15.3) is required, items will be scheduled for each class or type of finish, i.e.:

a) Wood-floated finish

b) Steel-floated finish

c) Power-floated finish, or

d) Other special finish

The rate shall cover the cost of providing the specified surface finish.

C3.3.3.8.4.4.2 SD8.4.4.2 Extra over for finishing to special accuracy……Unit: m^2

This item is extra over sub-item (b), (c) or (d) which will be stated.

The quoted rate shall include full compensation for the additional cost of finishing the stated area to closer tolerances than per Table 11 where specified e.g. SD 6.5.2 Settling tank walls and SD6.5.3 Flume structures.

C3.3.3.8.4.5 SD8.4.5 Aggregate (where measured separately)…….Unit: m^3

The rate shall cover the cost of supplying at the point of use and using the aggregate in the manner specified.

C3.3.3.8.4.6 SD8.4.6 Cement (where measured separately)…….Unit: t

The rate shall cover the cost of supplying at the point of use and using the cement in the manner specified.

C3.3.3.8.4.7 SD8.4.7 No fines concrete layer with mortar skim……Unit: m^2

The thickness of the no-fines layer and mortar skim will be stated.

The rate shall cover all costs to construct the no-fines layer to the required thickness and where specified, providing a mortar skim. The rate shall also cover the cost of power or steel floating the mortar skim to the required accuracy as well as curing

C3.3.3.8.4.8 SD8.4.8 Screeds……Unit: m^2

The type of screed and thickness will be stated. The name of any special bonding agent will also be stated.

This item includes all concrete screeds including grano screeds and screeds to settling tanks as scheduled in the Bill of Quantities.

The rate shall cover all costs to construct the specified screed to the required thickness and accuracy. The rate shall also cover the cost of providing a construction joint surface to the concrete below in accordance with SD4.7.12.1(b), applying a bonding agent and primer where specified, floating the surface of the screed, curing and all other specified requirements.

C3.3.3.8.4.9 SD8.4.9 Bond breaker below floor……Unit: m^2

The bond breaker between the blinding/ no-fines layer and the underside of the floor slab will be measured as the total area of the floor.

The rate shall cover the cost of the supply of all materials and labour for the application of the bond breaker in accordance with SD4.2.11.2.

C3.3.3.8.4.10 SD8.4.10 Casting pipes and specials in concrete……..Unit: m or No

The size (NB) of each pipe or special and the thickness of the concrete wall or floor through which it passes will be stated.

The rate shall cover all costs of fixing the item in position and casting it in in accordance with SD4.6.3.1, regardless of whether the Contractor chooses to fix the item into the formwork and cast it in or to box-out an opening and cast the item in later.

The pipe or special is measured elsewhere.

C3.3.3.8.4.11 SD8.4.11 Miscellaneous work……...Unit: As scheduled

Separate items will be scheduled for each type of miscellaneous work.

The tendered rates shall include full compensation for providing all labour, materials and equipment required to carry out the work, for all preparatory work, for constructing the work scheduled in a workmanlike manner and for finishing off and cleaning up when the work has been completed.

C3.3.3.8.5 SD8.5 DESIGNATED JOINTS ……..Unit: m

Only designated joints (SD3.1.4) as shown on the drawings or approved by the Engineer will be measured for payment. Non-designated joints will not be measured or paid for.

Separate items will be scheduled for different types of designated joints as shown on the drawings. These will include different types, sizes, and qualities of waterstops, bandage seals, sealants, joint fillers etc.

The unit rate shall cover the cost of all materials, labour and plant required to construct each type of joint as specified on the Drawings, including the cost of all formwork, preparation of construction joint surfaces as specified in SD4.7.12.1(b), the provision and installation of waterstops (including all joints), bandage sealing systems (including all joints), swellable sealing strips, bearings, sealants, fillers at expansion joints and sliding joints, bond breakers at contraction joints, recesses for sealants, chamfers or recesses as specified where concrete is exposed, as well as testing and repairing where necessary.

For designated joints in very thick members, it may be decided to measure the joint by area (m3).

In this case, the various components of the joint (waterstops etc) will be measured separately by length (m) as appropriate.

C3.3.3.8.6 SD8.6 MANUFACTURE (OR SUPPLY) AND ERECT PRECAST CONCRETE UNITS

Measurement will be any of the following:…….Unit: (No, m, m^2 or m^3)

1) The total number of units

2) The total length of units

3) The total surface area of units

4) The total volume of units

Separate items will be scheduled for:

a) Different qualities of concrete

b) Different types and sizes of units

c) Small units not exceeding 0.5m3 of formed concrete

d) Different positions of units for erection purposes

Except where separate items are scheduled for specific operations or materials, the rates shall cover all the costs of manufacture (or supply) and erection of the precast concrete units complete, in accordance with all the requirements of this Standard and Specification Data, including concrete and reinforcement and all materials, equipment and labour. The rates shall also include the cost of moulds for forming the units, special finishes, curing, transportation, handling, assembly, erecting, aligning, temporary support work, building in or fixing the units in their final position including grouting or other bedding and jointing materials, fixing dowels, and built-in metalwork and components including service ducts where applicable.

C3.3.3.8.7 SD8.7 GROUTING

a) Under bases (or beds)…….Unit: m^3
Grouting under structural steel column bases or members or under pumps, motors, or other machinery will be measured by the volume of grout (before the edges are trimmed at 45º from the bottom edges of bedplates) necessary to fill the voids and pockets between the underside of the metalwork and the top of the concrete. No deduction will be made for bolts, packers, and baseplate shear keys protruding into the grout space.

b) HD bolts, etc. (see SD8.8)……...Unit: m^3

Separate items will be scheduled for HD bolts or pockets, as applicable, of different diameters, lengths, and types, and for bearings and miscellaneous metal work of different types. The quantity will be measured by the volume of grout necessary to fill the voids in the concrete. No deduction will be made for bolts and packers protruding into the grout space.

The rates for a) and b) above shall cover the cost of scabbling, cleaning, and preparing the concrete surfaces, providing an approved proprietary grout, placing and ramming it solidly into all voids and pockets, and mitring the outside edges to a true wood-floated surface and all costs of grouting in accordance with Sub-clause 4.7.18, including the provision of formwork, if required.

C3.3.3.8.8 SD8.8 HD BOLTS AND MISCELLANEOUS METAL WORK…….Unit: t

Whether the item is to be supplied by the Contractor or by others will be stated. Separate items will be scheduled as specified in SD8.7 (b).

The rate shall cover the cost of supplying and delivering or taking delivery (as applicable), fixing or casting into concrete, and all cleaning, preparation, and finishing.

The cost of installing fixings for items such as handrailing, ladders and similar, shall be included in the unit rate or sum tendered for the item to be fixed.

C3.3.3.8.9 SD8.9 COLOUR MITIGATION…….Unit: m^2

Measurement shall be on the plane projection along the exposed planes of the area being coloured.

The rate shall cover full compensation for all labour, materials, operation of equipment, tools, supplies and incidentals necessary to complete the work specified or as directed by the Engineer.

C3.3.3.8.10 SD8.10 TEST FOR WATER TIGHTNESS…….Unit: Sum

Each water retaining structure will be stated.

The unit of measurement shall be the number of each structure successfully passing the specified watertightness tests to the satisfaction of the Engineer.

The sum shall cover all costs of testing each structure as specified, including for all water required for filling and for emptying the structure of water on completion of the test, including where the structure cannot be drained, and for measuring devices and all necessary equipment. The sum shall also include for testing of the roof of each water retaining structures as specified.

C3.3.3.8.11 SD8.11 CLEANING AND STERILISING……...Unit: Sum

Payment for the cleaning and sterilising of the reservoir will be by the sum which shall cover the cost of all labour, equipment and materials, including any water required, in cleaning and sterilising as specified in SD5.1.7.

C3.3.3.8.12 SD8.12 CAST IN OF PIPES WITH OR WITHOUT PUDDLE FLANGES ……Unit: No

All pipes cast into concrete will be with a puddle flange, or as indicated on the drawing. The rate to supply and install all special pipe fittings are as per Section L: Water Mains of the Bill of Quantities which will include all costs associated with the installation of the pipe into the concrete wall as a cast in item, including labour, formwork, grout, bentonite strips etc.

The tendered rates shall include full compensation for installing the pipe where new pipes are used (with or without a puddle flange) in the exact position as shown on the drawings, for splitting or cutting the formwork where required, for ensuring water tightness where required and for all additional costs required to install the pipes specified or shown on the drawings.

New pipes shall be measured under the items of the relevant section of the specifications.

C3.3.3.8.13 SD8.13 CAST IN OF PIPES WITH OR WITHOUT PUDDLE FLANGES……Unit: as scheduled

Separate items will be scheduled for each type of miscellaneous work.

The tendered rates shall include full compensation for providing all labour, materials and equipment required to carry out the work, for all preparatory work, for constructing the work scheduled in a workmanlike manner and for finishing off and cleaning up when the work has been completed.

C3.3.3.9 SD9 MEASUREMENT AND PAYMENT FOR PRE-STRESSED CONCRETE

C3.3.3.9.1 SD9.1 CIRCULAR PRE-STRESSED CONCRETE RESERVOIRS AND TANKS

C3.3.3.9.1.1 SD9.1.1 Scheduled Items

Pre-stressing work to circular pre-stressed concrete reservoirs and tanks will be measured and paid for only under Items SD9.1.2, SD9.1.3 and SD9.1.4.

C3.3.3.9.1.2 SD9.1.2 Supply and install sheathing and tendons (Including grouting the sheaths) .....Unit: MN.m

The unit, meganewton-metre, will be calculated as the product of the characteristic strength of the pre-stressing steel in megapascals, the cross-sectional area of the tendon in square metres and the length of the tendon in metres between the faces of the anchorages. In the case of fan and loop anchorages, the length of tendon will include the length of tendon forming the loop or fan.

The rate shall cover the cost of supplying sheathing, complete with threaded inlets and with vents, supporting the sheathing, supplying and making up tendons (including the cost of spacers and waste) and threading the tendons through the sheaths as well as:

a) Royalties (if any).

b) Site supervision and labour.

c) Plant and materials.

The rate shall also cover the costs of the preparation of calculations, drawings and records and furnishing information, the provision and installation of tendon carriers, the flushing out and grouting of the sheaths and all work and incidentals required for completing the work as specified.

C3.3.3.9.1.3 SD9.1.3 Supply and install anchorages and couplers (including stressing the tendons).....Unit: MN

The unit, meganewton, will be calculated as the product of the characteristic strength of the pre-stressing steel in megapascals and the cross-sectional area of the effectively anchored tendon in square metres.

The rate shall cover the cost of fabricating, supplying, storing, handling, protecting, forming a recess for the anchorage and, where relevant for any couplers, installing and fixing the complete anchorage assembly (including, where relevant any couplers) to formwork, together with the cost of the reinforcement design for the whole anchorage zone and the cost of spiral bursting reinforcement. The rate for loop or fan anchorages shall exclude the cost of the length of tendon forming the loop or fan.

The rate shall also cover the cost of:

a) Pre-stressing the unit by tensioning the tendons in a specified sequence.

b) Anchoring off and coupling where relevant.

c) Trimming of tendon ends.

The rate shall also cover the cost of the provision and installation of reinforcement to anchor head recesses, as well as making good the anchorage recesses and all work and incidentals required for completing the work as specified.

C3.3.3.9.1.4 SD9.1.4 Friction tests.....Unit (No)

Friction tests will be measured by the number of tendons tested. The rate shall cover all costs of the friction tests specified in SD4.9.6.5.

C3.3.4 ELECTRICAL

E100 PARTICULAR ELECTRICAL SPECIFICATION

E100.1 SCOPE OF WORKS
E100.2 SITE INFORMATION
E100.3 INCOMING ELECTRICAL SUPPLY
E100.4 ELECTRICAL INSTALLATION
E100.5 ELECTRONIC INSTALLATION
E100.6 EARTHING AND BONDING
E100.7 CONTRACTUAL MATTERS
E100.8 PRECEDENCE OF DOCUMENTATION
E100.9 TENDER DOCUMENTATION
E100.10 GENERAL

E200 STANDARD ELECTRICAL LOW VOLTAGE SPECIFICATION

E200.1 GENERAL DESIGN
E200.2 TESTING AND COMMISSIONING
E200.3 LOW VOLTAGE CABLES
E200.4 LOW VOLTAGE SWITCHGEAR AND CONTROL GEAR ASSEMBLIES
E200.5 CABLE SUPPORT SYSTEMS
E200.6 WIRING AND OUTLETS
E200.7 LIGHTINING
E200.8 STREET AND AREA LIGTHNING

C3.3.4.1 E100 PARTICULAR ELECTRICAL SPECIFICATION

C3.3.4.1.1 E100.1 SCOPE OF WORK

This contract makes provision for the following:

a) The Electrical Installation:

- New 80A 400V Low Voltage Connection to the Municipality.
- Lighting installation in accordance with the electrical lighting layout drawing.
- External lighting installation.
- Power installation, comprising of socket outlets and isolators.
- Containment, consisting of galvanised conduit, cable trays and cable ladders.
- New distribution board.
- Low voltage cable reticulation.
- Manholes and Sleeves (if required)
- Labelling
- Site Supervision
- Testing and commissioning
- Coordination with other sub-contractors
- Issue CoC's
- Earthing and Bonding

C3.3.4.1.2 E100.2 SITE INFORMATION

C3.3.4.1.2.1 E100.2.1 SITE LOCATION

The Halfway House Water Upgrade Project is located in the industrial suburb of Halfway House. The feeder portion of the bulk water pipeline starts at an existing water meter chamber located at the intersection of Dale Road and K101 Old Pretoria Main Road, runs parallel to the K101 Main Road, and terminates at the location of a new 25ML Halfway House Reservoir on Erf 520 at Halfway House Extension 65 (Midrand), between Pretoria Main (R101) Road and Morkels Close.

The supply portion of the bulk water pipeline starts at the location of the new 25ML Hlafway House Reservoir and terminates at the connection point to an existing 800mm diameter steel pipeline. This connection point is located at the intersection of K101 Old Pretoria Main Road and Bridal Veil Road. The bulk water steel supply pipeline then continues from the connection point to the end of the existing 800mm diameter steel pipeline and terminates at a point located at the intersection of Allandale Road and Harry Gaulaun Drive.

The purpose of this specification is to detail the electrical installation on the bulk supply portion of the pipe at the point that it crosses the N1 as a tunnel crossing.

Figure 1: Locality Plan

C3.3.4.1.2.2 E100.2.2 SITE CONDITIONS

The equipment offered as part of the tender shall be suitable for continuous operations under the local conditions with regards to electricity supply, ambient conditions, altitude and pollution.

Altitude	As per stated location
Average Minimum Temperature	16º
Average Maximum Temperature	28º
Relative humidity	28%

C3.3.4.1.3 E100.3 INCOMING ELECTRICAL SUPPLY

C3.3.4.1.3.1 E100.3.1 SUPPLY AUTHORITY

The local supply authority for this project is Eskom.

C3.3.4.1.3.2 E100.3.2 POINT OF SUPPLY

At the time of writing this specification, the exact point of grid tie into the Eskom Electrical Network had not been established. However, there is a medium voltage electrical network in the vicinity of the area. An application will be lodged with Eskom, thereafter which the exact point of tie into the grid will be established.

The contractor shall be responsible for the 400V supply cables from the minisubstation to supply the proposed low voltage kiosk on the premises as indicated on the site layout drawings.

C3.3.4.1.3.3 E100.3.3 NORMAL VOLTAGE

a) The nominal LV voltage will be as per SANS requirements

b) Three phase voltage (phase to phase): 400V AC

c) Current 80A

d) Frequency: 50Hz

e) Fault Level: 10kA at M/Sub

f) Voltage Regulation: ± 5%

C3.3.4.1.4 E100.4 ELECTRICAL INSTALLATION

The electrical installation will be done in accordance with SANS 10142: The wiring of premises Part 1: low voltage installations. All work shall be scheduled in liaison with the main contractor to suit his master program. This section shall be read in conjunction with the Standard Specification for Low Voltage Equipment and Installations, issued as part of this tender.

The contractor shall test and commission the electrical installation and issue Certificate of Compliance.

The latest 'Certificate of Compliance (COC)' and 'Occupational Health and Safety Act (OHS Act)' regulations should be taken into account and implemented on this project.

Financial provisions for specified contingencies have been allowed for as Provisional Sums or Prime Cost in the tender price schedule. The engineer retains the right to fully, partially, (or not at all) expand some or all of the provisional sum. In any event the sub-contractor mark-up shall remain a fixed percentage of the final expenditure, such percentage being offered by the sub-contractor in the bill of quantities.

This tender makes provision for the complete supply and installation of electrical services for the following:

a) Mains Supply Connection

Eskom to provide mains point of supply for the proposed development. The mains supply will consist of an 80A 400V Supply. The mains supply cable will be a 25mm² x 4C Cu Cable + 16mm² BCEW, from the minisub to the Main Distribution Board. It is estimated that the cable length shal not exceed 200m.

b) Distribution Board installation

The main distribution board will be installed as per the location indicated on the drawings.

c) Switched Socket outlets – IP65

The switched socket outlets shall be weatherproof and protected by an earth leakage unit.

d) Isolators for Mechanical Equipment – IP65

Isolators shall be IP65 rated and installed at heights as indicated on the drawings.

e) Interior lighting

All lighting shall be of LED technology, low glare and colour temperature 4000K.

f) Area lighting

External lighting will be required at the entrance and exits of the tunnel for security. The lighting will be protected from vandalism.

g) Sleeves and Manholes

Sleeves and manholes will form a part of the external reticulation to get power to the site.

The electrical installation will be in accordance with the following tender drawings In Annexure 1:

- 111242-0000-DRG-EL-4000 Electrical Legend Sheet
- 111242-0000-DRG-EL-4102 Electrical – Distribution Board
- 111242-0000-DRG-EL-4200 Small Power and Lighting Installation

C3.3.4.1.5 E100.5 ELECRONIC INSTALLATION

C3.3.4.1.5.1 E100.5.1 GENERAL

The scope of the contract includes the design, configuration, supply, installation, commissioning, 12-month maintenance and other work to deliver complete integrated systems. The persons performing the work shall be competent and suitably trained.

The scope includes the following:

- CCTV – Client Based Remote Monitoring System
- Manuals, training, maintenance, user support, etc.

There are other contractors on site that will provide supporting infrastructure for the security systems. Other contractors will provide the following:

- Electrical supply points
- Main cable routes such as conduits, ducts, manholes, cable trays, etc

C3.3.4.1.5.2 E100.5.2 STANDARD, SPECIFICATIONS, CODE AND REGULATIONS

The latest edition, including all amendments up to date of tender of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

- Occupational Health and Safety Act (Act 85, 1993)
- SANS 10142: The wiring of premises
- National Building Regulations Act No 103 of 1977 (SANS 10400)
- Occupational Health and Safety Act (Act 85, 1993)
- Local municipal by-laws and regulations
- Local fire regulations
- SANS 10222 Electrical security installations- all applicable sections
- SANS 11801 Information technology – Generic cabling for customer premises
- Fire Detection
  SANS 10139: Fire detection and alarm systems for buildings
- Public Address Voice Evacuation
  SANS 7240-series: Fire detection and alarm systems – Sound system control and indicating Equipment
- Information Communication Technology infrastructure
  SANS 10340-1: Installation of telecommunication cables part 1: Fibre optic cable in buildings.
  Telecommunication regulations

C3.3.4.1.5.3 E100.5.3 SUBMISSIONS

a) Operations and maintenance manuals

Provide all operational and maintenance documentation necessary to operate and maintain the equipment and systems installed. Manuals shall be in electronic format and in printed format and contain at least the following:

- As-installed drawings
- Schematic diagrams
- Cable schedules and routes
- Equipment details such as name, serial number, model number, manufacturer, supplier contact details, technical specifications, etc.
- Guarantee and warrantee start and end dates
- Operating procedures
- Configurations
- Software licenses
- Design information

b) Products and material

General: Submit samples and data showing dimensions and space requirements for the following if applicable:

- Manual call points
- Fire Detection Panel
- Smoke detectors
- Siren/ strobes

c) Shop drawings

Before commencing work submit shop drawings showing at least the following:

- Schematic diagram of all systems.
- Panel layouts and dimensions.
- Power supply requirements.
- Wiring access necessary for door frames.
- Cut-out dimensions.
- Fixing provisions for readers, intercoms, cameras, monitors, etc.

- Cable route requirements.

C3.3.4.1.5.4 E100.5.4 MAINTENANCE AND SUPPORT

The contractor needs to provide comprehensive maintenance, training and user support after hand over of the systems for a period of 12 months.

At least the following shall be included, and a complete written record shall be kept of all activities:

Attend to Breakdown call outs on site within 24 hours of notification. Rectify faults and replace faulty materials and equipment.

Do regular routine site visits every 2 months. These visits shall include:

- user training
- user support
- confirmation that all systems perform as expected
- resolve technical issues
- configure systems according to user requirements
- confirm siting or aiming of devices.

C3.3.4.1.5.5 E100.5.5 CCTV

An IP-based PoE (Power over Ethernet) High Definition-HD, Full High Definition-FHD and Megapixel video surveillance cameras will be provided to ensure continuous visual monitoring and surveillance. Cameras shall be installed at the entrance and exit locations of the tunnel. The CCTV shall be design for remote monitoring purposes by the client.

The video surveillance shall include following components:

- Security Fixed & PTZ Cameras, enclosures and mounting poles.
- Video Management System, Video Analytics, Video recording and Video monitoring.

- Cameras

Cameras shall be suitable for the application but shall at least comply with the following requirements:

- Cameras shall be PoE.
- Cameras shall be enclosed in an enclosure (type as indicated on the drawings) so that it will not be possible for a person to bump the camera thereby changing its viewing direction.
- Cameras shall at least have 1080p HD resolution.
- Cameras shall have wide dynamic range suitable for the application e.g. cameras located in contrasting light conditions shall have very a high dynamic range so that images in the dark and light areas are of high quality.
- Cameras shall be able to provide high quality colour images at light levels below 1 lux.

- Cameras mounted outdoors in low light areas shall have built-in infrared illuminators.

- Video recorders

Video recorders shall be suitable for the systems and shall at least comply with the following:

- All cameras shall be continuously recorded at full resolution and full speed.
- Storage media shall be hot swappable RAID 5 or better.

- The storage capacity shall be stored for at least 30 days.

C3.3.4.1.6 E100.6 EARTHING AND BONDING

The site earthing design shall be done in accordance with the following standards:

- SANS 10313: The protection of structures against lightning, in conjunction with-
- SANS 62305: Protection against lightning
- SANS 10199: The design and installation of earth rods
- SANS 1063: Earth rods, couplers and connectors

It will be the responsibility of tenderers to familiarise themselves regarding soil conditions on site. If the tenderers design is soil resistive dependent, then a soil resistivity test shall be carried out during the tender period, to ensure an accurate tender offer. No additional cost in this regard will be entertained.

The designs shall be submitted to the engineer for approval, prior to commencement of the installation.

Before the commencement of any excavations, ground drilling, driving earth-rod electrodes into the ground, the contractor shall obtain information from the principal contractor, as well as any related sub-contractors, regarding the position of any underground installed services.

The earthing and equipotential bonding arrangements shall be applied to all conductive metallic parts in the tunnel, this includes cable trays, ladders and other metallic containment.

Earth bars shall be manufactured from high conductivity copper (tinned for WWTW applications);

a) be located in a safe and easily accessible position;

b) have a minimum number of joints;

c) have at least one disconnecting link;

d) have facilities for connection to the main incoming earth terminal (the Supply Company earthing system and / or from a local earth electrode system) at each end of the bar, and

e) be rated and tested at a minimum of 60% of the busbar fault withstand capacity

f) have a cross-sectional area of not be less than 500 mm2, nor less than 50 mm in width.

g) be securely connected in each panel or cubicle to bare metal

Provision shall be made for the connection for the following connections to the fixed portion of the earth bar:

h) electrical installation main bonding conductors

i) functional earthing conductors

j) equipotential bonding conductors

k) other equipment protective conductors

l) an additional 2 No. spare terminations

All metallic non-current carrying parts of the Assembly shall be bonded together and connected to the Assembly earth busbar.

Over and above the requirements of SANS 10142-1, all cable tray and ladder systems that will support telecommunication and / or control wiring shall be bonded in accordance with NRS 083-2 (gives details of bonding methods that provide enhanced protection against the effects of electromagnetic cross-interference).

C3.3.4.1.7 E100.7 CONTRACTUAL MATTERS

Contractors shall adhere to all requirements of this tender documents. Partial, incomplete, and non-compliant tender offers may render the tender invalid.

C3.3.4.1.7.1 E100.7.1 TENDER CONDITIONS

For dates, preliminaries, and notes to tenderers, refer to notes for tender for Principal Contractor.

C3.3.4.1.7.2 E100.7.2 CONDITIONS OF CONTRACT

For Principal Building Agreement and other contract information refer to condition of contract for Principal Contractor.

C3.3.4.1.8 E100.8 PRECEDENCE OF DOCUMENTATION

C3.3.4.1.8.1 E100.8.1 THE PRECEDENCE OF THE DOCUMENTATION SHALL BE AS FOLLOWS:

a) Detail Specification

b) Drawings, in conjunction with this Detail Specification

c) Bills of Quantity

d) Standard Specification

C3.3.4.1.9 E100.9 TENDER DOCUMENTATION

This tender comprises of the following documents. The onus is on tenderers to ensure that they are in possession of all documents, listed in this section. The tenderer shall follow up with the issuing party, in the case where documents are missing, have not been received, or the electronic version thereof is corrupted.

C3.3.4.1.9.1 E100.9.1 SPECIFICATIONS

C3.3.4.1.9.1.1 E100.9.1.1 Standard Specification for Low Voltage Equipment and Installation

C3.3.4.1.9.1.2 E100.9.1.2 Particular Specification

C3.3.4.1.9.2 E100.9.2 BILLS OF QUANTITY

C3.3.4.1.9.1.2 E100.9.2.1 The following Bill of Quantity are included in this tender

a) Front Page
b) Bill 1- Electrical Application
c) Bill 2 – Preliminary and General
d) Bill 4 – Distribution Boards
e) Bill 5 – Low Voltage Cables
f) Bill 6 – Cable Routing and Wireways
g) Bill 7 – Small Power and Lighting
h) Bill 8 – Earthing and Bonding
i) Bill 9 – CCTV
j) Summary

C3.3.4.1.9.3 E100.9.3 ANNEXURES

C3.3.4.1.9.3.1 E100.9.3.1 Annexure 1: Drawings & Drawing Register

C3.3.4.1.9.3.2 E100.9.3.2 Annexure 2: Bill of Quantiles

C3.3.4.1.10 E100.10 GENERAL

C3.3.4.1.10.1 E100.10.1 WAYLEAVES

a) Application for servitude and approvals of wayleaves are required under this contract.

C3.3.4.1.10.2 E100.10.2 MATERIALS SUPPLIED BY OTHERS

b) No free-issue material will be supplied under this contract. The tender offer shall include all material and labour for a complete working installation.

C3.3.4.1.10.3 E100.10.3 ELECTRICAL INSTALLATION FOR CONSTRUCTION PURPOSES

a) The supply and temporary electrical installation for construction purposes of items such as cables, DB's, lights, socket outlets, etc., does not form part of this tender. It is covered under the Preliminary and General Items of the Principal Contract. No claims in this regard will be entertained.

C3.3.4.1.10.4 E100.10.4 CO-ORDINATION OF SERVICES

a) The Contractor shall be responsible for the on-site co-ordination with the Principal Contractor and other sub-contractors. Due allowance shall be made for this liaison and on-site co-ordination in the tender price.

b) The Contractor shall during construction be responsible to obtain all information regarding other services which may be affected by new works. Prior to commencement of construction, the contractor shall issue a method statement to the Principal Agent for approval, regarding the safeguarding of any services and works which may be encountered during construction. The cost of precautionary measures, which may be necessary to

ensure the safety of such services and existing works, as well as the protection of all persons, shall be borne by the Contractor. Any alteration required to other services, shall be carried out by the Authority concerned at the expense of the Contractor. The Contractor shall be held responsible for any damage, injury or accident caused due to the failure of taking precautionary measures.

c) The Contractor shall take all the necessary precautions to protect existing services, finishes and structures during the execution of the Contract, and shall be fully responsible for all repairs and damages thereto. The costs for any repairs of damages shall be recovered from the Contractor.

d) The Contractor shall also exercise extreme care when excavations are made, to avoid damage to existing or newly installed services. Any damages to other services shall be rectified forthwith and the costs for the rectification will therefore be recovered from the Contractor.

C3.3.4.1.10.5 E100.10.5 ON-SITE PERSONNEL

a) The electrical sub-contractor shall appoint a person in writing, to act as the Responsible Person on the site. A copy of this appointment shall be forwarded to the Engineer.

b) The Responsible Person shall be on site full time and shall be a Registered Person with the Department of Labour as an Installation Electrician with at least 10 (ten) years' experience in projects of this nature.

c) The Responsible Person must be authorised and competent to receive instructions on behalf of the Contractor.

d) All work shall be executed and supervised by suitably qualified staff. Only "ACCREDITED PERSONS" shall be permitted to carry out and supervise work.

e) The Contractor shall always have adequate number of workers available during the construction period ensuring no delay to the construction programme.

C3.3.4.1.10.6 E100.10.6 QUALITY MANAGEMENT

a) The neatness and correctness of the electrical installation will be monitored by the electrical engineer, during the construction phase. The engineer will carry out quality inspections during regular site visits in this regard. Snag lists will be compiled upon completion of the project and issued to the contractor for corrective action.

b) This does however not take away the contractor's responsibility to implement an internal quality and drawing management plan. The engineer will suspend inspections should it become evident that the contractor is not applying a quality management plan, as contractually required. A site instruction will be issued to the contractor for immediate implementation of a quality management plan. The engineer's quality inspections will be resumed, once the contractor has carried out internal quality control measures and proof of inspection sheets have been forwarded to the engineer.

C3.3.4.1.10.7 E100.10.7 QUALITY OF MATERIALS

a) All materials supplied or utilised under this shall be new and unused. Only materials of first-class quality and finish shall be utilised. All materials shall be subject to prior approval by the Engineer.

b) All materials shall comply with the relevant SANS specifications.

c) All manufacturer and brand names specified are for guideline purposes. Similar or equal and approved material may be offered on condition that the quality thereof is approved by the Engineer before procurement. Any material not found to be to the satisfaction of the Client, Architect or Engineer will be replaced by the Contractor at his cost.

d) All materials shall be unconditionally guaranteed for a period of 12 months from the date of practical completion, which is firsthand over. Where Supplier's guarantees are of a shorter duration than 12 months, the Contractor shall unreservedly agree to the extension and cession of all warranties and guarantees.

e) The Contractor shall replace any materials that are found to be defective during the 12 months defects liability period.

C3.3.4.1.10.8 E100.10.8 FINISHING AND TIDING

a) In view of the concentration of construction and other activities likely to be experienced during the Contract period, progressive and systematic finishing and tidying will form an essential part of this Contract. On no account will soil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of others. In the event of this occurring the Employer will have the right to withhold payment for as long as may be necessary in respect of the relevant Works in the area(s) concerned, without thereby prejudicing the rights of others to institute claims against the Contractor on the ground of unnecessary obstruction.

b) Finishing and tidying shall therefore not be left to the end of the Contract but shall be a continuous operation.

C3.3.4.2 E200 STANDARD ELECTRICAL LOW VOLTAGE SPECIFICATION

C3.3.4.2.1 E200.1 GENERAL DESIGN

C3.3.4.2.1.1 E200.1.1 SCOPE

This standard specification covers general design criteria and standards applicable to all sections of work. Should the requirements of this standard specification conflict with any other standard specification or the detail specification, the other standard specification or detail specification shall govern, and the Tenderer/Contractor shall seek information of such precedence from the Engineer. All items covered in this specification may not necessarily be applicable to this project.

C3.3.4.2.1.2 E200.1.2 DESIGN

a) The works shall be designed to facilitate easy accessibility, equipment replacement, maintenance, handling, inspection cleaning and repairs and to ensure satisfactory operation in which safety of plant, personnel and public and continuity of service is the first consideration.

b) All plant, equipment and apparatus shall operate satisfactory under the ambient and other conditions prevailing at the site.

c) All apparatus shall be designed to prevent the risk of accidental short circuits due to animals, birds, ants and vermin.

d) All moving, rubbing or wearing surfaces shall be machined or ground where they bear upon each other.

e) The plant and equipment shall be designed and constructed to keep maintenance costs and the number of persons employed for maintenance to a minimum.

f) All the equipment shall be to the approval of the Engineer and shall, unless otherwise specified, be suitably designed for operation on normal electrical supply systems, with voltage fluctuations of plus and minus 10% and under such sudden variations of load and voltage as may be met with under working conditions.

g) The design of equipment shall include as a major consideration the absolute safety of the general public, operating and maintenance personnel.

h) All dimensions, units and design parameters shall be in accordance with the international metric (SI) system.

C3.3.4.2.1.3 E200.1.3 STANDARDS

a) All electrical equipment shall be of approved manufacture and its construction, design and testing shall be in accordance with the requirements of the most recent South African, British Standards or IEC publications including all amendments issued thereto up to the date of tender. The installation and equipment shall also comply with the relevant clauses of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993), and the regulations promulgated in terms of the Act, and with the Code of Practice for The Wiring of Premises, SANS 10142-1.

b) Notwithstanding reference in this specification to South African or British Standards and IEC or ISO recommendations the supplier may submit for approval material and designs conforming to other technically equivalent national standards, provided that the supplier supplies the Engineer with a translation of the standards into English and satisfactory proof of actual compliance therewith.

C3.3.4.2.1.4 E200.1.4 QUALITY OF MATERIAL

All material shall be new and of a design and class suitable for working under the conditions specified, and shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion, deterioration, or the setting up of undue stresses in any part such as to affect the efficiency and reliability of the plant and also without affecting the strength and suitability of the various parts for the duty which they have to perform.

C3.3.4.2.1.5 E200.1.5 INTERCHANGEABILITY

Corresponding parts throughout the works shall be made to such close tolerances that all similar components and spares shall be fully interchangeable without any further alterations or adjustments being necessary.

C3.3.4.2.1.6 E200.1.6 BOLTS AND NUTS

a) The threads of all bolts, nuts and studs shall be in accordance with SABS 135.

b) No brass bolt or stud shall have a diameter of less than 6 mm.

c) All nuts and studs shall be locked in position by lock washers and where necessary, lock nuts.

d) Each bolt shall protrude by at least one but not more than five threads through the nut with all washers in position.

e) All bolts, nuts and washers used outdoors shall be of approved materials and treated to prevent corrosion of the threads.

f) The Contractor shall provide special tools if any bolt, nut, screw or other fastener is used in a position, which is not accessible using conventional tools. This also applies where the size or shape of the fastener is not conventional.

C3.3.4.2.1.7 E200.1.7 FIRE PRECAUTIONS

All apparatus, connections and cabling shall be designed and arranged to minimise the risk of fire and any damage, which might be caused in the event of fire.

C3.3.4.2.1.8 E200.1.8 GALVANISING

a) Where galvanising is specified, or is a requirement of the design, such galvanising shall be performed by the hot-dip process to SANS 121:2000.

b) For all parts, other than wires, the equivalent zinc coating thickness shall not be less than 455 g of zinc per square metre of surface area.

c) The galvanising must be clean, smooth, of uniform thickness, unblemished and free from defects.

d) The preparation for galvanising and the galvanising itself shall not adversely affect the mechanical properties of the coated material.

e) All drilling, welding, cutting, sawing, punching, filing and bending shall be complete and the metal shall be cleaned of any machining blemishes, mill scale, rust and lubricants, before galvanising.

f) Galvanised areas must be kept free of lubricants. Surfaces which are in contact with oil shall not be galvanised or cadmium plated.

g) Electrolytic deposition of zinc is not acceptable.

h) Where it is not practicable to coat the surface of metal by the hot-dip galvanising process, such equipment may be zinc-sprayed instead. The surface being zinc-sprayed shall be suitably prepared in accordance with the requirements of the process adopted and the rate of deposition of zinc shall not be less than 760 g per square metre of surface area. After zinc spraying the surface shall be painted with a suitable paint to render it completely impervious.

C3.3.4.2.1.9 E200.1.9 WELDING

a) All welding shall comply with the appropriate international standards such as BS 1856 (General specification) and BS 709 (methods of testing).

b) The welding shall be executed in accordance with modern accepted practice for welding and shall be sound, full strength and free from undercut and slag inclusions. Crater effects at the ends of weld runs shall be eliminated.

c) Intermittent welding and incomplete penetration butt-welding will not be accepted.

d) All fabricated items shall be stress relieved after welding.

e) The supplier shall well in advance of the commencement of fabrication, submit for approval details of proposed welding procedures.

C3.3.4.2.1.10 E200.1.10 ELECTROMAGNETIC INTERFERENCE

a) All equipment installed under this contract shall comply with the requirements of IEC 61000 Parts 1 to 6 Electromagnetic Compatibility (EMC).

b) Any equipment found producing Electromagnetic interference subsequent to commissioning, shall be suppressed or replaced to the satisfaction of the Engineer without any cost to the Employer.

C3.3.4.2.1.11 E200.1.11 LABELS AND NOTICES

a) Identification labels must be attached to all equipment, motors, control gear and all panels and the equipment contained therein.

b) All labels and plates shall be of an approved non-corrosive material and shall be fixed with stainless steel or nickel-plated screws of ISO metric thread form.

c) Labels shall have a matt or satin finish to minimise reflection.

d) Labels shall have black lettering on a white background. Danger plates shall have white lettering on a red background.

e) Cables shall be labelled at both ends, at through joints and at regular intervals.

f) Cables shall be labelled on both sides of the place where the cable passes through a permanent obstruction.

g) For outdoor applications labels shall be of aluminium, with letters filled in black, lightly sanded with fine grit paper and clear lacquered.

h) All lettering shall be in uppercase letters except where standard abbreviations of units are used, e.g. kWh, kVA, etc.

i) The wording of labels and character height shall be to the approval of the Engineer.

j) All labels shall be in English. In addition to the English text, all Warning/Danger labels shall also be in the regional indigenous language.

C3.3.4.2.1.12 E200.1.12 CLEANING AND PAINTING

a) The cleaning and painting of all exposed surfaces of all plant and accessories, unless otherwise specified or approved, shall be carried out as follows:

- Surface preparation
  All metal work shall be thoroughly cleaned by blast cleaning or pickling, to be free of all mill scale, dirt, rust, welding slag and spatter, grease and all other contaminants and to present a dry, bright metallic finish.

- Priming
  The metal work shall be primed with an approved primer which, for equipment intended for outdoor use, shall be red lead based and for indoor mounted equipment shall be phosphate based.

- Finishing
  The primed surfaces shall be finished with a minimum of two coats of approved alkyd-based enamel of which each coat shall be of a different shade.

b) Epoxy powder coating will be considered as alternative, for indoor applications, subject to the approval of the application procedure by the Engineer.

c) Top and bottom plates of chassis compartments assemblies and chassis runners may be protected against corrosion in an alternative approved manner (e.g. by passivated cadmium plating) due to the likelihood of damage to paint work on removal and replacement.

d) All painting shall be spray applied using dry oil-free air.

e) The final paint thickness shall be not less than 0,1 mm as determined by a magnetic film thickness gauge.

C3.3.4.2.1.13 E200.1.13 WATER AND DEBRIS ACCUMULATION

All outdoor equipment must be designed so that water and debris will not readily accumulate to cause deterioration of equipment or an electrical discharge hazard. Where this cannot be avoided such places shall be easily accessible for cleaning.

C3.3.4.2.1.14 E200.1.14 INSPECTION AND TESTS

a) All equipment will be inspected and tested, both in the factory during manufacturing and on site during installation. The tests required are prescribed in the standard and detail specification. The Engineer will do all inspections accompanied by the Contractor and the Contractor shall perform all tests with the Engineer as witness.

b) The Engineer will require seven (7) days notification to avail himself for any tests or inspection. The Contractor shall arrange for the maximum number of tests and inspections to be done on the same day.

c) The Contractor shall provide all testing facilities and instruments and all equipment and labour required for a test or inspection. All instruments shall be adequately scaled for the application. All testing facilities and instruments remain the property of the Contractor.

d) All instruments used shall have a valid test certificate issued by an accepted testing authority. The Engineer reserves the right to call for a calibration test on any instruments used during the test.

e) The Contractor shall ensure that the equipment is ready for testing or inspection and that the equipment conforms to the specifications before the Engineer is requested to witness tests or inspections. Should it be found that the equipment or contract works is not ready for testing/inspection, or does not conform to the specification, the Engineer reserves the right to charge the Contractor for any re-tests or subsequent costs.

f) On satisfactory completion of the commissioning and inspections the contractor shall test the entire installation, as per SANS 10142-1 requirements.

g) The contractor shall issue a Certificate of Compliance to the engineer, upon successful completion of the installation test.

C3.3.4.2.2 E200.2 TESTING AND COMMISIONING

C3.3.4.2.2.1 E200.2.1 SCOPE

This section covers the factory and on-site testing and commissioning requirements for all equipment supplied and installed under this contract. The procedures described are the minimum required and additional tests/requirements are specified in the relevant standard and detail specifications.

C3.3.4.2.2.2 E200.2.2 TESTING SEQUENCE

a) The testing to be performed on site is divided into two sections as follows:

- Before official commissioning commences the Contractor shall test his equipment as described below to ensure that the plant has been installed correctly.

- After the Contractor has been satisfied that his equipment is in running order, the commissioning of the plant will commence as described below.

C3.3.4.2.2.3 E200.2.3 SITE TESTING OF EQUIPMENT PRIOR TO COMMISSIONING

a) The Contractor shall timeously inform the Engineer when he intends to perform his first tests and start-up of equipment in order to allow a representative of the Engineer to witness the tests.

- Before starting up any section of the mechanical plant or filling tanks and sumps with liquid, the Contractor shall clean out the tanks, pipes, fittings, equipment or structures, and, if necessary, make arrangements with other Contractors to remove their building rubble from the structures, check that all safety devices and alarms have been set and activated, all nuts have been tightened correctly, that all the equipment is complete and ready for start-up, that the plant has been installed correctly, and that three copies of the operating manuals have been handed over to the Engineer.

- Each section of the equipment shall be started up by the Contractor, who shall ensure that all oil fillings, lubrication, vibration monitoring, etc., have been correctly completed. In addition, he shall be responsible for the first re-filling of all the lubricating oils as well as for adjusting the plant to operate according to specification. Before any equipment is started or energised, the Contractor shall ensure that it is safe for personnel and equipment on site to do so. Allowance for these costs shall be made in his tendered rates and sums.

- The Contractor shall conduct his own tests on the equipment and, only when he is satisfied that these tests meet the requirements of the specifications, shall he notify the Engineer that he is ready to conduct the official tests on completion. The Contractor shall not conduct an

official test without the Engineer being present or his approval to do so. All equipment tested shall conform to the requirements specified.

C3.3.4.2.2.4 E200.2.4 COMMISSIONING

a) The Contractor shall be responsible for commissioning all sections of the works and shall perform all the tasks set out below:

- Prior notice of and proper arrangements for the commissioning shall be made with the Employer, Engineer, supply authority, and all electrical Contractors and suppliers of equipment, which will be affected by the commissioning operation.
- If plant and equipment, which has been supplied by others has to be commissioned, the supplier's specific permission thereto, together with any specific requirements relating to commissioning shall be obtained prior to commissioning.
- All sections of the works shall be carefully inspected by a responsible representative of the Contractor to ensure that all construction and installation work has been properly completed.

b) Commissioning and testing on site shall be carried out by experienced personnel under the Contractor's supervision.

c) All pre-commissioning tests and checks shall be agreed with the Engineer prior to the commencement therewith.

d) When all the tests required before commissioning, or tests before tests on completion, have been completed and accepted by the Engineer, the commissioning may proceed. The commissioning period shall be undertaken over a trouble-free period of at least thirty consecutive calendar days. During this period the Contractor shall instruct the operating staff in the correct procedures of operating the plant under all circumstances of operation, including emergency conditions, the correct servicing of every part, the type of oil or grease to be used, and similar instructions. This shall be done by demonstration and confirmation in writing and operating manuals shall be referred to for this purpose.

e) At least four weeks before commissioning commences the Engineer will be requested to provide the Contractor with commissioning sheets for all the equipment installed by the Contractor. These forms shall be completed by the Contractor during the commissioning period and all items listed shall be entered. Final hand-over certificates will not be issued for equipment with incomplete commissioning reports. Information that is not available or applicable, or reasons for not performing certain tests shall be agreed with the Engineer.

f) The thirty-day commissioning period will commence with a day-one test and terminate with a day-thirty test in compliance with the commissioning report. Commissioning of the plant (which includes the thirty days between the day-one and day-thirty tests) shall include operating under conditions which shall adequately prove that all the specifications are met. All safety devices, stand-by plant, automatic controls and protection devices shall be adequately tested for reliability and correct functioning. The Contractor may be called upon to repeat testing during the maintenance period if the performance of any equipment supplied under this contract is suspected to be substandard by the Engineer. Such tests shall be for the Contractor's account and shall comply with the requirements specified. Copies of updated commissioning reports shall be provided to the Engineer within two days after a test has been performed.

g) After the Contractor has provided training to the Employer and provided all other contractual requirements have been met, the latter will sign the commissioning report.

h) Once a commissioning report is complete, the Engineer and the Contractor will sign and date the report, whereupon the Engineer will notify the Employer that maintenance for that particular piece of equipment from then on is the Employers responsibility in compliance with the general conditions of contract.

i) Programs for the day-one tests, day-thirty tests and instruction/training sessions with the client shall be prepared by the Contractor and provided to the Engineer no less than two weeks before the commissioning period commences. Weekly updates to these schedules shall be provided by the Contractor for the duration of the commissioning period.

j) Note that if any equipment should fail during the 30-day commissioning period, the equipment shall be repaired or replaced by the Contractor and testing and commissioning will commence from scratch.

k) During the thirty-day commissioning period, the Contractor shall be responsible for providing all labour and materials (including testing equipment) and shall carry out all the servicing and any adjustment of the plant required for ensuring that it operates as specified. Valid calibration certificates shall be available for all testing equipment on site during the commissioning period.

l) The Contractor shall conduct all the tests required to satisfy the Engineer that the plant is capable of performing in accordance with the specification and shall make allowance therefore in his tendered rates and prices. Any defects detected during the commissioning period shall be made good, by and at the expense of the Contractor, including all additional costs incurred by the Employer and his representatives and the Engineer. These tests shall be conducted to certify that the plant, as installed, is operating in accordance with the specified requirements. Note that all equipment will be tested as part of a system, where appropriate, and will not be passed if all protection devices, interlocking with other equipment, etc., are not fully functional.

m) On satisfactory completion of the commissioning and inspections the contractor shall test the entire installation, as per SANS 10142-1 requirements.

n) The contractor shall issue a Certificate of Compliance to the engineer, upon successful completion of the installation test.

C3.3.4.2.2.5 E200.2.5 MEASUREMENT AND PAYMENT

a) All costs for equipment, labour and other expenses for the on-site testing and commissioning of equipment shall be included in the tendered rates set out in the measurement and payment clauses of each piece of equipment and in the schedule of quantities. Any additional tests specified in the standard and detail specifications shall also be included in the tendered rates.

C3.3.4.2.3 E200.3 LOW VOLTAGE CABLES

C3.3.4.2.3.1 E200.3.1 SCOPE

a) Application

- This document specifies the standard requirements for the supply, delivery to site, site installation, site testing, commissioning and handover of Low Voltage cable systems.
- This document specifies the standard requirements for the design, installation, testing and commissioning of electrical installations operating on voltages up to 1 000 volts AC / 1 500 Volts DC.
- The primary intention of this specification is to ensure the provision of an electrical installation, which has been designed and constructed to ensure safe, reliable, operation and to facilitate safe inspection, testing and maintenance.

- Note, however, that this specification only covers such installations (or sections of installations) that are covered by SANS 10142-1. Note also that certain provisions of this specification are inappropriate for direct application to installations where additional measures (such as earthing, intrinsic safe equipment, etc.) are required by SANS 10142-1 and SANS 10108 (i.e. medical and hazardous locations). For these types of installations, SANS 1411.

b) Electrical System Characteristics

- The design of the installation shall comply with SANS 10142-1.
- The design of the installation shall consider the following supply characteristics:
  - Voltage, frequency and number of phases
  - Maximum prospective short circuit current (phase to phase and phase to neutral)
  - Type of system, e.g. TN-S, TN-C-S
  - Maximum earth loop impedance of the earth fault path external to the installation
  - Type and rating of the cut-out or switch device
  - Load capability of the supply source, particularly the effects on the supply voltage of the starting of new equipment

c) The installation of protective devices shall be correctly co-ordinated within the installation and with respect to existing installations. Discrimination studies shall be performed to validate the co-ordination of the installation.

d) All equipment which requires operation or attendance by a person, or requires cleaning or maintenance in service, shall be constructed and installed to allow adequate and safe means of access and adequate working space for such activities.

e) Where additions or alterations to an existing installation are to be performed, the rating and condition of existing equipment, including that associated with the supply, shall be verified to confirm its suitability to carry any additional load. The earthing and equipotential bonding arrangements shall also be verified. No addition or alteration shall have an adverse effect on the existing installation.

C3.3.4.2.3.2 E200.3.2 STANDARDS

a) Associated Documentation

- This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.
- Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.
- The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the installation.

b) Regulations, Specifications and Standards

- The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:
  - Occupational Health and Safety Act (Act 85 of 1993)
  - Construction Regulations 2003 issued in terms of Section 43 of the Act
  - Local Fire Regulations; and
  - Regulations of the Local Supply Authority

and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 1 Section 3: Reference Standards

Standard Number	Description
SANS 1213	Mechanical cable glands
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
IEC 50086	Conduit systems for cable management

- The installation shall also comply with:
  - This Specification, including all Technical Data Sheets; and
  - Any documentation issued by, or on behalf of, the Employer in respect of the Installation

C3.3.4.2.3.3 E200.3.3 GENERAL

a) General

- Cables shall be manufactured strictly in accordance with SANS 1507.
- Cables shall be delivered within 12 months of manufacture and shall be delivered to site on cable drums or coiled with protective wrappings.
- Cables shall be delivered, stored and handled in accordance with the manufacturer's instructions. Where the performance of the cable is likely to be adversely affected by the ingress of moisture, it shall be adequately sealed at both ends.
- The end protruding from the drum shall be protected against mechanical damage.

- Cable selection and sizing should comply with SANS 10142-1. Cables and their wireways shall, where required by SANS 10400 Part T to be protected against the effects of fire, be selected and installed in accordance with the provisions of such code.

- Cables shall have copper or aluminium conductors according to SANS 1411-1. Cores of cross-sectional area greater than 1,5 mm² shall be stranded or flexible.

- Where neutral conductors are to be provided, they shall be of the same cross-sectional area as the associated phase conductor, unless otherwise specified in the Particular Specification and drawings.

C3.3.4.2.3.4 E200.3.4 LOW VOLTAGE CABLES

a) Types of Low Voltage Cables

- Unless otherwise specified, all LV cables shall have copper conductors to SANS 1411-1. Cores of cross-sectional area greater than 1,5 mm² shall be stranded or flexible. Where neutral conductors are to be provided, they shall be of the same cross-sectional area as the associated phase conductor, unless otherwise specified in the design documentation and drawings.

- All LV cables used in an electrical installation shall be as specified in the Particular Specification (or cable schedule as part of the Particular Specification) and shall comply with either of the following:

  - PVC/AWA/PVC and PVC/SWA/PVC

    - Cables shall comply with SANS 1507-3 and be rated at 600/1000 V.

    - Single core cables shall have aluminium wire armouring.

    - Multicore cables comprising five conductors and above shall have each core individually coloured, or, where not available, be coloured white with phase identification in black numerals.

  - XLPE/AWA/PVC and XLPE/SWA/PVC

    - Cables shall comply with SANS 1507-4 and be rated at 600/1000 V.

    - Single core cables shall have aluminium wire armouring.

  - PVC/PVC

    - Cables shall comply with SANS 1507-3 and be rated at 600/1000 V.

  - XLPE/PVC

    - Cables shall comply with SANS 1507-4, and be rated at 600/100 V.

  - Single Core PVC

    - Cables shall comply with SANS 1507-2 and be rated at 600/1000 V.

    - The insulation shall be phase coloured, and, where used in single phase systems, line cables shall be red, neutral cables black and earth cables yellow and green.

- Flat Twin and Earth PVC
  - Copper conductors shall comply with SANS 1411-1, PVC insulated to SANS 1411-2, laid up with a bare copper earth continuity conductor between them, with PVC bedding to SANS 1411-2.
  - Cables shall be rated at 300/500 V.
- Fire Resistant Cables
  - Cables requiring protection against the effects of fire shall be of fire-resistant construction (note here that “fire-rated” cables are not the same as “fire-resistant” cables).
  - Fire-resistant cables shall thus comply with SANS 60331-21 and / or BS EN 50200.
  - Except where prior approval in this regard has been granted by the Engineer, increasing the resistance to fire of normal (i.e. non-fire resistant) cables though the application of a coat of fire-resistant compound will not be accepted.

b) Cable Accessories

– Cable Markers

Concrete markers for the indication of cable or trench routes shall be placed at a minimum of 50 m intervals, changes in trench or cable direction and at road crossings. The markers shall protrude by 25 mm above finished ground level, except where they are likely to cause obstruction, when they shall be laid flush with the finished ground level.

C3.3.4.2.3.5 E200.3.5 INSTALLATION OF CABLES

a) General

– The cable installation shall comply with the requirements of SANS 10142-1.

– Cables shall be installed strictly in accordance with the cable route drawings.

– Cables installed in groups shall run in straight lines and not cross over each other, except where transposing of cables is required to reduce capacitive or inductive effects.

– Cables installed above ground shall, as far possible, run parallel with the lines of building construction. Cables and wireways shall then only be installed in horizontal and vertical runs, and the installation shall be as visually unobtrusive as possible.

– Cables buried below ground shall, as far as possible, follow features of the site such as roadways and building lines.

– Where a redundant cable installation is required, the cables shall not be installed along the same route, and their routes shall be through separate fire compartments (except where no separation occurs, as may be the case in the vicinity of the source and load).

– Cables and their support systems shall not be fixed to protective barriers, guards or directly to guard-rails.

– Cables shall not be exposed to direct sunlight after installation. If the cable route compels the support system to be in direct sunlight, the Contractor shall ensure cables are covered with a suitable canopy or cover of the same material as the support system (tray). Cables shall be installed strictly according to the manufacturer’s requirements pertaining to:

- Maximum tensile or compressive stresses (e.g. due to pinching or squashing)
- Minimum bending radii
- Temperature of installation; and
- Operating environment

– No joints or repairs to outer sheathings or insulation shall be allowed in low-voltage cables without the prior approval of the Engineer.

– Propriety (i.e. suited to and manufactured for such use) cable support systems shall be used.

– Unarmoured cables shall only be used where there is no risk of mechanical damage.

– Fire resistant cables shall only be supported by fire resistant cable support systems.

– After cable installation, the open end of all cable sleeves and the openings in building structures specifically provided for the passage of cables (including unused openings) shall be fire sealed to SANS 10177 Part 2, thus preventing the ingress of harmful or flammable gases, liquid, smoke, fire and vermin.

b) Separation of Cables

– Cables shall be classified as follows:

Table 2: Cable classification

	AC	DC
High Voltage	> 1000 Vrms	> 1500 V
Low voltage (power, control, small power and lighting)	50–1000 Vrms	120–1500 V
Extra-low voltage (signal/instrument, data transmission and telecommunication)	< 50 Vrms	< 120 V

– Except for reasons of electromagnetic compatibility, where larger separation will be required, the minimum separation distance between cables of different classifications shall be according to the following table.

Table 3: Separation distance

Separation (mm)	Extra Low Voltage	Low Voltage	Other Services (Above Ground)	Other Services (Below Ground)
Extra Low Voltage	-	As specified	150	500
Low Voltage	As specified	2 x cables above ground 100mm below ground	150	500
High Voltage Cables	500	300	300	500
Other Services (Above Ground)	150	150	-	-
Other Services (Below Ground)	500	500	-	-
Note:				
1. The above figures need not to apply to the short lengths of cables near the equipment to which the cables are connected. 2. Clearances to power lines are excluded from above table as they are covered by the Electrical Machinery Regulations. Furthermore, clearances to traction lines are subject to the regulations of the relevant railway authorities.				

- The figures specified in the table above do not apply to cables that are installed in separate metal enclosures and/or cables on cable support systems (cable trays/ladders) that are separated with conductive partitions, provided such partitions are electrically bonded to earth.

- Notwithstanding above, cables of different classifications and/or purpose (e.g. data, audio or power), shall not be installed in the same duct or wireway, and the minimum separation distance shall be kept even when their ducts or wireways are bonded (since radio frequency interference may then still be exhibited).

When cables have to cross, the crossing shall be at right angles.

c) Cable trenches in ground

- General

  - The proposed trench route shall be surveyed for the presence of underground cables and/or services before digging commences.

  - The site shall be preserved as far as possible. Only the minimum of trees, shrubs, rocks, etc. shall be removed and cleared for the cable route.

  - Where surplus material has to be disposed of, the Contractor shall remove it from site and dispose of it in a location of his choosing in accordance with statutory environmental regulations.

- Excavation

  - The cable trench shall be excavated along the routes indicated on the relevant drawings.

  - Should the Contractor, during the excavation operations, come across obstacles (or other interferences, e.g. soil drenched with hydrocarbon-based solvents such as spilt

oil, which could adversely affect cable insulation), the Contractor shall report the matter to the Engineer, who shall then advise an appropriate course of action.

- Trenches shall be dug to within the dimensional tolerances given by SANS 1200, parts DB and LC.
- Where the Contractor cannot excavate by means of machines, due to limited access and the proximity of other services, excavations shall be by hand.
- The bottom of the trench shall be level and shall follow the contours of the final ground level. Where the excavation is in excess of the required depth, the excavation shall be backfilled and compacted with suitable material to the required depth.
- The Contractor shall trim the trenches and clean up the bottom of the trenches after he has completed the required excavation.
- The Contractor shall remove all sharp projections, which could damage the cable where the trench is excavated through rocky formations, and shall remove all loose rocks, material, etc. from the bottom of the trench.
- No excavated material shall be left closer than 300 mm from the side of the excavation.
- Once the excavations for cable trenches have been completed, the Contractor shall give the Engineer one working day notice to inspect the trench and to be present when the measurements are made.
- The Contractor shall maintain the excavation in a good condition, free of water, mud, lose ground, rocks, stones, gravel and other strange material until the cables are installed.

– Installation of cables directly in ground.

- Dimensions of trenches for the installation of cables directly in ground
- Trenches shall be excavated as follows:

Table 4: Excavation of trenches

	Width	Depth
Telecommunication Cable	450 mm	650 mm
LV Cable	450 mm	650 mm

- However, the following minimum clearances shall be maintained:

Table 5: Minimum clearances

	Vertical	Horizontal
Data and Telecom Cables	300 mm	300 mm
Water pipes	300 mm	300 mm
Sewer pipes	300 mm	800 mm
Storm water pipes	300 mm	600 mm
LV cables on same route	100 mm	One cable diameter of larger cable

- Where a cable will cross over other services, the cable shall not be installed at a depth less than 600 mm below ground level, and if this is not possible the cable shall be installed underneath the other service and shall be protected in the prescribed manner by means of concrete slabs. The depth of the cable shall be maintained for one metre on either side of the crossing.

- If it is not possible to cross over or underneath a service in the prescribed manner, the matter shall be referred to the Engineer for a decision.

- Where more than one cable needs to be installed in a trench, the width of the trench shall be increased with a distance equal to the clearance required.

– Sand bed and sand bed cover for cables

  - A sand bed layer of soft soil shall be installed and levelled at the bottom of each trench after the trench has been approved by the Engineer, and prior to cable laying.

  - If the excavated material is not suitable for the sand bed layer, then suitable soil shall be imported for this purpose. Quarried sand, man-made sand, sand clay and loam are usually suitable; sea sand, river sand, clay, chalk, unmixed ouklip, peat and mine sand may not be used. The cost of importing shall be included in the price for the excavation.

  - The minimum thickness of the sand bed layer shall be 50 mm.

  - If the soil for the sand bed and sand cover has to be sifted, a sieve with holes not larger than 6 mm shall be used.

  - The cable shall, after the completion of the trench, be laid as soon as possible so that the trench can be backfilled.

  - The sand bed cover for LV cables shall be 150 mm thick, of similar soil and shall be placed directly after the cable(s) has been inspected by the Engineer.

  - Only one cable shall be laid at a time and the Contractor shall take precautions that the cables which are already installed are not damaged.

– Laying of cables

  - Cable rollers shall be used when cables are drawn into trenches. The cable rollers shall be placed so that the cable does not touch the bottom or the sides of the trench.

  - If the Contractor intends using a winch to draw the cable into the trench, a cable stocking shall be used or the draw wires shall be soldered to the cable, such that the tension is exerted on all the cores, lead sheath and/or steel wire armouring at the same time.

  - The maximum tension on a cable during laying operations shall not exceed the value specified by the manufacturer.

  - Sufficient lengths of cable shall be left at the beginning and end of the cable routes to allow for the termination of the cables. The Contractor shall take the necessary precautions to protect the cable ends until they are terminated. The cable ends shall be sealed by means of lead or heat-shrink sealing caps to ensure that the cable is waterproof.

  - Where cables are drawn through sleeves, care shall be taken that they are not kinked or excessively bent.

  - The Contractor shall keep accurate records of each length of cable laid. The following information shall be recorded:

i) Cable drum number

ii) Size of cable

iii) Position of where the cable has been installed, i.e. the starting and finishing points

iv) Length of cable

v) Date of installation

- The Contractor shall be liable for the repair of cables due to the faulty manufacture, should this information not be recorded directly after the cable has been laid.
- The Engineer shall inspect all cable trenches before backfilling to ensure that the laying of cables complies with the specification.

– Backfilling of trenches

- When the cable has been laid, inspected and approved and the sand bed cover has been installed, the trench shall be backfilled with soil containing not more than 40% rock or shale which shall be able to pass through a 100 mm sieve and which is approved by the Engineer.
- Where more than 40%, but less than 70%, rock occurs, the Contractor shall replace the rock with imported soil. However, should more than 70% rock occur then all the backfilling material shall be imported.
- The Contractor may import further stone-free material to the site or sieve the excavated material for sand bedding and cover, but payment shall only be compensated for the actual quantity of imported material required as determined by the Engineer. The quantity of imported material required shall be calculated from the nominal trench width.
- The excavated material shall be backfilled in layers of 150 mm and shall be well compacted and consolidated to 90% MOD AASHTO. Where the Engineer deems necessary, the Contractor shall use a mechanical vibrator to compact the trench.
- The Contractor shall maintain the completed sections of the cable trench in a proper safe condition for the duration of the contract. The Contractor shall refill and compact the trench where subsidence occurs.
- After completion of the work the route of the cable shall be neatly finished off and cleared. All stones bigger than 25 mm, as well as all loose organic material and rubble, shall be removed.
- Electrical warning tape, consisting of two tapes laid side-by-side and overlapping (such that their combined width is 150% of a single tape width), shall be installed on all cable routes (LV and MV), 200 mm above the top cable layer. Where a cable route exceeds 600 mm in width, multiple warning tapes shall be run, in such a way that the space between adjacent warning tapes does not exceed 150 mm.

– Installation of concrete slabs

Where cables cross other services such as water pipes, sewage pipes and other cables, or where the chance exists that the cable may be damaged as a result of excavation by others,

the cable shall be protected by means of reinforced concrete slabs. The slabs shall protect the cable for a distance of 500 mm on either side of the crossing.

c) Cable Sleeves

– General

- The construction of sleeves draw pits and associated earthworks shall be in accordance with SANS 2001-DP3.
- Sleeves shall be PVC unless otherwise specified.
- The sleeves shall have a minimum wall thickness of 5 mm and mass not exceeding 45 kg per sleeve length.
- Where a change of direction is required, draw pits shall be constructed. Bends may only be used where prior approval has been granted by the Engineer. Where such approval has been granted, the maximum angle of a single bend in a sleeve shall be:

  i) 45º, when all cables have a diameter less than 35 mm; or

  ii) 22.5º, where any cable has a diameter greater than 35 mm.

- All bends shall be of the long radius type.

– Method of Laying

- In order to facilitate future location of the sleeves, they are to be installed strictly in accordance with the relevant drawings.
- The Contractor shall select the number and/or dimensions of sleeves such that an additional cable, of outside diameter equal to 20% of the sum of the outside diameters of the installed cables, can be pulled into the sleeve at a future date. Under roadways, this spare capacity shall be 50%. Notwithstanding above requirement, a minimum of two sleeves shall be installed under all roadway crossings.
- When installed beneath roads, there shall be a minimum of 750 mm of cover above the crown of the sleeve, and the sleeve shall be extended to 1,5 m on either side of the road surface or kerb face.
- Where sleeves are installed during road construction, the sleeve positions shall be marked with the letters "E" or “ESC” for electrical, and “TEL” for telecommunication sleeves, cut or cast into the concrete of the kerb (or concrete marker, should the road be without kerbs). The grooved letters shall also be painted red, to facilitate easy identification.
- The sleeves shall be laid straight to within the dimensional tolerances given by SANS 1200-part LC.
- After installation, all foreign matter in the pipe shall be cleared.
- The sleeves shall be sealed with PVC plugs to prevent the entry of sand before backfilling.
- Precautions shall be taken to prevent damage to the sleeves during future construction activities.

- All sleeves shall be left with an 8 mm diameter nylon draw wire, or draw wire to SANS 2001-DP3, in place, anchored at each end.

– Bore and Sleeve Jointing

- The bore shall be accurate, smooth and without surface cracks, and the inside edges edged or rounded.
- The edging or rounding shall be such that no ridge is formed when two sleeves are joined.
- A suitable slip collar, or other simple device, shall be provided to maintain the 5 mm spacing after the installation of the sleeves.
- Joints shall be carried out with suitable couplings to prevent movement between pipe ends.
- Joints shall be flexible enough to allow angular adjustments of up to 5º between adjacent lengths of sleeves during installation and afterwards to allow for subsequent subsidence of the ground.
- The joints need not be watertight but shall stop sand and other materials entering the sleeves.

– Draw pits and masonry

- Where they are to be constructed in residential or commercial zoned areas, and where part of the draw pit will be visible above ground, the masonry units to draw pits shall be FBS (face brick standard). All other draw pit builds shall utilize solid concrete units.
- Draw pits covers shall be of cast iron manufacture, or as specified in the particular specification.

C3.3.4.2.3.6 E200.3.6 MARKING AND LABELLING OF CABLES

a) Low Voltage Cables

– Conductors and/or cables shall be identified at both ends by cable markers, consisting of plastic sleeves with pre-printed, legible and indelible alpha/numeric element inserts. The plastic sleeves shall fully encircle the conductor and/or cable. The markers shall be suitable for the intended environment, for instance, UV resistant where installed in sunlight, etc. Reference character sizes shall not be less than 3 mm high.

– The colours of conductor PVC insulation shall comply with SANS 10142-1, par. 6.3.3. The colours of conductors for sub-circuits shall as far as possible correspond with the colour of the supply phase. Except in the case of multi-way switching, the colour of a conductor may not change at any point along its run, starting from its point of origin at a circuit breaker inside the switchgear assembly. In other words, where loop wiring is employed, the colour of conductor insulation shall be the same throughout the circuit.

C3.3.4.2.3.7 E200.3.7 DRAWINGS AND DOCUMENTATION

a) General

– All drawings, information, and documentation shall be in English, and each item shall be identified with:

- The Client's name and contact details
- Client's project / scheme / contract reference title and numbers
- The Engineer's name and contact details
- Engineers reference numbers
- Contractor's work / contract / order references

– Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

b) Drawings for Approval

– The following documentation and drawings shall be submitted to the Engineer prior to the installation of cables and wireways and before civil construction have started on the areas where cable routes are required:

- Cable route layout drawings showing
- Type of wireways
- Trenching
- Cable junction boxes

c) As-built Drawings

– The Contractor shall produce detailed "as-built" drawings, clearly labelled as such, and consisting of 3 sets of drawings printed to their original size. Where the original drawings were larger than A3, 3 sets of printed drawings scaled to A3 size will be supplied. The A3 drawings will not have any information omitted from the printed area. The drawings will indicate the positions of the following:

- Wireways (e.g. trenches, conduit, cables ladder/trays, power skirting etc.)
- Cable routes (including any cable joints)
- General arrangement drawings
- Single line diagrams

d) Operating and Maintenance Manual

– Three Operation Manuals, three Maintenance Manuals and three Certification copies shall be provided for all equipment supplied. The manuals shall be in A4 format.

– The operating and maintenance manuals shall include at least the following:

- A schedule of installed components and equipment, containing the following information:

  i) Manufacturers name and contact details

  ii) Circuit number (DB name, circuit breaker e.g. DB01-CB08); and

iii) Function (e.g. switching lighting circuit DB03-L1)

- A schedule of all installed cables, with the following information:

  i) Circuit number (DB name, circuit breaker e.g. DB01-CB08)

  ii) Size

  iii) Installed length; and

  iv) Function (e.g. “Feeding Submersible pump IW-SP-01”)

- Description and details of:

  i) Detailed description of the function of all operator controls

  ii) Procedures for fault finding

  iii) Maintenance instructions for all components and including repair, overhaul, change-out and installation procedures

  iv) Inspection schedules; and

  v) Spare parts information and recommended spares

C3.3.4.2.3.8 E200.3.8 TESTING AND COMMISSIONING

a) General

- The installation shall be inspected and tested in accordance with SANS 10142-1.
- Inspection and testing shall only be performed by personnel with approved, current qualifications. The Contractor shall provide qualified personnel for the supervision for all inspection and testing activities.
- The Contractor shall provide all necessary safety equipment and test instruments. All test instruments shall comply with SANS 61010 and have an up-to-date test and calibration certificate.
- The Contractor’s safe working arrangements shall comply with the safety management systems and procedures prevailing on site. Where there may be a risk of injury to personnel, the Contractor shall submit a risk assessment and method statement for approval, prior to starting work.
- Unless otherwise specified in the Particular Specification, all inspection and test results shall be recorded using pro forma documentation (test certificates and schedules) complying with SANS 10142-1.
- The Contractor shall make provision for all inspection and testing activities to be witnessed. Unless otherwise specified in the Particular Specification, the period of notice for witness testing shall be 5 working days.
- Where most of the inspection and testing activities are not witnessed, the Contractor shall allow for 10% of the inspection and testing activities to be repeated for witness testing.
- If there is a requirement for additional inspection and test activities to be performed as part of the commissioning process, this shall be specified in the Particular Specification.

- Unless otherwise agreed by the Employer, no part of the installation shall be commissioned until all defects or omissions revealed by inspection and testing have been rectified. Where a defect or omission renders all or part of the installation unsafe for use, the Contractor shall take approved precautions to ensure that no part of the installation can be commissioned.

b) Test Sequence

- Inspections before testing:
- Before testing, inspections shall be performed to verify:
  - All equipment and material are of the correct type and complies with applicable SANS and IEC standards
  - All parts of the installation are correctly selected and erected
  - No part of the installation is visibly damaged or otherwise defective
  - The installation is suitable for the environmental conditions; and
  - The installation complies with this Specification
- Testing of Installation
  - On satisfactory completion of the commissioning and inspections the contractor shall test the entire installation, as per SANS 10142-1 requirements.
  - The contractor shall issue a Certificate of Compliance to the engineer, upon successful completion of the installation test.

C3.3.4.2.4 E200.4 LOW VOLTAGE SWITCHGEAR AND CONTROL GEAR ASSEMBLIES

C3.3.4.2.4.1 E200.4.1 SCOPE

a) Application

- This Standard Specification defines the requirements for the design, construction, installation, inspection, testing and commissioning of LV switchgear and control gear assemblies (Assemblies), including distribution boards (DBs), motor control centres (MCCs), single standalone motor starters or controllers, control panels (either standalone or forming an integral part of the Assembly), control desks and consoles. Where this type of electrical equipment is incorporated within a plant supply package, the provisions of this Specification shall also apply.

b) General Requirements

- An Assembly shall incorporate all components and equipment necessary to achieve the
- All materials, components, and equipment used in the manufacture of the Assembly shall be new and unused, shall be of current manufacture, and shall be free from any defects or imperfections.

C3.3.4.2.4.2 E200.4.2 STANDARDS

a) Associated Documentation

- This Specification contains standard amendments and requirements which shall be applied to the referenced statutory and national standards. The project-specific requirements are provided in the Detail Specification, which shall be read in conjunction with this Specification.

- The design, construction, installation, inspection, testing and commissioning of the Assembly shall comply with all relevant statutory regulations, and the latest editions (current at the time of Tender) of all relevant South African National Standards.

- The manufacturer shall operate an approved, auditable quality assurance system covering the design, construction, inspection and testing of the Assembly.

b) Statutory Requirements

- The Assembly as manufactured, and as installed on site, shall comply with the following:

  - Occupational Health and Safety Act of 1993

  - Manufacturer's specifications and installation instructions

c) Reference Standards

- The Assembly and all its constituent components and equipment shall comply with the latest published edition of all relevant national standards, including the following:

Table 6: Section 4: Reference standards

Standard Number	Description
SANS 152	Low-voltage air-break switches, air-break disconnectors, air-break switch-disconnectors, and fuse-combination units
SANS 156	Moulded case circuit-breakers
SANS 172	Low Voltage Fuses
SANS 1091	National colour standards for paint
SANS 1973	Low-voltage switchgear and control gear assemblies
SANS 9000	Quality management systems
SANS 10108	The classification of hazardous locations and the selection of apparatus for use in such locations
SANS 10142	Standard Regulations for Wiring of Premises.
SANS 60044	Instrument Transformers
SANS 60204	Safety of machinery. Electrical equipment of machines.
SANS 60269	Low-voltage fuses.
SANS 60439	Low-voltage switchgear and control gear assemblies
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 61558	Isolating transformers and safety isolating transformers.
SANS 60947	Low-voltage switchgear and control gear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61643-1	Low-voltage surge protective devices Part 1: Surge protective devices connected to low-voltage power distribution systems

C3.3.4.2.4.3 E200.4.3 CONSTRUCTION REQUIREMENTS

a) General

- Assemblies shall be designed and constructed to facilitate inspection, cleaning, repair and maintenance and to ensure absolute safety during operation, inspection and maintenance.
- The arrangement of all circuit components / functional units shall be to the approval of the Engineer.
- Where detailed in the Detail Specification, spare compartments of a given size shall be provided within the enclosure. Each shall be equipped with a plain (i.e. un-punched) opening compartment door.
- Every spare compartment shall be sized to house a triple pole and neutral incoming short circuit protective and isolating device and shall be provided with a compartment earthing terminal.
- Every spare compartment shall be provided with a gland plate or have access to an existing cable way within the enclosure.

b) Enclosures

- All conductors and terminals that form part of the Assembly, including earth conductors and the Assembly earth bar, shall be enclosed within it. An earth stud may be provided as a part of a cable glanding facility.
- Assemblies shall be constructed of materials capable of withstanding the mechanical, electrical and thermal stresses to which it may be subjected and the environmental and operating conditions likely to be encountered in normal service.
- All boards, panels and cubicles shall be vermin and dust proof and the minimum degree of protection shall be:

Table 7: Minimum levels of ingress protection

Location	Description	Minimum rating
Indoor	Clean, dry areas (e.g. inside substations or motor control rooms)	IP44 (doors closed) IP2X (inter-compartment & doors open)
Outdoor	Located outside buildings	IP65 (doors closed) IP2X (inter-compartment & doors open)

- Where heat is generated within the enclosure, it shall, where possible, be designed to dissipate naturally from the enclosure surface. Where this is not possible, ventilation openings shall be provided that maintain the highest practicable IP rating of the enclosure, subject to a minimum of IP42. Where cooling air is drawn into the enclosure, dust filters shall be provided where practicable.
- For all variable speed drives and soft-starters (without bypass contactors) installed in indoor Assemblies, mini-extraction fans shall be installed inside the drive compartment to dissipate heat, without compromising the assembly's IP rating.
- Particular attention shall be given to the ventilation of outdoor mounted boards, to eliminate build-up of excessive heat inside the boards caused by the solar radiation or internal heat generation.

- Any internal partitions necessary to provide inter-compartmental segregation within the enclosure shall be of the same material as the sides of the enclosure.

- All the surfaces of the enclosure, and of its constituent equipment and components shall be suitably protected against the effects of any likely atmospheric corrosion present at the operating location.

- Purpose-made gland plates shall be protected against corrosion by electro-plating, galvanising, or be made of stainless steel and shall not be painted.

c) Construction of Free-Standing MCCs and DBs

- Free-standing MCCs and DBs shall be constructed from steel with a structural frame permanently clad with side plates, so as to provide a multi-compartmented structure that is rigid with all doors and covers removed, and such that it will not deform during transport or installation. The enclosure doors and covers shall themselves be suitably braced so as to be rigid and not deform or flex when fully equipped and handled.

- Each compartment formed within the enclosure for the purpose of housing components or equipment shall be provided with dedicated mounting plates for that purpose, which when removed do not expose any other compartment or live parts. Cabling shall only be terminated on or in the enclosure at gland plates provided for that purpose.

- Horizontal wireways (top and bottom) shall extend through the width of each section.

- The minimum metal thickness of the enclosure's constituent parts shall be as follows:

  - External cladding: 2 mm
  - Internal partitions: 1.6 mm

  - Doors and removable panel covers: 2 mm

- Free-standing Assemblies shall be mounted on and bolted to a rigid hot-dip galvanised steel 100 x 50 x 6 mm channel base.

- The maximum height of any Assembly (including its base) shall be 2 100 mm above finished floor level. No equipment other than busbars and/or inter panel control wiring shall be installed higher than 1900 mm above finished floor height, neither shall any equipment, other than cable glands and inter panel control wiring be installed lower than 300 mm above finished floor level.

- Compartment single doors shall have vertical hinges mounted on their left-hand side, and all doors shall have an angle of opening that is limited to 95 degrees. Where specifically agreed with the Engineer, a compartment single door on a front access only Assembly may be hinged on the right-hand side if this will reduce the number of dropper / cable way chambers required. Wide compartments with dual doors shall open in wardrobe style, such that the second door is interlocked with the first.

- Any cover which is required to be removed for adjustment, access, or maintenance and exceeds 0.75m² in area, shall be provided with supporting lips, lift-off hinges, locating dowels, or handles, in order to facilitate safe removal and replacement.

- Doors and any covers shall be fixed to the enclosure using captive bolt type fasteners, and each hinged door shall be capable of being removed, following disconnection of the electrical and earthing connections. Compartment doors shall be provided with securing catches which can be locked with a padlock, as follows:

  - door ≤ 400 mm high 1 No.

- door >400 mm high 2 No.
- door >1200 mm high 3 No.

– The Assembly shall be constructed for front and rear access unless otherwise specified in the Detail Specification. Where the Assembly shall be designed for front access only it shall be possible to gain access to every component, item of equipment, busbar and cable from the front (or for busbars, the top) of the enclosure; whether for maintenance or for replacement.

– The form of internal separation (in accordance with SANS 60439-1) shall be as specified in the Detail Specification. Form 3b or 4a as appropriate, shall be considered the minimum allowable internal separation for MDBs and MCCs.

– Any apertures between compartments (including busbar compartments) through which the copper-work or cabling passes, shall be effectively closed off to minimise the possibility of an arc fault propagating between compartments.

– Fixings for components, component mounting plates, etc. shall not penetrate another compartment containing live parts. Where self-tapping screws are used for component fixing, they shall be of the thread forming or thread rolling type. Components, wiring, labelling, etc., shall only be located within compartments on a removable mounting plate, and in such a manner that facilitates easy inspection, maintenance, or removal and replacement, and without necessitating the removal or dismantling of any other components or wiring, or the use of special tools.

– Unless detailed otherwise specified in the Detail Specification, the Assembly shall be constructed so as to facilitate future extension by the addition of extra full height sections at either end. To accommodate this, any covers, fixings, etc. shall be flush with the end faces of the enclosure, and the end sections of busbars and earth bars shall be prepared for future extension.

– The Assembly shall be constructed so as to permit it being split into sections in order to facilitate transportation and subsequent site erection. Each transportable section shall be labelled as to its shipping weight, shall be equipped with lifting eyes, which shall be removed on completion of the site erection.

– All Assemblies shall have at least 15% spare unequipped space complete with busbars, partitioning into compartments, etc. for future extensions.

d) Power distribution within an Assembly

– The power distribution and circuit protective arrangements within an Assembly shall be designed so as to co-ordinate with the characteristics of the electrical system(s) connected to the incoming terminals of the Assembly, including emergency or temporary supplies and specifically noting the following:

- maximum prospective RMS short circuit current from all simultaneously available sources of supply, together with any fault contribution from large motors directly connected to the Assembly
- type of system earthing (i.e. TN-S, TT, etc.), the maximum available earth fault current, and the maximum earth fault loop impedance
- up-stream protective device ratings and settings

- Where this information is not stated in the Detail Specification, it shall be obtained from the Engineer before the design of the Assembly commences.

- Where the maximum prospective RMS short circuit current from all simultaneously available sources of supply, together with any fault contribution from large directly- connected motors, exceeds 10kA, the Assembly a Type Tested Assembly with stated deviations in compliance with SANS 1973-1.

- Where the maximum prospective RMS short circuit current is 10kA or less, the Assembly shall comply with the requirements of SANS 1973-3.

e) Functional unit short-circuit protection and isolation

- The Assembly shall be provided with separate incoming isolation for every electrical power system (including emergency or temporary supplies) connected to it.

- The connection from the Assembly power distribution system into every compartment shall be terminated on a short circuit protection device, which may also incorporate a compartment isolating device, for short-circuit protection of all the components within a functional unit.

- Every motor starter compartment shall be provided with a door interlocked isolation device, which shall isolate all sources of supply that enter the motor starter compartment. Where a functional unit; e.g. a motor starter, etc., comprises a group of interlocked compartments, the isolation device shall be located in the compartment receiving the supply.

- Every compartment containing a distribution board or low voltage transformer shall be provided with an isolation device, which may be located in an adjacent compartment. For some compartments housing power monitoring equipment or instrumentation and process control equipment, it may be appropriate to provide a means of isolation within the compartment.

- Unless separate fuses are used as the short circuit protection device, the isolation device and short circuit protection device shall be combined. Fuses may only be used to limit fault currents if approved by the Engineer.

- Separate isolating devices shall be switch-disconnectors suitable for on-load switching. They shall be capable of being padlocked in the isolated / 'off' position at the compartment door, and at the isolating mechanism with the compartment door open. Any isolator mechanism extension shafts shall be provided with guide brackets as necessary to prevent excessive shaft deflection.

- The compartment door shall be mechanically interlocked such that it shall not be possible to open the door when the isolating device is in the 'on' / 'closed' position or when the operating handle is padlocked in the 'off' / 'open' position. Where the means of isolation is only accessible from within the compartment, it shall be protected to a level of IP2X.

- The following types of devices may be used:

  - Air circuit breaker (ACB) or moulded case circuit breaker (MCCB)

  - Fuse switch-disconnector

  - Switch-disconnector with separate fuses

- All field circuits connected to a functional unit (e.g. valve actuators, limit switches, etc.) shall be provided with isolation either by or within that functional unit.

- Where safety interlock keys are provided, e.g. to control device operation or to restrict access, they shall only be released in the safe condition, and shall be unique across that Assembly and any other Assembly installed at the same site.

C3.3.4.2.4.4 E200.4.4 ELECTRICAL COMPONENTS

a) Circuit Breakers (CBs)

- Circuit breakers shall be either air circuit breakers (ACBs) or moulded case circuit breakers (MCCBs), as indicated on the single-line diagram for the Assembly.
- CBs shall have a rated service short-circuit breaking capacity not less than that of the maximum prospective fault current at the point of connection in the power system, which shall be taken to be the busbar rated short-time withstand current specified for the Assembly Incomer CBs shall have a rated short-time withstand current and time not less than that of the busbars.
- CBs with rated currents over 100 A shall have built-in protection, that will discriminate with both up-stream and down-stream protective devices, as appropriate to the application.
- ACBs for incomer and feeder applications shall be fitted with adjustable electronic protection. MCCBs for incomer applications shall be fitted with adjustable thermal-magnetic or adjustable electronic protection.
- An ACB shall incorporate pad-lockable cover(s) to permit the securing of the open, close, and trip actuators against inadvertent or unauthorised manual operation.
- Where an ACB or MCCB has electrically operated control circuits; e.g. opening, closing, tripping, spring charging, indication, etc., they shall be provided with individual fuse or MCB protection.
- All ACBs and selected MCCBs (as indicated on the single-line diagrams) shall be of a withdrawable pattern with the number of poles indicated on the single-line diagram.
- A withdrawable ACB or MCCB shall be provided with clearly visible carriage position indication (connected/disconnected/test) and shall be capable of being locked in each position. Mechanical interlocks shall be provided that only permit movement of the carriage whilst the main circuit contacts are in the 'OFF' position. It shall be possible to test the control circuits of an ACB with it partially or fully withdrawn.
- As a withdrawable ACB or MCCB is being withdrawn, pad-lockable safety shutters shall automatically cover over the supply side and the load side fixed connections. These shutters shall be capable of independently being opened for testing purposes.
- One (only) handling truck shall be provided suitable for each type of withdrawable ACB or MCCB supplied as a part of the Assembly, or as a part of any other Assembly supplied to the same building housing the Assembly.
- Special maintenance tools, where required, shall be provided with each breaker.
- Cables connected directly to CB terminals will generally not be permitted. Adequately sized cable/busbar adapters shall be provided.

b) Switch-disconnectors

- The switch shall be suitable for the continuous rated duty of the circuit it controls.

- The utilisation category of the switch-disconnector shall be AC23 for motor switching duties, and AC22 for switching of mixed resistive and inductive loads, with an appropriate utilization category (A for frequent switching and B for infrequent switching).

- Rotary switch-disconnectors shall be provided with a 'break-before-make' operation for each pole. The rotary switch, or changeover switch formed by the proprietary interlocked interconnection of two switch-disconnectors or fuse switches, shall incorporate a centre 'off' position.

- Switch-disconnectors for motor starter or variable speed drive duties, that incorporate a test position, shall enable the control circuit supplies while ensuring isolation of the main supply.

c) Fuse switches

- Fuses and fuse bases shall comply with the requirements of SANS 172 and shall be provided with an indicating device to show the "blown" state of the fuse.

- Only Motor circuit fuse links as defined in BS 88 shall be permitted on motor starting circuits.

- Fuse current ratings shall be indicated on engraved 20 x 12 mm white-black-white traffolyte labels in 4 mm figures. The labels are to be fitted at the fuse bases and shall not be obscured by wiring.

- This shall comprise a moulded carriage accommodating either HRC fuses or solid links and shall provide for a switched neutral where required.

- Provision shall be made for the following:

  - Double break contacts on each pole.
  - Arc barriers on each pole.
  - IP2X protection in either state.
  - Silver plated copper contacts.
  - Neutral link where required.
  - Mechanically operated ON/OFF indicator.
  - Auxiliary switch facility.
  - Full interchangeability of equivalent rated units

- The continuous thermal rating and the circuit fuse rating shall be indicated adjacent to the switch.

- The minimum utilisation category of the fuse switch shall be AC23 for motor starting duties, and AC22 for power distribution only duties.

- All fuses used on LV circuits shall be HRC cartridge type fuse links complying with both SANS 60269 and BS 88 Part 6 / BS 88 Part 2 Section 2.2 (fuse links with bolted connections), except as follows:

  - semi-conductor protection fuses recommended or provided by the manufacturer of any power electronics incorporated into the Assembly;

- sub-distribution fuses for extra-low voltage control circuits in ICA equipment compartments.

– The sub-distribution fuses for control circuits (mentioned above) shall be miniature ceramic cartridge fuses complying with BS 2950. They shall be mounted in knife-edge ('swinging blade') disconnect type DIN rail mounted terminals. Knife-edge disconnect type terminals shall similarly be used for neutral links.

– Neutral and earth link holders shall be non-interchangeable with fuse holders, and fuse and link holders shall be segregated according to circuit voltage.

– Where HRC cartridge type fuse links do not form an integral part of an item of equipment such as an enclosed transformer, a fuse switch, etc., they shall be mounted in all-insulated fuse carriers fitted into fuse holders. An associated neutral circuit shall be provided with a solid copper link, which shall be mounted in an identical manner adjacent to the phase circuit fuse holders.

– Fuse and link bases shall contain insulating shrouds, that can only be removed using a tool. A fuse or link shall only be capable of insertion into its base using the appropriate carrier. Fuse and link carriers and holders shall be coloured as follows:

- fuse links: black
- neutral links: white
- earth links: green

– A spare set of all fuse types and ratings used within a functional unit shall be mounted within each functional unit.

– Combination fuse switches shall comply with SANS 152 and shall be of the independent manual operation type and shall afford minimum protection of IP21.

d) Switch operator

– Switch operating mechanisms shall include operators for fuse switches, switch-disconnectors, moulded case circuit breakers and motor protection circuit breakers for Assemblies.

– Switch operating mechanisms shall be door mounted and the switches shall be fixed mounting.

– Switch operating mechanisms shall positively engage with the switch shaft when the door is fully closed and shall be so interlocked with the door so that:

- It shall not be possible to gain access via a cover or door to any live points unless the switch is in the open position.
- It shall not be possible to re-close the door or cover unless the switch is in the open position. Operation of the switch with the door open is permissible.

– Clear indication shall be given, both with the access cover or door open or closed, as to whether the switch is in the open or closed position. Colour indication alone will not be acceptable.

– Operating handles shall be pad lockable in the "off" / "open" position. The mechanisms shall accept not less than two padlocks each having a shackle diameter of 6 mm.

- Any isolator mechanism extension shafts shall be provided with guide brackets as necessary to prevent excessive shaft deflection.

e) Contactors, Relays and Timers

- Contactors and relays shall be selected so as to be suitable for the foreseeable operating duty (utilisation category) and operational frequency. They shall operate reliably under reduced voltage conditions by closing (i.e. pulling in and holding) at 85%, and remaining closed at 60%, of the rated coil voltage, and shall be suitable for continuous operation at 110% of the rated coil voltage.

- Contactors shall comply with SANS 60947-4-1 and shall be electro-magnetically operated air-break multi-pole block type construction. They shall readily accept a wide variety and configuration of auxiliary contact blocks, which shall have their terminals protected to IP2X.

- Relays and timers shall be totally enclosed plug-in devices. The bases shall be keyed in order to differentiate between differing relays and timers, and their differing coil / electronics operating voltages, and to prevent incorrect insertion. Bases shall be fitted with retaining clips, and each relay / timer shall have its pin configuration printed on the side of its casing.

- Relay / timer bases shall have screw clamp type terminals protected to IP2X, which shall be accessible with a screwdriver whilst the relay / timer is plugged in.

- Relays shall be provided with a transparent enclosure, visual indication that the relay is in the energised and closed state, and a manual test button.

- Timers shall operate electronically or be synchronously driven and shall be provided with linearly calibrated time interval scales. The smallest indicated time interval shall be 10% (or less) of full scale, with a repeatability of 1% (or better) of full scale. Timers shall be provided with ‘energised’ and ‘timed out’ indicators.

- Where timers require to be viewed by operators, they shall be flush front of panel mounted behind a transparent lockable cover.
- Contactors shall be satisfactorily withstand the thermal and dynamic effects arising from the magnitude and duration of through fault currents dictated by the characteristics of the associated protective devices and shall be selected in accordance with the kW/current rating.

- Contactors shall be triple-pole electromechanically operated air-break type, held in or latched pattern as specified.

- Contactors shall be classified as utilisation category AC3 uninterrupted duty for motor starting and as utilisation category AC1 intermittent duty, Class 1, 60% for heater duty.

- Contactors shall be fitted with the required auxiliary contacts. These shall be rated at not less than 6 A and shall be positively driven in both directions.

- Auxiliary relays for control purposes shall be of the multiple pole type and shall preferably possess the feature of field convertible contact configuration.

- Plug-in type relays shall have:

  - Positive-acting mechanical retaining clips. Contact friction alone as a retaining method is unacceptable.

  - A keyed member on plug and socket sides to prevent incorrect insertion.

- Clear and indelible markings on both the relay and its base indicating the circuit reference in conformity with the associated circuit and connection diagrams.

– Auxiliary time delay relays shall be of electronic or synchronous motor-driven type and the time setting shall be infinitely adjustable over the range of 5–100% of the maximum delay. Timing relays deriving the delay function by thermal or pneumatic means will not be acceptable.

– Auxiliary relays shall have a minimum of 4 individual contacts and shall preferably have the facility to add an extension block with an additional four (4) individual contacts.

f) Control switches and pushbuttons

– Control selector switches shall be of a rotary spring-loaded type, with an AC11 rating, and shall have clearly identified switch positions. Where switches are lockable, the key shall be held captive in the abnormal or over-ride position.

– Pushbuttons shall comply with SANS 60947-5-1 and shall be of a 22 mm diameter, flush bezel type.

– Emergency stop pushbuttons shall be of a mushroom headed push to stop, stay-put and twist-to-release type. Key type release buttons shall not be used.

– Pushbuttons shall be coloured as follows:

Table 8: Pushbutton colours

Function	Colour
Start	Green
Stop	Red
Reset	Black
Emergency stop	Red
Lamp test	Black
Close / Down	Green (or black)
Open / Up	Green (or white)
On	White (or green)
Off	Black (or white)
Forward	Green (or white)
Reverse	Green (or black)

– Pushbuttons shall be of the one-hole fixing, oil tight pattern.

– Operators (and the mating holes) shall be keyed to prevent rotation of the assembly in the panel.

– Contacts shall be adequately rated for the circuit duty but shall not be less than 10A, 230V AC or 120V DC rating.

– In addition, the operator shall carry an internationally acceptable symbol indicating its function or shall have mounted immediately above it a clear legend of its function or action.

– Operators initiating a motion or circuit closure shall be flush with the surrounding bezel, while operators stopping a function or opening a circuit shall project beyond the bezel.

– Operators providing a selective function e.g. local/remote or auto/manual, shall operate in a semi-rotational manner with equal angular displacement about an imaginary vertical centre line.

g) Indicating lamps

– Indicating lamps shall be suitable for use on either 230V AC or 24V DC control supplies and shall be light emitting diode (LED) type. Lamps suitable for use on 230V AC shall incorporate a step-down transformer. Indicating lamps shall be continuously rated for a voltage of 10% in excess of the rated voltage.

– Lamps shall comprise 22 mm diameter units incorporating either a multi-cluster array of LEDs or a single high intensity surge protected LED; replaceable from the front of panel without any special tools.

– Indicating lamps shall render good visibility under conditions of an ambient illumination level of 400 Lux.

– Lamps shall be provided with one of two indicator lamp colour coding schemes as follows:

- a primary colour coding scheme, in compliance with IEC 60073, or
- a secondary colour coding scheme; which although not standard, is required in order to harmonise with existing operational equipment.

– Unless detailed otherwise in the Detail Specification, the Assembly shall be provided with indicating lamps coloured in accordance with the primary colour coding scheme, which shall be as follows:

Table 9: Primary colour coding scheme

Function	Colour
Dangerous condition	Red
Emergency / hazardous condition	Red
Emergency stop operated	Yellow
Impending critical condition	Yellow
Alarm / abnormal condition	Yellow
Tripped / fault condition	Yellow
Warning	Yellow
Normal condition	Green
On	Green
Running	Green
Closed condition	Green
Mid position / mid travel	Green + White
Open condition	White
Available / auto available	White
General indication / monitoring	White
Mandatory operation required by operator	Blue

– Where specified in the Detail Specification, the manufacturer shall supply an additional number of loose indicating lamps (or their coloured lenses) of a specified type and coloured in accordance with the primary colour coding scheme and shall retrofit these to specified existing assemblies.

– Where an assembly is provided that incorporates lamp colours in accordance with the secondary colour coding scheme, the manufacturer shall also supply an additional quantity

of loose indicating lamps. There shall be a sufficient quantity of the required types and colours; coloured in accordance with the primary colour coding scheme, to permit a third party to retrofit them the Assembly at a later date in order to bring it into compliance with the primary colour coding scheme. In addition, the final drawings for the Assembly shall not detail the colour of any indicating lamp that does not comply with the primary colour coding scheme.

h) Power measuring instruments and current transformers

- The Detail Specification states which functional units shall be provided with power/current and voltage measuring instruments, the type, and the facilities required.
- Display instruments used to indicate voltages and currents shall normally be analogue instruments, shall comply with IEC 60051, be of the low-impedance type and have an accuracy class of 1.5. They shall be flush front of panel mounted with a 90° quadrant minimum scale length, and be DIN96 size for power distribution functional units, and DIN96 or 72 sized for motor starter functional units.

- External zero adjustment shall be possible on all indicating instruments to facilitate adjustment without dismantling the instrument.

- Instruments shall be scaled to 120% of the anticipated designed indication. Ammeters shall be provided with compressed scales to accommodate motor starting or other in-rush currents, and ammeters monitoring motor currents shall be provided with an adjustable red pointer to indicate full load current.

- Meters and relays shall be capable of withstanding, without damage, the secondary currents associated with the maximum available through fault current.
- Instruments shall be provided with shrouded connections to their rear, and ammeter circuits with a full-scale deflection in excess of 25 A shall be connected via current transformers (CTs). Apart from CT and ammeter circuits, instrument circuits shall be fused.

- Instruments used in power distribution circuits shall be flush front of panel mounted and shall provide selectable front of panel digital display of at least the following measurements:

  - voltage between phases and between phases and neutral
  - current in each phase
  - power (kW)
  - kVA
  - power factor
  - consumption (kWh)

- They shall provide data output signals for presentation to PLC, SCADA, telemetry, etc.

- Where the Detail Specification indicates that instruments shall provide fieldbus communication with a control system, this shall be via an open protocol compatible with the proposed control system.

- Run hour meters shall be of a 5-digit minimum non-re-settable odometer type, with visual indication of operation, and a minimum resolution of one hour.

- Current transformers (CTs) shall be air insulated, shall comply with SANS 60044, and shall have short circuit ratings in excess of those prevailing at the point of connection. They shall

bear individual rating plates, which shall clearly identify the winding polarities (primary or secondary), together with the connection details of any multi-ratio windings.

– Current transformer accuracy classes shall be selected as follows unless otherwise indicated on single-line diagrams:

Table 10: Transformer accuracy classes

Type of circuit	Class	Comments
Indication	3 or 5	To match the % accuracy of the instrument
Measurement	0.5 or 1	To match the % accuracy of the instrument
Motor protection	10P10	Or as required by protection device manufacturer
Power system protection (e.g. IDMTL)	10P20	Or as required by protection device manufacturer
Power system unit protection (high accuracy; e.g. REF, generation, unit protection)	PX	As specified by protection device manufacturer

– One pole of the secondary winding of each CT (or group of CTs) shall be connected to earth via a link. All connections to the CT secondary winding shall be made via a proprietary shorting terminal test block. Provision shall be made for attaching test links.

– Current transformers shall be of the low-impedance type and shall, where ratio, class and output requirements permit, preferably be of the ring-type bar-primary design.

– Current transformers shall be rated to withstand the thermal and magnetic stress resulting from the maximum available through fault current.

– Bridging terminals for current transformers shall be provided at the outgoing terminals where external connections are required. In addition, terminal blocks shall be provided to permit secondary injection tests on protective relays.

i) Control-circuit and auxiliary supply transformers

– Voltage transformers shall be designed, constructed and tested in accordance with the requirements of SANS 60044.

– Voltage adjustment over the range 95–105% of nominal ratio shall be provided by off-circuit tappings.

– Transformers shall be provided with isolating switches on the HV side and with protection on both the HV and LV sides.

– Voltage transformer primary and secondary windings shall be protected by fuses.

– The protection on the HV side shall be rated sufficient to withstand inrush currents.

– Control transformers shall be rated as follows:

- Sum of sealed-in burden of all contactors, relays, timers and lamps fed from that unit; plus
- Pickup burden of largest Contactor fed from that unit; plus 10%.

- The regulation on closing the largest circuit with all the loads except that of the largest load, or if there is more than one, one of the largest loads, imposed on the transformer, shall not exceed 5%.

- One side of the transformer secondary winding, or the star point thereof, shall be connected to earth via a removable bolted link.

- Voltage transformer nameplates shall be fixed in a position so that details can easily be read when fitted in the cubicle.

j) Capacitors

- Capacitors shall be of the non-toxic, dry, self-healing, metallised film type, and comply with SANS 60831.

- Capacitors shall be fitted with a means of electrical discharge to reduce the residual voltage to less than 60 V within 5 seconds of being switched off.

C3.3.4.2.4.5 E200.4.5 MOTOR STARTER FUNCTIONAL UNITS

a) General requirements

- Motor starter functional units shall be provided as indicated on the single-line diagrams and as detailed in the Detail Specification, and all equipment, components, and wiring shall be included to achieve the required functionality. The following methods of motor starting shall be considered, where the selection is the Contractor's responsibility, to provide the required functionality:

  - direct-on-line (DOL)
  - star/delta (open/closed transition to suit application)
  - line reactor
  - auto-transformer (closed transition)
  - soft starters and variable speed drives using power electronics

- Where specified in the Detail Specification, integral direct-on-line starters complying with SANS 60947-6-2, shall be used for motor starters of less than 10 kW. The integral motor starter shall incorporate an isolation device, a short circuit protective device, a contactor and overload protection with Type 2 coordination.

- Each motor starter shall be provided with an isolation and short circuit protection device.

- Motor starter contactors, short circuit protective devices, and thermal overloads shall be selected so as to provide Type 2 Co-ordination in accordance with SANS 60439-4-1. The minimum starter contactor utilisation category shall be AC3.

- Motor circuit residual current protection shall only be provided where necessary to discriminate with upstream protection, where the power supply is derived from a TT source, or where specified in the Detail Specification.

- Contactors used where simultaneous closure would be dangerous, e.g. in reversing, star-delta, or closed transition starters, shall be provided with both mechanical and electrical interlocks.

- Where components with short time ratings are used, e.g. resistors, transformers, etc., they shall be provided with hardwired temperature monitoring circuits, arranged to trip the line contactor if their thermal limits are reached.
- Withdrawable starters shall be provided with suitable interlocks to prevent chassis withdrawal or insertion when the starter isolation device is in the “on” position.

b) Functional requirements

- Every individual motor starter unit shall include all equipment, components and wiring necessary to safely and reliably operate the driven plant item. It shall be possible to manually operate plant item from the front panel of its functional unit, notwithstanding any failure or de-selection of any automatic control system, networking / communication facility, PLC, SCADA, or telemetry system. In order to achieve this, the appropriate push buttons / keypads and indicators shall be provided front of panel.

- If the power supply fails whilst a motor is running, the line contactor shall open. On restoration of the power supply, the motor starter shall immediately be made available to re-start the motor without manual attendance or intervention on receipt of a start command (be it initiated manually or automatically). However, where a hardwired automatic control facility is available, a power-on delay timer (adjustable between zero and 60 s) shall be provided in the hardwired circuit.

- Where a ‘healthy' signal is required, it shall confirm that the functional unit isolation device is closed, the starter control supply is healthy, no fault condition exists, emergency stop(s) are released, the local isolator (where fitted) is closed. The ‘healthy' signal shall be used to provide the ‘drive available’ input signal to any automatic control schemes or automatic duty selection routines.

- Each functional unit shall provide any automatic control schemes (including auto duty selection routines) with the following status signals as a minimum, as well as all others as specified in the Detail Specification:
  - Manual/auto mode
  - Running
  - Tripped
  - E/Stop activated

- Each motor starter shall be provided with an emergency stop circuit, which together with its components shall comply with BS EN 418. A field ‘twist to reset’ emergency stop button shall be provided. On operation of the emergency stop circuit, the motor line contactor shall immediately open, and the emergency stop circuit shall lock out until it is reset. A front of panel ‘emergency stop operated’ indication lamp and a status signal for PLC monitoring shall be provided. A composite starter may have a common emergency stop circuit controlling all of its constituent drives.

- Where identified in the Detail Specification, specific process or driven plant interlocks shall be hardwired into the motor starter, and when operated, shall stop and inhibit the drive.

- Front of panel pushbuttons shall be provided for manual start (forward, and where applicable; reverse), and manual stop. A front of panel control selector switches shall be provided for ‘Manual / Off / Auto’ or ‘Remote / Local’ as specified in the Detail Specification.

- Front of panel indicator lamps shall be provided for ‘running’ and ‘tripped’, and an ammeter shall be provided for motor circuits; other front of panel indications e.g. specific fault

indication lamps, hours run meter, number of starts counter, etc. shall be as specified in the Detail Specification.

c) Motor protection

- As a minimum, every motor starter circuit shall be provided with a thermal overload unit connected to monitor the current in each energised winding of the motor. Unless otherwise specified in the Detail Specification, motors of over 30 kW shall be provided with electronic overload protection, and motors of over 75 kW shall be provided with electronic motor protection relays. Intelligent multifunction electronic relays shall be provided if specified in the Detail Specification.

- Thermal overloads shall be scaled and adjustable such that the motor rated current is mid-range and shall provide a temperature compensated thermal element for each supply phase to the motor. The unit shall provide single phasing protection and incorporate auxiliary tripping contacts with a manual test facility. The unit shall be capable of being manually or automatically reset (set to auto). Unless otherwise specified in the Detail Specification, thermal overloads shall be trip class 10.

- Electronic overload units shall incorporate the features required of a thermal overload, together with provision for the adjustment of tripping and reset times. In addition, stalled rotor protection shall be provided, together with integral thermistor protection where required. Where required, electronic overloads shall be suitable for use in conjunction with power electronics (soft starters or variable frequency converters).

- Electronic underload protection shall be provided for all centrifugal pump, fan, or directly driven mixer motor circuits above 30 kW. When detecting underload, the device shall measure the true motor power (and not just the phase angle), shall be configured to detect an unloaded running motor condition, and shall incorporate start delay, motor trip, and manual / auto reset (set to auto) facilities. The unit shall incorporate a digital percentage load display.

- Where required on drives of less than 30 kW, the underload unit shall be provided with overcurrent protection providing the same facilities as a thermal overload. When required on larger drives, underload protection shall be provided as an integral part of an electronic overload or motor protection relay, and where applicable shall be suitable for use in conjunction with power electronics.

- Motor thermistor and RTD (PT100) relays shall be provided for motors which have been specified to be fitted with thermistors or RTDs.

- Motor starter functional units for immersible/submersible pumps shall incorporate all the standard integral motor and pump protection, such as water ingress, temperature of windings and bearings, vibration, etc.

- All protection devices shall operate in a fail-safe manner via electrically maintained relays which de-energise on a fault condition. On sensing a trip condition, the devices and relays shall electrically lock-out the emergency stop circuit and shall be reset manually using a front of panel common fault reset pushbutton. In addition, they shall automatically reset on control supply switch on and upon power restoration in the event of a power loss.

- Electronic motor protection relays and digital overload and underload devices which provide operator interfaces shall have front of panel mounted displays and controls.

d) Test circuits

- The motor starter control circuit supply shall be provided with a functional test facility, whereby the functionality of the control circuit and its equipment and components can be

fully demonstrated with the compartment door(s) open, but whilst the motor circuit supply remains isolated at the functional unit isolating device.

- A control selector switch shall be provided for 'Normal/Test' selection inside the relevant compartment

- The test supplies shall be arranged to be de-energised when the motor circuit supplies are energised. The test supply shall be provided with short circuit protection and shall be capable of isolation.

C3.3.4.2.4.6 E200.4.6 BUSBAR AND BUSBAR TRUNKING

- The main distribution circuit through the Assembly shall comprise a main and distribution busbar system, comprising of 3 phase and neutral busbar system. The rated current of the busbar system shall match the rating of the main incomer

- All main and distribution busbars, risers and droppers shall be air-insulated and shall be fabricated from hard drawn, high-conductivity copper. Aluminium busbars will not be permitted. Busbars shall be tinned for wastewater treatment works (WWTW) applications. If pre-tinned copper work is provided, cut surfaces may remain bare, providing the current path is unaffected and suitable contact lubricants are used before tightening joints.

- Main busbars shall be enclosed together within the top of the Assembly. No other conductors shall be run in the busbar compartment. Access to the busbars shall be through covers, requiring the use of a tool for removal. All internal fixings shall be held captive. No components shall be placed in a busbar compartment.

- Main and distribution busbars shall be continuous over each section, extending to over the full length of the Assembly with the same current rating and cross-sectional area throughout their length.

- Main busbars, distribution busbars and all flexible connections, shall be adequately sized, braced and supported to withstand any electromagnetic forces and thermal effects to which they may be subjected, including the occurrence of fault currents, up to the full fault levels specified.

- The vertical riser buses shall be copper full height and rated for the section total load. Small openings in the vertical barriers shall permit the plug-on control unit contacts to pass through and engage with the vertical bus bars. Unused plug-on openings in the vertical barriers shall be equipped with plastic snap-in closing plugs.

- All busbar connections shall use joints secured against loosening. Joints and Tee-off connections in busbars shall be made by means of high-tensile bolts, nuts and approved locking washers. A minimum of two such bolts shall be used per joint or tee. The joints shall not be taped in order to facilitate visual inspection and checking of bolt tensions. The joint contact areas shall be smooth, very flat and polished or tinned for dry jointing.

- Busbars shall be provided with phase colour markers, red, white, blue (and black in the case of four wire systems). Such colour identification may take the form of coloured bands at intervals along the busbar run of not more than 800 mm. The combined width of the colour bands per phase shall not be less than 300 mm per 800 mm busbar length. The use of the convention, Red, Rear, Right shall be employed

- The maximum length of any cable connections from a busbar shall be 1000 mm.

- A cabled 'busbar' system of the specified radial or closed ring arrangement may be offered as an alternative to a conventional system if:

- The Assembly has a rated short-time withstand current or rated conditional short-circuit current not exceeding 10 kA; or
- The Assembly is protected by current limiting devices having a cut-off current not exceeding 17 kA at their rated breaking capacity.

– This will generally mean that the rated current of such an Assembly will be less than or equal to 100 A.

C3.3.4.2.4.7 E200.4.7 INTERNAL WIRING AND FILLED CONNECTIONS

a) General

– All wiring within the Assembly shall run directly between terminals, without any joints or other connections. Wiring shall be carried out using multi-strand, single-core PVC-insulated copper conductor, 660/1 000 V grade (minimum), to SANS 1507, sized and de-rated where required for the currents to be carried. Single-stranded conductors shall not be used, and no conductor shall be less than 1.5 mm² cross-sectional areas.

– Field wiring connections will be identified by others using the field device tag references. This information will be provided by the Engineer, and the Contractor shall use these field identifiers when identifying the compartment field terminations.

– Wiring layout shall permit alterations to individual circuits without requiring shut down of the complete Assembly.

b) Cable Ways inside Assembly

– All bus wiring and interconnections between compartments within the Assembly shall be contained within the enclosure and shall be segregated in wire-ways separate from other compartments. Where such wiring is terminated in a compartment, it shall be segregated from all other wiring in that compartment. All wiring and cabling entering or leaving a compartment or passing through a partition shall do so via a permanently fixed bush.
– Wiring between components shall be:

- carried out in a neat and systematic manner
- contained in non-metallic trunking
- Run to compartment doors in spiral wrapping.

– Any wire containment system shall securely locate the wiring and provide 25% spare capacity on completion. Cableways shall have furthermore sufficient space to enable the installation and removal of any cable without the need to remove any other cable or component. Cableways shall incorporate adequate facilities to locate and support the cables.

– Wiring on compartment doors shall be similarly supported and shall be provided with support and protection across the door to compartment side wall transition, whilst permitting the door to be fully opened without straining the wiring. Wiring system accessories shall not deteriorate with heat or propagate flame.

– Wiring shall be segregated according to need; circuits that enter the compartment without isolation shall be separately segregated and loomed with spiral wrapping and identified. Control circuits shall be wired in twisted pairs or screened cables, and together with data network cabling, shall be physically segregated from power circuits by barriers. If lightning

and/or surge protection measures have been used to protect individual circuits, these circuits shall be segregated from the wiring of other unprotected circuits.

- Cable-ways or chambers shall not contain any equipment or components.
- Where field cables are terminated other than in the base of the enclosure, cable-ways or cable chambers shall be provided to transport the cables through the enclosure to the compartment or cable box at which they are glanded or terminated. Careful thought should be given to the termination of power cables and their location within the assembly.

c) Gland Plates

- All field cables and wiring shall enter the enclosure through gland plates, which shall be located so as to facilitate the spreading of cable cores.
- Gland plates shall be rigidly supported and maintain the IP rating of the enclosure
- Gland plates and cable boxes shall minimise the effects of eddy currents and be suitable for the type of cable used. Single core cable gland plates shall be made of non-magnetising material.
- Gland plates for bottom access cabling shall be located at least 300 mm above the finished floor level.
- Each compartment gland plate shall be an integral part of the construction of that compartment

d) Identification

- All wires shall be identified at both ends using colour coded alpha-numeric ferrules. Within a compartment, a wire shall have the same identifier at both ends; and this identifier shall not be duplicated within a functional unit.
- Components and wiring shall be installed such that the identification of every wire is clearly visible and readily accessible on completion of the Assembly installation at site. Horizontal wiring identifiers shall be read left to right, and vertical wiring identifiers shall be read bottom to top.
- All conductors shall be identified in conformity with the approved circuit and connection diagrams. No number shall be used more than once in each panel except where electrically identical. Wires/conductors shall have the same number on either end of the wire and all wires which are electrically identical shall have the same wire number
- Circuit wiring shall be coloured in accordance with the following:

Table 11: Colour code for wiring

Wire colour	Function
Red (white, blue)	Red (white, blue) phase connections in current and voltage-transformer circuits or connections in red (white, blue) phase power circuits
Black	Neutral (star-point) connections whether earthed or unearthed insulated wires
Red / black	Connections in AC control circuits (black = neutral)
Red / black	Connections in DC control circuits (black = negative)
Green and yellow	Earth wires and earthing

- Power-circuit conductors shall be coloured according to the phase to which they are connected.

e) Termination

- Wiring shall be terminated using crimped cable ends, lugs or any other approved method that is appropriate for the conductor size and type of termination. All of the strands forming the conductor shall be connected at the point of termination. Soldered connections shall only be used on electronic equipment where it is not practicable to use any other termination method.

- Wiring with a cross section area of less than or equal to 6 mm² shall be terminated in terminals mounted on DIN rail. Wiring with a cross section area of greater than 6 mm² shall be terminated in bolted terminals.

- All wiring entering or leaving a compartment shall do so via terminal rails, with the exception of specialised signal or data circuits, which may be cabled directly to dedicated connections on electronic equipment located at the periphery of the component mounting plate.

- The conductor shall be clamped in such a manner that the captive clamping screw does not come into contact with the conductor. Alternatively, screw-less spring clamp tensioning terminals may be used to terminate single conductors of up to 10 mm². Conductors of cross-section above 16 mm² shall be terminated using stud type terminals; similarly mounted and grouped on DIN rail.

- No more than two conductors shall be connected to one side of a terminal. Where it is necessary to connect adjacent terminals together, proprietary shorting bars or combs shall be used.

- Spare cores shall be terminated at both ends or tied back but shall not be cut short.

- All terminals shall be protected to IP2X, including stud type terminals; which shall be shrouded to achieve this. Terminals shall be segregated according to function and operating voltage; by grouping or by terminal rail mounted partitions or barriers. All stud type terminals shall be provided with individual segregating barriers.

- All circuit terminal rails shall include 10% spare space.

- Terminals shall be grouped together and segregated according to operating voltage and function by terminal rail mounted barriers. Stud type terminals shall be provided with individual segregating barriers.

- Terminals shall face the compartment door for ease of connection.

- Terminals shall be located and spaced so as to enable the easy disconnection and reconnection of conductors, whilst providing sufficient space for the looming and spreading of cable cores. Where practicable, the layout of terminal rails shall be such that cores from the same field cable are not split between non-adjacent groups of terminals.

- All wiring of external connections shall be brought out to individual terminals on a readily accessible terminal block.

- All spare contacts are to be wired back to terminals.

C3.3.4.2.4.8 E200.4.8 LOW VOLTAGE EARTHING

a) Main incoming earth terminal

- The Assembly shall incorporate facilities for connecting to the main incoming earth terminal, subject to its location being clearly identified and easily and safely accessible with the Assembly energised. The Assembly earthing system may comprise either an earth bar extending the full length of the Assembly or, for Assemblies with less than or equal to two (2) functional units and a supply rating of less than 100 A, a stud arrangement.

- Earth bars shall:

  - be manufactured from high conductivity copper (tinned for WWTW applications);
  - be located in a safe and easily accessible position;
  - have a minimum number of joints;
  - have at least one disconnecting link;
  - have facilities for connection to the main incoming earth terminal (the Supply Company earthing system and / or from a local earth electrode system) at each end of the bar, and
  - be rated and tested at a minimum of 60% of the busbar fault withstand capacity
  - have a cross-sectional area of not be less than 500 mm2, nor less than 50 mm in width.
  - be securely connected in each panel or cubicle to bare metal

- Provision shall be made for the connection for the following connections to the fixed portion of the earth bar:

  - electrical installation main bonding conductors
  - functional earthing conductors external to the Assembly
  - equipotential bonding conductors external to the Assembly
  - other equipment protective conductors external to the Assembly
  - the Assembly main earth bar / circuit, which shall be terminated onto the fixed portion
  - an additional 2 No. spare terminations

- All metallic non-current carrying parts of the Assembly shall be bonded together and connected to the Assembly earth busbar.

b) Compartment earthing

- Each compartment shall include an earth stud connected to the main earth bar or stud by separate connections or by a common vertical earth tape. Earth conductors to each compartment shall be sized to withstand the fault level, subject to a minimum cross-sectional area of 6 mm².

- The following shall be directly connected to the compartment earthing terminal by earthing conductors with a minimum cross sectional of 4 mm² or braided straps of similar rating:

  - compartment door
  - any removable cover

- component / equipment mounting rails and earth terminals

– A compartment may contain subsidiary earth terminals or bars to which the following circuits may be specifically connected:

- 'clean' earths from instrumentation circuits and equipment
- functional earths; e.g. from telecommunications equipment
- surge protection earths; e.g. direct connections from lightning protection units

– These earth terminals or bars shall be separately connected directly back to the Assembly main earth bar with 6 mm² minimum cross-section conductor.

– Cable gland plates associated with a compartment shall be provided with an earth stud, which shall be connected directly to either the compartment earthing terminal, or to the main earth bar, with a conductor of 6 mm² minimum cross-sectional area.

– Doors having components mounted on them shall be bonded to the main structure by means of flexible copper earth connection arranged so that it cannot be trapped as the door is opened or closed. Metal hinges shall not be considered sufficient to ensure electrical continuity.

– Where cables carry low level high frequency signals, or are installed where there is a significant risk of high frequency interference; (e.g. in signal circuits connected to equipment containing power electronics), they shall where necessary have their screens / braids capacitively connected to earth in a proprietary manner, and proprietary means shall be included to provide 360° earthing for field cable braids / screens.

c) Intrinsically safe circuit earthing

– If specified on the Detail Specification, separate earth bars or studs shall be provided for connecting equipment requiring a clean earth or an intrinsically safe earth directly to the main incoming earth terminal. If required, such earth bars or studs shall be located adjacent to the equipment requiring a clean earth or an intrinsically safe earth, as appropriate.

– Where Zener diode safety barriers are contained within a compartment, they shall be separately and directly connected to the main earth bar via duplicate earthing conductors; each of 6 mm2 minimum cross-section. These conductors shall be clearly identified as intrinsically safe earths.

C3.3.4.2.4.9 E200.4.9 POWER FACTOR CORRECTION

a) General requirements

– Power factor correction capacitors shall be so selected and sized as to raise the lagging power factor due to induction motor loads; either individually or when summated across the Assembly, to a final corrected power factor of 0.98 lagging. When designing the system, the un-corrected power factor for each motor shall be taken as that quoted in manufacturers' literature for a high efficiency motor of equivalent rating operating continuously at its 75% duty point.

– Capacitors shall be of the non-toxic self-healing dry metallised film type. Every capacitor or group of capacitors shall be provided with integral discharge resistors to reduce the residual terminal voltage to less than 50 V within one minute of being disconnected from the supply.

- Capacitors shall be suitable for continuous connection to a three-phase low voltage industrial power supply. If the low voltage power system to which the Assembly will be connected has significant voltage waveform distortion or harmonic content or has other capacitive or inductive networks (e.g. harmonic filters) connected to it, additional information must be obtained by the Contractor via site surveys.

b) Power factor correction for individual drives

- Where power electronic soft starters are used, the sequence of the connection and de-energising of the capacitors shall be in accordance with the manufacturer's recommendations. Power factor correction shall not be applied to variable speed drive systems.

c) Bulk power factor correction

- Where detailed in the Detail Specification, bulk power factor correction shall be provided for the whole Assembly, in a purpose designed functional unit occupying one or more compartments within the enclosure.

- Capacitors shall be arranged into banks, suitably sized to enable the incremental control of the power factor against a changing load. Each bank shall be automatically contactor controlled, in a manner that minimises switching surges, and capacitor bank status information shall be derived from the contactor auxiliary contacts. A proprietary multi-stage power factor controller, with a minimum of six steps, shall be used to monitor and sequence the switching of the capacitor banks.

- Where there is provision to supply the Assembly from a generator, automatic means shall be included that will inhibit bulk power factor correction when the generator is in use.

C3.3.4.2.4.10 E200.4.10 POWER FACTOR CORRECTION

a) Soft starting equipment

- 10Soft starters shall comprise a proprietary item of chassis mounted equipment, designed for installation within an Assembly. They shall be rated to continuously carry the intended motor full load current and provide the required number of starts per hour.

- The soft starter shall be thermally designed to carry the motor current until the motor protection operates, and where this cannot be guaranteed, high speed semiconductor fuses shall be provided to protect the power electronics. Where such fuses are used, a spare set shall be provided and fixed within the compartment.

- Soft starters shall be of a digital energy optimising design and shall incorporate appropriate motor protection, and where pumping circuits are being controlled, soft stop features shall be included. When the soft starter has completed the ramped application of motor voltage, a 'top of ramp' signal shall be generated.

- Soft starters shall incorporate a built-in by-pass contactor rated for the full load running current of the motor, such that on receipt of the 'top of ramp' signal, the by-pass contactor shall close and divert the motor current away from the power electronics. When running in the by-passed condition, the motor shall continue to be provided with the full protection and monitoring features afforded by the motor starter. When a controlled stop command is received, the by-pass contactor shall be de-energised, in such a manner that the control of the motor is transferred to the power electronics.

- Facilities shall be provided for the emergency stopping of the controlled motor in the shortest possible time. The emergency stop facility shall not be dependent on any software functions within the soft starter or its associated equipment and shall disconnect the soft starter from

the supply by means of a full load rated line contactor fitted between the compartment isolation / protective device and the soft starter.

- Where specified in the Detail Specification, connectivity between the soft starter functional unit and other equipment or systems within the Assembly shall be via an open field device network compatible with the proposed PLC control system. It shall preferably use an interface device integrated within the soft starter, so as to provide remote network access to the full range of the soft starter's control and monitoring facilities.

b) Variable speed drives (VSDs): General

- The VSD motor starter shall comprise a variable frequency converter (VFC), phase shift transformer(s) (where required), and all other components necessary to provide the full speed and torque control of an a.c. cage induction motor over the specified operating speed range up to the

- VFCs shall either be wall-mounted, housed within a motor control centre or free-standing units within their own enclosures as specified in the Detail Specification.

- Unless otherwise specified in the Detail Specification, VFCs shall have uncontrolled rectifiers (i.e. diode front-end) with the specified pulse number (6/12/18). Either a.c. line reactors or d.c. link chokes shall be provided with all 6-pulse VFCs to reduce input current harmonics.

- Where a phase shift transformer is required to achieve the specified rectifier pulse number, the transformer shall be provided as an integral component of the VSD and, unless otherwise specified in the Detail Specification, shall be of the dry type and housed in a dedicated section of the VFC enclosure.

- VFCs shall be capable of operating under the service conditions specified in Clause 4 of SANS 61800 Part 2, and any unusual environmental service conditions specified in the Detail Specification. Functional features and performance requirements shall be in accordance with Clauses 3 and 6 of SANS 61800 Part 2 respectively as varied

- The output rating of the VFCs shall be selected to suit the associated motor and shall take into account the operating speed range.

- Every VSD motor starter shall be provided with incoming supply isolation and short circuit protection as well as an input contactor if specified in the Detail Specification.

- The VSD shall provide the specified motor protection either as an integral part of the VFC or by way of a separate motor protection relay.

c) Where any semiconductor or special d.c. circuit fuses are used in the VFC power circuit, a spare set shall be provided. A list of all fuses, type, ordering code and supplier and supplier details shall also accompany the spare fuses.

- The VSD control system shall incorporate comprehensive diagnostics to provide fault supervision and status indication in accordance with Clauses 3.2 and 3.3 respectively of SANS 61800 Part 2 and any additional requirements specified in the Detail Specification.
- Input/output devices and communication links shall be provided as specified in the Detail Specification.

- The Contractor shall ensure that the suppliers of the VFC and the associated motors confirm that their standard equipment is fully compatible and, if not, that the necessary equipment design changes (e.g. enhanced motor insulation) and/or supplementary equipment (output filters or reactors) is provided to ensure compatibility.

- The Assembly shall permit adequate heat rejection from the VSD compartments and the Contractor shall provide estimates of the total heat rejection from the Assembly. The location of the Assembly and VSD panels, and the ventilation arrangement, shall be as specified in the Detail Specification.

d) Variable Speed Drives (VSDs): EMC Requirements

- All VSDS shall comply with the requirements of product standard SANS 61800-3 for Category C2/C3 as appropriate and an EMC filter shall be provided as part of a VFC if necessary, to achieve the required electromagnetic compatibility.

- The supply voltage distortion limits specified in the Detail Specification shall be achieved through the use of diode front-end VFCs with higher pulse numbers, active front-end VFCs or harmonic filters. Documentary proof shall be provided with the Tender that the VFC input current harmonics will be limited to the required levels.

- When specified in the Detail Specification, the Contractor shall carry out a harmonic survey at the point of supply to measure background voltage harmonics. The Contractor shall repeat the survey after the commissioning of all VSDs to demonstrate that the actual harmonic performance of the VSDs under worst case operating conditions does not exceed the specified limits.

- Any VFC input harmonic filters or line reactors and any output filters (i.e. dU/dT, common mode or sine filters) or reactors shall be provided as part of the VFC and shall be included in the supply price. Output filters shall be provided where required to ensure motor insulation compatibility and/or control of bearing currents. Output reactors shall be provided if motor supply cables exceed the allowable length.

- The design of dedicated VFC input harmonic filters shall take account of the supply impedance provided in the Detail Specification, any background voltage harmonics, any other reactances (e.g. transformers) or capacitors (e.g. power factor correction), or other filters connected to the power system, so as to avoid possible resonance problems.

e) Variable Speed Drives (VSDs): Control

- The VSD control panel / operator interface shall be mounted in the face of the VSD panel/ Assembly. Control parameter adjustment shall be easily achievable by menu-driven option selections, with engineering options protected from unauthorised changes by the use of multi-level password protection.
- All operator controls and indications shall be available front of panel, either via an operator interface / keypad, or by using discrete pushbuttons and lamps, etc.
- The VFC shall incorporate on-board protection, control and monitoring features, which shall include, as a minimum, the following:

  - On
  - Unit Ready
  - Overload
  - Failure
  - Current limit
  - Over voltage
  - Manual start and stop

- Raise and lower speed
- Current operating status
- Speed indication

– The VSD shall be such that when set in the 'manual' mode, operation from the control panel / operator interface shall be as follows:

- a start command shall cause a normal ramped start up to the pre-set speed
- a stop command shall cause a normal ramped down stop and shutdown of the drive

– All diagnostic and fault messages shall be stored, whether reset or not and it shall be possible to recall them from the operator interface/control panel.

– All VFC function parameters shall be programmable from a dedicated keypad, or via a standard programming software package installed on a standard portable notebook. A serial communications port to RS232 / RS485 standard or other network communication port shall be provided for dedicated communication with the VFC, and via which all programmable, control, monitoring and diagnostic functions available locally at the VFC shall be accessible

– A copy of the configuration /standard programming software shall be provided with each VSD.

C3.3.4.2.4.11 E200.4.11 CONTROL CIRCUIT SUPPLIES

a) Provision of control circuit supplies

– Fixed pattern functional units shall incorporate individual control circuit supplies that are derived from within the functional unit.

– Control circuit supplies shall be 230V AC (single pole and neutral) or 24V DC as specified in the Detail Specification. They shall be separately derived from double wound transformers, which where practicable shall have 400V primary windings. Double pole primary winding protection shall be provided by fuses or a miniature circuit breaker.

– The rating of each control transformer shall exceed the sum of the foreseeable maximum continuous load (which for an electromagnetic device shall be the 'hold-in' VA) plus the in-rush.

– Control circuit supplies shall comply with SANS 60204-1, and the neutral terminal of each transformer secondary winding shall be provided with a removable link and shall be connected to earth. Secondary winding overcurrent protection shall be provided.

b) Control circuit features

– One pole of every contactor and auxiliary relay coil, timer, etc. shall be connected directly to the neutral (i.e. earthed) side of the control supply. Each control circuit shall be sectionalised and arranged such that where practicable, discrimination is achieved under fault conditions.

– Where possible, common controls and ICA compartment circuits shall operate at 24V DC and shall interface with the functional unit 230V AC control circuits by means of 24V DC interposing relay(s) located in the functional units.

C3.3.4.2.4.12 E200.4.12 SIGNS AND LABELS

a) General

- Safety signs and labels shall be provided wherever necessary in relevant languages so as to unambiguously communicate safety and functional guidance to any person who may operate the Assembly or otherwise come into contact with any part of the electrical system forming a part of the Assembly, and shall be provided for the specific identification of every component contained within the Assembly.

- Signs and labels shall be located in such a manner that:

  - it is obvious as to the nature and location of the hazards or component(s) to which they relate

  - when mounted on any enclosure cover or plate, there is no possibility of that cover or plate being interchanged with any similar item on that Assembly or on any other Assembly supplied to the same site

  - they are not fixed to easily removable parts (e.g. trunking covers, etc.), unless their purpose is to warn of the consequences of removing a removable part

  - they are at all times adjacent to the item to which they refer, and accommodate situations where components could be moved along a DIN mounting rail

  - they will not be obscured by any equipment, components, or wiring, etc.

  - they are legible and will remain easily read throughout the life of the Assembly

  - Signs and labels shall be securely and permanently fixed using an appropriate number of corrosion resistant, mechanical fixings. The fixing of labels, safety signs and notices shall not affect the IP rating of the Assembly.

- Short individually fixed labels covering several items only, shall be used in lieu of long multi-legend labels; e.g. above a row of indicator lamps.

- Self-adhesive, vinyl safety signs may be used if there is no requirement for special legend and propriety safety signs are available.

- Safety signs and labels shall be of such size that the legend thereon is clearly legible from the operating position (or a 3m distance), and the pictograph and its accompanying text shall be chosen so as to provide the appropriate communication in an explicit and unambiguous manner.

- Safety signs and labels fixed to the outside of the enclosure shall be manufactured from 1.5mm thick anti-reflective polycarbonate with the legend reverse screen printed, or alternatively from 3mm thick bevel-edged clear Perspex rear engraved with black characters. Internal labels may be manufactured from a laminated plastic material which shall normally provide a black legend against a white background. Where specifically agreed with the Engineer, internally mounted labels and charts, e.g. for distribution boards, etc., may be of permanently printed plastic, plastic laminated thin card, or thin card protected behind Perspex.

b) Safety Signs

- As a minimum, safety signs shall be fitted to removable covers over busbars and live connections, and to doors of compartments containing:

- incoming supply cable termination points
- internal switching and isolation devices
- incoming or internal means of isolation; stating the highest voltage controlled by the means of isolation
- functional units incorporating capacitors
- more than one supply or multiple control circuits originating elsewhere
- equipment located in a 'safe area' but associated with certified apparatus located in a hazardous area; a sign shall also be fitted at the safe area cable termination rail.

– A safety sign identifying the operating voltage shall be placed in any compartment where there is equipment, components, or wiring, that can be energised at above extra low voltage.

– Where there is no suitable standard symbol or pictograph, an application specific sign may be produced using simple and appropriate symbols, pictographs, and text, to indicate the hazard in a simple and straight forward manner that is acceptable to the Engineer.

– Multipurpose signs shall be used where there is a need to communicate multiple hazard messages.

c) Labelling

– The text of every label, excluding individual internal component identification labels, shall be as agreed with the Engineer.

– Every Assembly shall be provided with a name plate detailing the following:

- Manufacturer's name or trademark
- Manufacturer's contact details
- Manufacturer's type designation, serial / identification number
- Date of manufacture
- Rated operational voltages, frequencies, and number of phases
- Continuous busbar rating
- Short circuit withstand current and duration
- Cascading label
- IP rating

– An application name shall be prominently displayed on the Assembly, as detailed in the Particular Specification.

– Each compartment shall be identified with a designation label which shall include the full plant functional name and the alpha numeric tag-number, kW rating, full load amp rating. For rear access Assemblies, a duplicate designation label, mounted adjacent to the gland box, shall also be provided at the rear of each compartment.

- The material used shall be selected having regard to the size and fixing methods of the label and the label shall not warp in service. Labels mounted on the outside of the Assembly shall rectangle in form and be manufactured of either:
    - Laminated plastic, engraved so as to produce black letters on a white background
    - Engraved sandwich board ("Trifoliate", "Darvic" or equal)
    - Reverse engraved acrylic material ("Perspex") with filled letters and reverse sprayed
- For outdoor applications (where specified) labels shall be brass or aluminium (with letters filled in black), lightly sanded with fine grit paper and clear lacquered
- Labels for door mounted components and labels used inside the Assembly shall be to the same standard or may alternatively be printed using an approved, propriety system.
- Text characters shall be uniform in height, in upper case (except where standard abbreviations of units are used, e.g. kWh, kVA, etc.) and of the following minimum dimensions:
    - application labels: 8mm
    - compartment designation labels: 6mm
    - information or warning labels: 6mm
    - component identification labels: 3mm
- All components shall be clearly labelled. Internal components shall be clearly identified by individual labels to indicate the equipment to which they relate. The component identification labels shall correlate with the Assembly drawings and documentation. If this is not practical due to space restrictions, common labels (e.g. diagrams may be used).
- Current transformers shall be provided with separate and individual identification and rating plates.
- Each distribution board shall be provided with a circuit chart laid out in a way that matches the orientation and layout of the protective devices in the distribution board.
- A typed circuit chart shall be permanently fixed inside each Assembly or immediately adjacent to the distribution board. The chart shall be laid out in accordance with the physical arrangement of the protective devices that it is easy to relate the circuit chart details to the appropriate protective device. As a minimum, the chart shall be enclosed in a transparent protective cover attached to the inside of the compartment door.

C3.3.4.2.4.13 E200.4.13 INSTALLATION REQUIREMENTS

a) Shipping

- Assemblies shall be shipped in sections to facilitate field handling for transportation and installation. The shipped sections shall be joined together to form a complete unit assembly.
- Preparation for shipment shall protect the Assembly auxiliary devices accessories, etc. against corrosion, breakage or vibration injury during transportation and handling.
- Disassembly shall be into the largest components or sub-assemblies possible, consistent with packing, road transport and handling limitations.

- All parts shall be clearly and lastingly match marked to facilitate field erection prior to disassembly and packing for transport. Instructions shall be provided for reassembly of sections in the field or accompanied by a qualified representative from the Assembly Manufacturer.

- The Contractor shall be responsible for delivery including loading and unloading of all equipment to site.

- The Contractor shall provide information (in time) regarding specialised handling and storage requirements/techniques for equipment on the site until finally installed in the operating location.

C3.3.4.2.4.14 E200.4.14 LOCAL CONTROL PANELS

a) General requirements

- The START/STOP pushbutton or control station shall be mounted adjacent to the drive.

- The enclosure incorporating the pushbuttons, selector switches and indicating lights shall be fully water, weather and vermin-proof and shall have a minimum rating of IP65. The enclosure shall be manufactured from 3CR12 and shall be painted B26 to SANS 1091.

- All pushbutton control station shall be pedestal mounted on a bracket at least 1 000 mm above ground/floor level.

- All START pushbuttons shall be green and the operator shall be flush with the surrounding bezel.

- All STOP pushbuttons shall be a red mushroom head latching push button and shall serve as an emergency stop.

- All selector switches shall be rotary selector switches with black operators.

- The control/pushbutton station shall be adequately designed to provide space for the following:

  - The required pushbuttons, selector switches and indicating lights complete with their appropriate labels.

  - Termination of all control wiring associated with the drive or group of drives. The minimum terminal strip length is 150 mm. A single multicore control cable shall be installed from the Assembly to the station, from where the required signals will be individually wired.

  - Stations for submersible equipment shall in addition of the required control cables, also provide for the termination of all the required power cables.

  - Sufficient space shall be provided for the glanding of the required cables.

- All further requirements pertaining to the design, construction, installation and commissioning of control panels (e.g. Labelling, earthing, commissioning, etc.) shall be as specified in the relevant subsections of this Specification.

- Start/Stop pushbutton stations

- In addition to the above general requirements, START/STOP pushbutton station shall confirm to the following additional requirement:
  - One START pushbutton
  - One STOP pushbutton, The STOP pushbutton shall be twist to release.
  - Where reverse local control is required the reverse button shall not latch unless required.

C3.3.4.2.4.15 E200.4.15 FUNCTIONAL DESIGN

a) Specification to the Contractor

The Engineer shall provide the Contractor with the following information, which will form the basis for the design of the Assembly:

- The Particular Specification
- The Detail Specification will detail all project specific requirements.
- MCC and Local Control Table
- The MCC and Local Control Table will be a schedule of all external connections and their function, ratings, etc. It gives an indication of each load's kW rating and the relevant circuit breaker size that must be selected. Also stated will be the type of starting, the local visual indication and the requirements for manual, automatic and local control needed.
- I/O Schedule
- The I/O Schedule will detail all the input and output signals (analogue and digital) for the controller connections, and the relevant equipment part it connects to.
- Technical Data Sheets
- The Technical Data Sheets are intended for use as standard templates, which will be completed and inserted into the Detail Specification documents, so as to detail the project and product specific requirements for each Assembly as a whole, and for its constituent functional units.
- Project specific configuration of the Technical Data Sheets will take the form of a 'YES' 'NO', insertion of a value or, together with the provision of an associated Particular Specification clause, cross-reference, or stated requirement, etc., as appropriate. When compiling a Detail Specification document, only those Technical Data Sheets applicable to the required functional units will be included.
- One set of Technical Data Sheets will be prepared per Assembly, unless therein detailed otherwise. Individual Technical Data Sheets may be duplicated if applicable, in order to accommodate the extent of scheme specific information.
- Control Philosophy
- The Control Philosophy will detail the functionality of all control and automation systems.
- Cable Block Diagram

- The cable block diagram is a schematic that shows how the components of the Assembly is connected to the equipment and motors that it controls. It also indicates starting method, cable and circuit breaker sizes.

- Assembly general arrangement drawing

- A proposed layout shall be provided for the Contractor as indication of the relevant size constraints for the Assembly. It shall also indicate the number of functional units (e.g. motor starters, feeders, etc.) that is required for the Assembly.

- Building arrangement drawing

- A drawing indicating the Switchgear-room layout shall be used for functional considerations of the Assembly design. This drawing could be provided under the civil part of the project.

C3.3.4.2.4.16 E200.4.16 TESTING AND COMMISIONONG

a) General requirements for testing

- On completion of manufacture, the Assembly shall be subjected to a factory acceptance test (FAT), comprising the Manufacturer's in-house tests, and the repeat tests witnessed by the Client and the Engineer.

- Once the witnessed FAT has been carried out, signed off, and any remedial works have been completed and re-tested, the Assembly is ready for delivery to site. Once erected in position, the Assembly shall be subjected to a witnessed site acceptance test (SAT).
- Once the SAT has been carried out and signed off, any remedial works shall be completed and re-tested. Plant installation and site cabling will then be carried out by others, and on its completion, witnessed commissioning shall commence.

- The manufacturer shall allow for each test (apart from in-house tests) to be witnessed by both the Client and the Engineers simultaneously. An individual testing activity shall not be considered to have been completed until any results have been recorded, and it has been signed off by the Engineer.

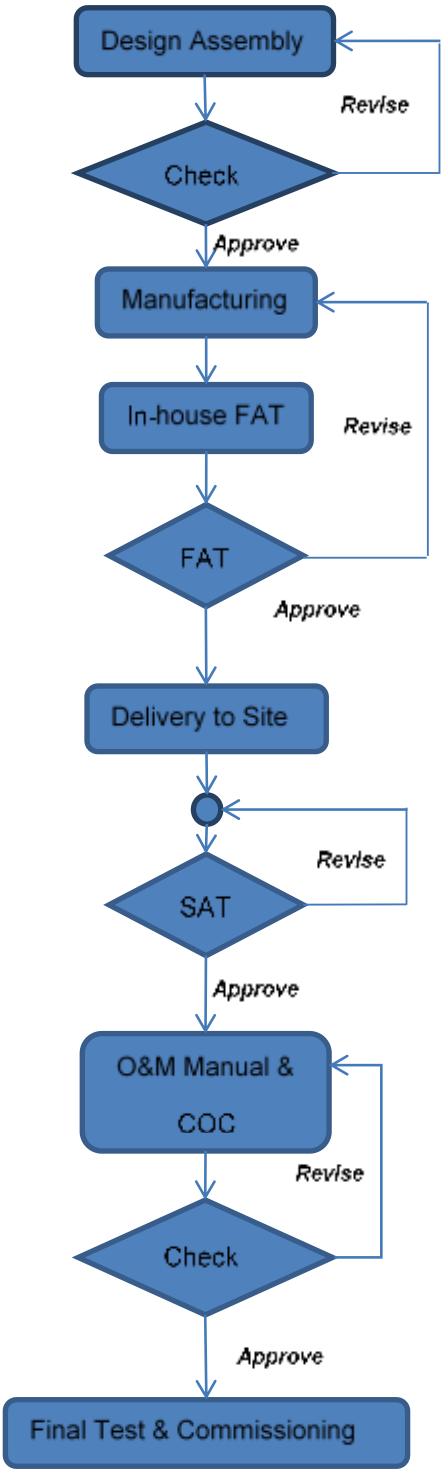
- The manufacturer shall provide the Client and Engineers with all reasonable facilities, including testing staff and test equipment, to carry out the inspections and tests, and to check the Assembly for compliance with all of the Client's requirements.

- The manufacturer shall ensure that all testing is carried out in a safe manner and shall protect those witnessing from danger; in accordance with the Occupational Health and Safety Act.

- In order to demonstrate the functionality of each circuit, external devices shall be simulated in a representative manner. A small motor shall be used as a test load where motor starters incorporate power electronics. During development, software may be electronically verified away from the Assembly using a simulation / diagnostic package; notwithstanding this, control systems shall be witnessed tested with the software loaded into the programmable devices, and with simulation of the physical I/O devices.

- Where the Assembly incorporates equipment requiring special testing facilities or procedures, the manufacturer shall ensure that appropriate resources are available; including where necessary, representatives from the equipment Manufacturer.

PROCEDURE FOR TESTING AND COMMISSIONING

Action	Action By	Documentation
	Manufacturer/Contractor	
	Engineer	SLD drawings, Assembly GA drawings
	Manufacturer/Contractor	
	Manufacturer/Contractor	In-house FAT document
	Manufacturer/Contractor/ Engineer/ Client (If required)	Final FAT document, Functional Specification
	Manufacturer/Contractor	
	Manufacturer/Contractor /Engineer	SAT document
	Contractor to provide to Engineer	Draft Copy of O&M manual COC
	Engineer Contractor provides O&M Manuals	3 Copies of approved O&M manual
	Manufacturer/Contractor /Engineer/Client(If required	Commissioning Test document

FAT: ***Factory Acceptance Test;*** **O&M Manual:** ***Operating & Maintenance Manual;*** **SAT:** ***Site Acceptance Test;*** **COC:** ***Certificate of Compliance***

b) Factory acceptance tests (FATs)

- The manufacturer shall perform his in-house works tests in accordance with the proposed FAT procedures and shall satisfy himself as to the accuracy and quality of the manufactured Assembly in accordance with the accepted design. Once the in-house FAT has been carried out, signed off by the manufacturer, and any remedial works have been completed and re-tested, the tests shall be repeated and witnessed by the Client (if required) and the Engineer.

- The in-house and the witnessed FATs shall check compliance with SANS 60439-1, and shall include the following:

  - A thorough external and internal visual inspection.
  - Confirmation of adequate earthing.
  - Secondary injection testing of all protective circuits shall be carried out, except where discrete current transformers are used; in which case sufficient primary injection testing shall be carried out to prove the ratio and the polarity.
  - Meggar tests shall be performed across all main and distribution busbar joints.
  - All busbars shall be subjected to a single witnessed reduced voltage dielectric 'flash' test; the in-house test shall also be at a reduced voltage.
  - All power circuits shall be subjected to insulation resistance tests.
  - The operation of every mechanical device and interlock shall be verified.
  - All circuits and their functionality shall be tested as detailed in the Control Philosophy and MCC and Local Control Table.
  - Any other test necessary to verify satisfaction with the requirements of Table 7 of SANS 60439-1.

- When testing the performance of any software, it shall be demonstrated using the hardware intended to be incorporated within the Assembly, and where this is not possible appropriate operator interfaces, programming units, and terminal units, etc. shall be provided. Where it is necessary to demonstrate an interface with a piece of unavailable equipment to be supplied by others, appropriate means to replicate that equipment and simulate the interface shall be provided.

- The Engineer preserves the right to cancel and postpone tests if he finds that the Contractor has not made reasonably sure that the test will be successful. Any extra costs incurred shall be borne by the Contractor.

c) Site acceptance test (SAT)

- All equipment and every circuit that was altered or disturbed subsequent to the completion of the FAT, or for shipping and site erection, shall be specifically re-tested for integrity and functionality.

- During the SAT, all busbar joints that are re-tightened on site shall be subjected to a further Meggar test, and all busbars shall be subjected to a single witnessed full voltage dielectric 'flash' test.

- The process functionality of each aspect of the control system and its operator interface shall be demonstrated, including the correct operation of all I/O and network links external to the Assembly or not otherwise tested during the FAT.

- A COC shall be provided to the Engineer, before final Testing and Commissioning can start.

d) Commissioning and other tests

- The manufacturer shall provide attendance during the commissioning of the Assembly, whereby the functionality of the Assembly and its control system and software shall be proven. During commissioning the manufacturer shall make such adjustments, software modifications, and circuit changes, as are deemed necessary to provide the level of plant functionality and performance specified by the Client. All such changes shall be immediately incorporated into the 'as installed and tested' documentation and the Operating and Maintenance Manual, by the Contractor.

- The manufacturer shall provide an acceptance document, to detail and record the tests and their anticipated results, and the acceptance document shall have provision for recording and signing off the results.

C3.3.4.2.4.17 E200.4.17 DOCUMENTATION AND TRAINING

a) General

- All drawings, information, and documentation shall be in English, and each item shall be identified with:

  - the Client's name and contact details
  - Client's project / scheme / contract reference title and numbers
  - the Engineer's name and contact details
  - Engineers reference numbers
  - Contractor's works / contract / order references.

- Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

b) Drawings for Approval by the Engineer

- The following documentation and drawings shall be submitted to the engineer prior to the procurement or manufacturing of Assemblies and related equipment:

  - Cable block diagrams.
  - General arrangement and elevation drawings, compartment door layouts, typical component mounting plate layouts, and foundation plans.
  - Electrical schematic diagrams showing all equipment and components incorporated into the Assembly. Known circuitry outside of the Assembly and connected to it, shall be shown on all drawings. Drawings shall be cross-referenced using a grid / line reference system.
  - Protective device grading for overcurrent, short circuit, and earth fault / leakage devices incorporated within the Assembly, together with a schedule of proposed settings that will ensure discrimination.

- PLC software and configuration documentation; including ladder logic diagrams and HMI display screens, etc. The documentation shall be complete and annotated with purpose, function, duty, cross-references, and descriptions, etc.; sufficient to guide an unfamiliar person through the operation of the software.

c) Testing Documentation and Reports

– The FAT and SAT shall be according to BS EN 62381.

– A factory acceptance test (FAT) document shall be provided to the Engineer prior to the witnessed FAT. This documentation shall show the manufacturer's in-house test procedures and results for all items of equipment, components, hardware, and software. The document shall show hardware checks, the software simulation procedures, and their combined functional testing. It shall comprehensively and clearly show the test results of the in-house testing. The subsequent report of the FAT witnessed by the Engineer shall be appended to this documentation.

– The Contractor shall provide his own testing report template to document the FAT witnessed by the Engineer. This shall be to the satisfaction of the Engineer.

– A site acceptance test (SAT) document shall be produced, which shall detail all tests necessary to demonstrate the functionality of the Assembly following its final erection on site. This shall include details of tests and checks on all circuits disconnected for shipping, together with any equipment, components, wiring, or software altered or incorporated into the Assembly; following the completion of the witnessed FATs.

– All drawings, schedules, listings, and other design documentation for acceptance shall be supplied as a comprehensive and integrated package and collated into folders; unless otherwise agreed with the Engineer. Three copies of appropriate documentation shall be submitted on each occasion that agreement is sought.

– A Certificate of Compliance (COC) shall be provided for all new Assemblies. For all refurbished Assemblies, a letter shall be provided listing all the repairs and stating that the Assemblies are still deemed to be reasonably safe.

– The FAT, SAT, and COC shall each have been submitted and agreed with the Engineer, prior to the commencement of final testing and site commissioning.

d) Certificate of Compliance

– A Certificate of Compliance (COC) shall be provided for all new Assemblies. For all refurbished Assemblies, a letter shall be provided listing all the repairs and stating that the Assemblies are still deemed to be safe.

– The original COC shall go to the client's electrical representative.

– A copy of the COC shall be included in the O&M Manual.

e) Operating and Maintenance Manual

– One copy of the draft operating and maintenance manual and spare parts list shall be provided at an agreed date; in advance of the date of the start of the final testing and commissioning SATs, for acceptance by the Engineer. Three copies of the final editions shall be provided to the Engineer by an agreed date before successful completion of final testing and commissioning.

- The Operating and Maintenance Manual shall be bound into a suite of hard-backed ring binders and shall be provided with an index of all drawings pertinent to the Assembly. The index shall include each drawing's origin, number, issue, status, and the Client's drawing number (where issued by the Engineer).

- The Operating and Maintenance Manual shall include the following:

  - All design drawings and documentation relating to the Assembly; as delivered and tested.

  - 'As installed and tested' records showing verification against stated design and installation criteria, including a schedule of all the final settings for all user adjustable equipment and components, and copies of all documentation presented and completed during the FATs, the SATs, and any other specified tests on completion.

  - Schedules of plant and equipment for each compartment / circuit; including a listing of the applicable standards, manufacturer, settings, type number, re-order code, etc., for each item of equipment and component included within the Assembly.

  - Manufacturers' contact details, technical information sheets for all items of equipment and components included within the Assembly. Manufacturers' catalogues may be provided subject to clear identification of the relevant components. All individual manufacturers' equipment / component test certificates and certificates of conformity shall be included.

  - Inspection, testing, and maintenance recommendations, including detailed and specific operation, maintenance, and diagnostic data, and safe isolation information suitable for use by maintenance personnel, shall be provided for all equipment, components, and systems incorporated into the Assembly.

  - Schedule of spares provided with the Assembly, including manufacturer, description, part number, order code, and quantity.

- The Operating and Maintenance Manual shall include detailed descriptions for use by the Client, on how the controlled plant and its management systems are intended to operate and be operated; under both manual and automatic control. Clear and detailed descriptions for each element of the Assembly shall be provided; and shall include system objectives, controlled plant start-up and shut-down procedures, automatic control, manual intervention, primary and secondary control routines, plant selection including duty and standby options, local and remote selections, operational and safety constraints, status information, alarms and control interfaces with control systems, fault routines, etc.

- The Operating and Maintenance Manual shall include 'as-installed and tested' information on both the hardware and software for each programmable device incorporated within the Assembly, including:

  - Overview of system operation in relation to the controlled plant.

  - System configuration.

  - Manufacturers' literature on operation, maintenance and testing of hardware and ancillaries, programming instructions, and diagnostics.

  - Hard copy program; with listings fully documented.

  - Listing of the final settings of all process dependent variables.

- Permanent back-up copies, licensed in the name of the Client, shall be provided for all software, including operating programmes, application programs, and configuration software for all configurable devices.

– Any interconnecting leads, protocol conversion modules, connectors, etc. necessary to connect and communicate with each programmable / configurable device to a standard portable Notebook.

– Manual format shall be A4 size on the filing side which shall be vertical with 20 mm margin for filing.

e) Training

– General

- The LV switchgear and Control Gear training shall form part of the overall training programme.
- The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the Assemblies.
- The Assemblies shall be in a complete working order before training shall commence.
- A training schedule, together with the name and background of the person who will perform the training, shall be submitted to the Engineer for approval.
- Training and training manuals shall be based on the O&M Manuals.
- Training manuals shall be delivered for each trainee with two additional copies delivered for archival at the project site. The manuals shall include an agenda, defined objectives for each course.
- Where the Contractor presents portions of the course material by audio-visuals, copies of those audio-visuals shall be delivered to the Employer as part of the printed training manuals.
- The Employer reserves the right to videotape the training sessions for later use.
- The training shall include operator training and technical/maintenance training.
- During the installation phase, a person will be designated by the Employer to be closely involved with the installation and commissioning process. The intention is not to interfere with the Contractors' installation team, but to do observation in order to obtain the maximum possible information regarding the installation, to enable efficient maintenance to be undertaken by the Employer after final hand-over and expiring of the guarantee period.

f) Operations and Maintenance training sessions

- There shall be training sessions for the operation and maintenance of the Assemblies
- The program for the training shall include instruction for at least one day per Assembly (8 hours) instruction on-site.
- The program shall at a minimum cover the following:
  - General system overview

- Functional operation of the system i.e.:
  - i) System start-up and shut-down procedures
  - ii) System access requirements
  - iii) Alarms
  - iv) Fault Finding
  - v) Backup Power Procedure (if applicable)
  - vi) Incident Reporting
- Maintenance
  - i) Maintenance Schedule
  - ii) Standard Maintenance Procedures
  - iii) Spare Part Lists

- Upon completion of the course, the operators should be fully proficient in the system operation and have no unanswered questions regarding the system.

C3.3.4.2.5 E200.5 LOW VOLTAGE SWITCHGEAR AND CONTROL GEAR ASSEMBLIES

C3.3.4.2.5.1 E200.5.1 SCOPE

a) Application

- This document specifies the standard requirements for the design, installation, testing and commissioning of electrical installations operating on voltages up to 1 000 Volts AC / 1 500 Volts DC.
- The primary intention of this specification is to ensure the provision of an electrical installation, which has been designed and constructed to ensure safe, reliable, operation and to facilitate safe inspection, testing and maintenance.
- Note, however, that this specification only covers such installations (or sections of installations) that are covered by SANS 10142-1. Note also that certain provisions of this specification are inappropriate for direct application to installations where additional measures (such as earthing, intrinsic safe equipment, etc.) are required by SANS 10142-1 and SANS 10108 (i.e. medical and hazardous locations). For these types of installations, thorough reference must be made to the relevant statutory documentation.

b) Electrical System Characteristics

- The design of the installation shall comply with SANS 10142-1.
- The design of the installation shall consider the following supply characteristics:
  - Voltage, frequency and number of phases
  - Maximum prospective short circuit current (phase to phase and phase to neutral)
  - Type of system, e.g. TN-S, TN-C-S

- Maximum earth loop impedance of the earth fault path external to the installation
- Type and rating of the cut-out or switch device
- Load capability of the supply source, particularly the effects on the supply voltage of the starting of new equipment and any fault contributions from new equipment

– The installation of protective devices shall be correctly co-ordinated within the installation and with respect to existing installations. Discrimination studies shall be performed to validate the co-ordination of the installation.

– All equipment which requires operation or attendance by a person, or requires cleaning or maintenance in service, shall be constructed and installed to allow adequate and safe means of access and adequate working space for such activities. Similarly, the positioning of equipment shall not impede access to, or working space at, non-electrical equipment and services for operation and maintenance activities.

– The installation shall be suitable for access and use by electrically unskilled persons.

– Where additions or alterations to an existing installation are to be performed, the rating and condition of existing equipment, including that associated with the supply, shall be verified to confirm its suitability to carry any additional load. The earthing and equipotential bonding arrangements shall also be verified. No addition or alteration shall have an adverse effect on the existing installation.

C3.3.4.2.5.2 E200.5.2 STANDARDS

a) Associated Documentation

– This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.

– Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.

– The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the installation.

b) Regulations, Specifications and Standards

– The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:

- Occupational Health and Safety Act (Act 85 of 1993)
- Construction Regulations 2003 issued in terms of Section 43 of the Act
- Local Fire Regulations; and
- Regulations of the Local Supply Authority
- and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 12: Section 5: Reference standards

Standard Number	Description
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 156	Moulded-case circuit-breakers
SANS 164	Two-pole and earthing-pin plugs and socket outlets
SANS 475	Luminaires for interior lighting, streetlighting and floodlighting - Performance requirements
SANS 767	Earth leakage protection unit
SANS 950	Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1063	Earth rods, couplers and connections
SANS 1085	Wall outlet boxes for the enclosure of electrical accessories
SANS 1088	Luminaire entries and spigots
SANS 1091	National colour standards of Paint
SANS 1195	Busbars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1431	Weldable structural steels
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1700	Fasteners
SANS 1777	Photoelectric control units for lighting
SANS 1783	Sawn softwood timber
SANS 1973	Low-voltage switchgear and control gear Assemblies
SANS 10155	Accuracy in buildings
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10177	Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 10400	The application of the National Building Regulations
SANS 60269	Low-voltage fuses
SANS 60309	Plugs, socket-outlets and couplers for industrial purposes
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
SANS 60669	Switches for household and similar fixed-electrical installations

Standard Number	Description
SANS 60947	Low-voltage switchgear and control gear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements
SANS 61238	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV)
SANS 61643	Low-voltage surge protective devices
Other Standards	**Description**
ARP 035	Guidelines for the installation and maintenance of street lighting
BS 88	Specification of supplementary requirements for fuses of compact dimensions for use in 240 / 415 V industrial and commercial electric installations
IEC 157	Low voltage switchgear and control gear
IEC 408	Low voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units
IEC 12373	Aluminium and aluminium alloys. Anodizing. Method for specifying decorative and protective anodic oxidation coatings on aluminium
IEC 50086	Conduit systems for cable management
IEC 60898	Specification for circuit-breakers for overcurrent protection for household and similar installations

- Standards are often tailored to the conditions of their country or origin (in terms of permissible voltages, expected ambient temperatures, etc.). Therefore, and unless normatively referenced to the contrary in a Standard of higher precedence, the decreasing order of precedence of Standards shall be:
    - South African National Standards (SANS, VC, etc.)
    - South African Sectoral Standards and Specifications (NERSA, CKS, ARP, NRS, PIESA, etc.)
    - ISO Standards
    - IEC Standards
    - Harmonized British Standards (BS EN)
    - Other Harmonized European National (EN) Standards (CEN, CENELEC, ETSI)
    - Non-Harmonized British Standards (BS)
    - Other international standards
- Where Standards of the same order are not in agreement with each other, the Standard with the most rigorous requirements shall apply.
- The installation shall also comply with:
    - This Specification, including all Technical Data Sheets; and

- Any documentation issued by, or on behalf of, the Employer in respect of the Installation.

C3.3.4.2.5.3 E200.5.3 INSTALLATION OF CABLE SUPPORTS

a) Cable Trays, Mesh and Ladders

– General

- Cable management systems (cable trays, cable ladders and cable mesh) shall be selected and installed strictly in accordance with their manufacturer's guidelines, with a safety factor of 1.5 after taking into account maximum permissible loading and all external factors (not limited to wind, snow and thermal expansion). Upon demand to do so, the Contractor shall furnish all data and calculations he used to derive the type and spans of the systems to the Engineer.

- Notwithstanding above, the deflection of a cable management system due to installed cable weights shall be, in accordance with IEC 61537, limited to 1/100th of the span.

- Except where it is to be installed in locations with corrosive atmospheres, cable management systems shall be manufactured of galvanized and/or epoxy-powder coated steel. In locations with corrosive atmospheres, systems shall be manufactured from stainless steel (316 Marine Grade) or aluminium.

- All clamps, clips, hinges screws, bolts, nuts and support fittings used for fastening cable trays or cables shall be of the same material as the cable management system itself.

- Over and above the requirements of SANS 10142-1, all cable tray and ladder systems that will support telecommunication and / or control wiring shall be bonded in accordance with NRS 083-2 (gives details of bonding methods that provide enhanced protection against the effects of electromagnetic cross-interference).

- Cable management systems shall be selected and installed such that spare capacity (weight as well as height and width) of 20% will be available for the addition of future services (the cable management system to still exhibit a 1.5 safety factor after services were added).

– Perforated Cable Trays

- All cable trays shall be of the heavy duty, increased upstand ("side-rail"), type.

- Metal cable trays shall be manufactured from base-perforated (in excess of 30% of the surface area, in accordance with SANS 10142-1, in other words, class D according to Table 4 of IEC 61537) rolled steel. Metal trays manufactured to the following standards shall be used:

  i) Less than 150 mm wide: 1,2 mm minimum thickness with 12 mm minimum upstand

  ii) 150 mm to 450 mm: 1,2 mm minimum thickness with 19 mm minimum upstand

  iii) Above 450 mm (heavy duty): 2,5 mm minimum thickness with 76 mm upstand

- The edges of cable trays are to be turned up on both sides to improve rigidity (return flange cable tray), and, where necessary, the sides of trays shall be reinforced with galvanised steel angles, minimum 25 x 25 x 3 mm, with 25 x 3 mm cross-braces at 600 mm centres.

- Cable trays shall be hot-dip galvanised only after the perforation and bending processes have been completed.

– Wire Mesh Cable Trays

Wire mesh cable trays shall be manufactured from wire, resistance butt welded on all wire intersections. The tray shall be hot dip galvanised after completion of the manufacturing process. Heavy or medium duty trays may be used, ensuring that the selection of trays is suitable for the projected loading, as per manufacturer's specification.

- Medium duty trays shall be manufactured from wires not less than 4mm diameter thick. The tray shall have a side upstand of no less than 50mm. The aperture sizes for the base shall not exceed 50 x 75 mm and 25 x 50mm for the side upstand.

- Heavy duty trays shall be manufactured from wires not less than 5mm diameter thick. The tray shall have a side upstand of no less than 75mm. The aperture sizes for the base shall not exceed 50 x 50 mm and 25 x 50mm for the side upstand.

– Cable Ladders

- Metal cable ladders shall have side rails with 2 mm minimum thickness. Cross rungs shall be spaced at maximum intervals of 300 mm (measured between the centres of rungs). Where cables of 10 mm² or smaller are installed on cable ladders, the spacing of cross rungs shall be reduced to 125 mm.

- Cable ladders consisting of slotted metal rails which accommodate plastic or metal cable binding bands may be used in vertical cable runs against walls, etc. These cable ladders will be considered in horizontal cable runs for small cables for communication and control wiring only after approval by the Engineer.

– Cable Tray and Ladder Connections

- Cable tray and ladder connections shall be suited to and of the same manufacture as the linear sections that they connect.

- The dimensions of these connections shall correspond to the dimensions of the linear sections to which they are connected.

- The radius of all bends shall be 1 m minimum. The inside dimensions of horizontal angles or connections shall be large enough to ensure that the allowable bending radii of cables are not exceeded.

- Sharp angles shall be 45° mitred.

– Installation of Cable Ladders, Wire Mesh Cable Trays and Perforated Cable Trays

- Horizontal cable ladders and trays shall be suspended from the overhead structure, such as slab soffit or roof trusses/ purlins with hangers and P2000 or similar catalogue product as cross supports, at distances not exceeding 1,2m unless otherwise specified by the manufacturer. The hangers shall be galvanised threaded rods or steel cables, which shall be arranged to support the trunking rigidly in both directions. Where fixed to a concrete slab the hanger shall be fastened by a suitably sized expandable drop-in

anchor, as specified and recommended by the manufacturer. Hangers fixed to an overhead steel roof structure, shall be fastened by supplier recommended standard catalogue product hanger brackets/ beam clamps, designed for this purpose. Make-shift and or self-manufactured brackets/ beam clamps will not be accepted. No cutting, drilling or any other modification may be done to the existing overhead steel structure, to accommodate and of fasten hanger brackets/ beam clamps to the said structure.

- The use of wall mounted cantilever brackets for horizontally mounted cable trays shall be approved by the engineer, prior to installation. No installation of this mounting method shall commence, without written consent.

- The spacing between tiers of ladders, trays and/or mesh shall be 300 mm minimum. Furthermore, they shall be installed such that a minimum separation of 300 mm exists between ceilings and the top of a tray or ladder (where the latter is installed horizontally) and 50 mm between the nearest sides of trays or ladders and the finished surfaces of walls, floors and ceilings for other configurations.

- Fixing materials shall be compatible with cable management system materials and offer resistance to corrosion.

- Cuts in trays shall not pass through perforations, except where practically impossible to implement.

- Cable trays and mesh shall be mounted with a minimum air gap of 25 mm between the underside of the tray and the mounting surface.

– Installation of Cables on Cable Trays, Ladders and Mesh

Under no circumstances shall the cable support systems be used as ladders, walkways or any other form of support for people. This can lead to personal injury, possible damage to the cable support system and installed cables.

- Electrical MV and LV cables shall be installed on suitably sized cable ladders. MV and LV cables shall not share the same cable tray.

- Cables for communication and or other electronic services shall be installed on wire mesh cable trays. Cables shall be neatly bunched together by means of cable ties. Only cables of the same service (i.e. smoke detection, CCTV, audio, etc) shall be bunched together. Perforated cable trays may also be used in lieu of wire mesh cable trays. Electrical and electronic services cables shall not share the same cable tray.

- Cables shall be supported to avoid damage during installation, prior to dressing and fixing.

- Depending on the overall diameter, single cables and groups shall be secured according to the following.

Table 13: Installation of cables

Fixing method	Overall diameter of cable
Nylon UV Protected Cable Ties	< 35 mm
Propriety cable clamps	> 35 mm

- In outdoor applications, where the installation maybe subject to ultra-violet light, PVC covered aluminium tape shall be used instead of nylon cable ties.

- Cables installed in groups shall be installed in straight lines and not cross over each other, except where single core cables need to be transposed.
- Where cables exit ladders, trays or mesh, the latter shall be formed or covered with PVC to ensure a smooth surface.
- Single core cables shall be installed in trefoil formation by means of non-magnetic type trefoil cable clamps. Only single core cables originating the same feeder shall be grouped together in the same trefoil formation.

C3.3.4.2.5.4 E200.5.4 DRAWINGS AND DOCUMENTATION

a) General

– All drawings, information, and documentation shall be in English, and each item shall be identified with:

- The Client's name and contact details
- Client's project / scheme / contract reference title and numbers
- The Engineer's name and contact details
- Engineers reference numbers
- Contractor's works / contract / order references.

– Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

b) Drawings for Approval

– The following documentation and drawings shall be submitted to the Engineer prior to the installation of cables and wireways and before civil construction have started on the areas where cable routes are required:

- Cable route layout drawings showing
- Type of wireways
- Trenching
- Cable junction boxes

c) As-built Drawings

– Detailed "as-built" drawings, clearly labelled as such, and consisting of three sets of drawings printed to their original size, and, where the original drawings were larger than A3, three sets of drawings printed (with reduced scaling, but without omitting any information from the printed area), to A3, shall be provided by the Contractor, indicating positions of the following:

- Wireways (e.g. trenches, conduit, cables ladder/trays, power skirting etc.); and
- Cable routes (including any cable joints)
- General arrangement drawings

- Single Line Diagrams

d) Operating and Maintenance Manual

– Three Operation Manuals, three Maintenance Manuals and three Certification copies shall be provided for all equipment supplied. The manuals shall be in A4 format.

– The operating and maintenance manuals shall include at least the following:

- A schedule of installed components and equipment, containing the following information:
  - Manufacturers name and contact details
  - Circuit number (DB name, circuit breaker e.g. DB01-CB08); and
  - Function (e.g. switching lighting circuit DB03-L1)
- A schedule of all installed cables, with the following information:
  - Circuit number (DB name, circuit breaker e.g. DB01-CB08)
  - Size
  - Installed length; and
  - Function (e.g. “Feeding Submersible pump IW-SP-01”)
- Description and details w.r.t:
  - Detailed description of the function of all operator controls
  - Procedures for fault finding
  - Maintenance instructions for all components and including repair, overhaul, change-out and installation procedures
  - Inspection schedules; and
  - Spare part information and recommended spares

C3.3.4.2.5.5 E200.5.5 TESTING AND COMMISSIONING

a) General

– The installation shall be inspected and tested in accordance with SANS 10142-1.

– Inspection and testing shall only be performed by personnel with approved, current qualifications. The Contractor shall provide qualified personnel for the supervision for all inspection and testing activities.

– The Contractor shall provide all necessary safety equipment and test instruments. All test instruments shall comply with SANS 61010 and be covered by a current test and calibration certificate.

– The Contractor’s safe working arrangements shall comply with the safety management systems and procedures prevailing on site. Where there may be a risk of injury to personnel,

the Contractor shall submit a risk assessment and method statement for approval, prior to starting work.

- Unless otherwise specified in the Particular Specification, all inspection and test results shall be recorded using pro-forma documentation (test certificates and schedules) complying with SANS 10142-1.
- The Contractor shall make provision for all inspection and testing activities to be witnessed. Unless otherwise specified in the Particular Specification, the period of notice for witness testing shall be 5 working days.
- Where most of the inspection and testing activities are not witnessed, the Contractor shall allow for 10% of the inspection and testing activities to be repeated for witness testing.
- If there is a requirement for additional inspection and test activities to be performed as part of process commissioning, this shall be specified in the Particular Specification.
- Unless otherwise agreed by the Employer, no part of the installation shall be commissioned until all defects or omissions revealed by inspection and testing have been rectified. Where a defect or omission renders all or part of the installation unsafe for use, the Contractor shall take approved precautions to ensure that no part of the installation can be commissioned.

b) Test Sequence

- Inspections before Testing
  - Before testing, inspections shall be performed to verify:
  - All equipment and material is of the correct type and complies with applicable SANS and IEC standards
  - All parts of the installation are correctly selected and erected
  - No part of the installation is visibly damaged or otherwise defective
  - The installation is suitable for the environmental conditions; and
  - The installation complies with this Specification
- Testing of Installation
- On satisfactory completion of the inspections specified in 5.2.1, the following tests shall be undertaken in the sequence listed as per SANS 10142-1:
  - Continuity of conductors
  - Resistance of earthing conductor
  - Continuity of ring circuits earth fault loop impedance at main switch
  - Elevated voltage on supply neutral earth resistance
  - Insulation resistance
  - Voltage, main distribution board - no load
  - Voltage, main distribution board - on load

- Voltage at available load
- Operation of earth leakage units
- Earth leakage test button
- Polarity at points of consumption
- Switching devices

C3.3.4.2.6 E200.6 LOW VOLTAGE SWITCHGEAR AND CONTROL GEAR ASSEMBLIES

C3.3.4.2.6.1 E200.6.1 SCOPE

a) Application

– This document specifies the standard requirements for the design, installation, testing and commissioning of electrical installations operating on voltages up to 1 000 Volts AC / 1 500 Volts DC.

– The primary intention of this specification is to ensure the provision of an electrical installation, which has been designed and constructed to ensure safe, reliable, operation and to facilitate safe inspection, testing and maintenance.

– Note however that this specification only covers such installations (or sections of installations) that are covered by SANS 10142-1. Note also that certain provisions of this specification are inappropriate for direct application to installations where additional measures (such as earthing, intrinsic safe equipment, etc.) are required by SANS 10142-1 and SANS 10108 (i.e. medical and hazardous locations). For these types of installations, thorough reference must be made to the relevant statutory documentation.

b) Electrical System Characteristics

– The design of the installation shall comply with SANS 10142-1.

– The design of the installation shall consider the following supply characteristics:

- Voltage, frequency and number of phases
- Maximum prospective short circuit current (phase to phase and phase to neutral)
- Type of system, e.g. TN-S, TN-C-S
- Maximum earth loop impedance of the earth fault path external to the installation
- Type and rating of the cut-out or switch device
- Load capability of the supply source, particularly the effects on the supply voltage of the starting of new equipment and any fault contributions from new equipment

– The installation protective devices shall be correctly co-ordinated within the installation and with respect to existing installations. Discrimination studies shall be performed to validate the co-ordination of the installation.

– All equipment which requires operation or attendance by a person, or requires cleaning or maintenance in service, shall be constructed and installed to allow adequate and safe means of access and working space for such activities. Similarly, the positioning of

equipment shall not impede access to, or working space at, non-electrical equipment and services for operation and maintenance activities.

- The installation shall be suitable for access and use by electrically unskilled persons.
- Where additions or alterations to an existing installation are to be performed, the rating and condition of existing equipment, including that associated with the supply, shall be verified to confirm its suitability to carry any additional load. The earthing and equipotential bonding arrangements shall also be verified. No addition or alteration shall have an adverse effect on the existing installation.

C3.3.4.2.6.2 E200.6.2 STANDARDS

- Associated Documentation
  - This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.
  - Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.
  - The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the installation.
- Regulations, Specifications and Standards
  - The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:
    - Occupational Health and Safety Act (Act 85 of 1993)
    - Construction Regulations 2003 issued in terms of Section 43 of the Act
    - Local Fire Regulations; and
    - Regulations and by-laws of the Local Supply Authority

    and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 14 Section 6: Reference standards

Standard Number	Description
SANS 32	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants
SANS 97	Electric cables – Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3kV to19/22kV (excluding pressure assisted cables)
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 156	Moulded-case circuit-breakers
SANS 164	Two-pole and earthing-pin plugs and socket outlets

Standard Number	Description
SANS 475	Luminaires for interior lighting, street lighting and floodlighting - Performance requirements
SANS 767	Earth leakage protection unit
SANS 950	Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1063	Earth rods, couplers and connections
SANS 1085	Wall outlet boxes for the enclosure of electrical accessories
SANS 1088	Luminaire entries and spigots
SANS 1091	National colour standards of Paint
SANS 1195	Busbars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1431	Weldable structural steels
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1700	Fasteners
SANS 1777	Photoelectric control units for lighting
SANS 1783	Sawn softwood timber
SANS 1973	Low-voltage switchgear and control gear Assemblies
SANS 2001	Construction Works
SANS 10155	Accuracy in buildings
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10177	Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 10400	The application of the National Building Regulations
SANS 60269	Low-voltage fuses
SANS 60309	Plugs, socket-outlets and couplers for industrial purposes
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
SANS 60669	Switches for household and similar fixed-electrical installations
SANS 60947	Low-voltage switchgear and control gear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements
SANS 61238	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV)
SANS 61643	Low-voltage surge protective devices
Other Standards	**Description**
ARP 035	Guidelines for the installation and maintenance of street lighting

Standard Number	Description
BS 88	Specification of supplementary requirements for fuses of compact dimensions for use in 240 / 415 V industrial and commercial electric installations
IEC 157	Low voltage switchgear and control gear
IEC 408	Low voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units
IEC 12373	Aluminium and aluminium alloys. Anodizing. Method for specifying decorative and protective anodic oxidation coatings on aluminium
IEC 50086	Conduit systems for cable management
IEC 60898	Specification for circuit-breakers for overcurrent protection for household and similar installations

- Standards are often tailored to the conditions of their country or origin (in terms of permissible voltages, expected ambient temperatures, etc.). Therefore, and unless normatively referenced to the contrary in a Standard of higher precedence, the decreasing order of precedence of Standards shall be:
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    - South African Sectoral Standards and Specifications (NERSA, CKS, ARP, NRS, PIESA, etc.)
    - ISO Standards
    - IEC Standards
    - Harmonized British Standards (BS EN)
    - Other Harmonized European National (EN) Standards (CEN, CENELEC, ETSI)
    - Non-Harmonized British Standards (BS)
    - Other international standards
- Where Standards of the same order are not in agreement with each other, the Standard with the most rigorous requirements shall apply.
- The installation shall also comply with:
    - This Specification, including all technical data sheets; and
    - Any documentation issued by, or on behalf of, the Employer in respect of the Installation.

C3.3.4.2.6.3 E200.6.3 COMPONENTS AND EQUIPMENT

a) General

- All equipment and components shall be suitable for their operating environment, particularly with respect to the following:
    - The degree of ingress protection against dust and moisture (IP rating)
    - The corrosion resistance of the materials of construction; and

- Mechanical properties (especially impact strength)

b) Power Outlets

– Commercial Socket Outlets

- All socket outlets with switches shall fully comply with SANS 164-0 and SANS 60669-1.
- Flush mounting units shall be suitable for a wall box of not less than 100 x 100 x 50 mm deep.
- Surface mounted patterns shall be housed in heavy pressed steel boxes.
- Any socket outlet exposed to weather, condensation, dripping or splashing of water shall have a rating of at least IP44.
- All socket outlets with switches shall be continuously rated at 16A and shall be suitable for operation on a 250V, 50 Hz, AC system.
- All socket outlets shall have shutters included on the live and neutral socket holes.
- Cover plates shall have bevelled edges which overlap the box.
- Socket outlets and their cover plates must adhere to the following colour and earth pin convention:
  - SANS 164-1, white (conventional system), 16A, 2-pin with round earth pin shall be protected by an earth leakage sensing device.
  - SANS 164-2, white (IEC system), 16A, 2-pin with round earth pin shall be protected by an earth leakage sensing device.
  - SANS 164-3, white (conventional system), 6A, 2-pin with round earth pin, shall only be used for connecting luminaires. The use thereof is not covered by this part of the specification.
  - SANS 164-4, red (dedicated system), 16A, 2-pin with 0° shaven earth pin is not protected by an earth leakage sensing device. This socket outlet would generally be connected to a dedicated supply system (this outlet shall be referred to as "red dedicated").
  - SANS 164-4, black (dedicated system), 16A, 2-pin with -53° shaven earth pin is not protected by an earth leakage sensing device. This socket outlet would generally be connected to a dedicated supply system (this outlet shall be referred to as "black dedicated").
  - SANS 164-4, blue (dedicated system), 16A, 2-pin with +53° shaven earth pin is not protected by an earth leakage sensing device. This socket outlet would generally be connected to a dedicated supply system (this outlet shall be referred to as "blue dedicated").
  - SANS 164-6, white (two-pole system for connection of class II equipment), 16A, 2-pin, un-earthed (the earthed version of this socket outlet is illegal in South Africa and may not be used). The contractor shall only install this socket outlet under

specific instruction of the engineer (this outlet is also referred to as a “Schuko” socket outlet).

- BS1363-2, 13A, rectangular 3-pin, British type socket outlet shall not be used.

– Industrial Socket Outlets

- Plugs, couplers and socket outlets shall conform to the requirements of SANS 1239.
- Where pilot connections are required, they shall disconnect before the main phase connectors disconnect.
- 3-Phase Socket Outlets
  - 400V socket outlets shall be five poled (three phases, one neutral and one earth), incorporating isolation mechanically interlocked with the plug.
  - The equipment enclosures shall be at least IP 55 to SANS 60529.
  - All welding plugs and socket outlets shall be 5 poled (3-phase, plus neutral, plus earth).

– Single Phase Outlets

- 16 A, 250 V socket outlets shall be two pole and earth, incorporating isolation mechanically interlocked with the plug.

– Local Isolators (Switch-disconnectors)

- Local isolators shall be selected from the following:
  - Isolator in accordance with SANS 60947-3, complete with additional late-make, early-break auxiliary contacts as required
  - Plug and socket assembly to SANS 60309-1 and SANS 60309-2, incorporating isolation mechanically interlocked with the plug; or
  - Plug and socket assembly to SANS 60309-1 incorporating a de-contactor arrangement or additional late-make early-break auxiliary contacts.

– Local isolators exposed to the weather, condensation, dripping or splashing of water shall have a rating of at least IP44.

C3.3.4.2.6.4 E200.6.4 INSTALLATION OF COMPONENTS AND EQUIPMENT

a) General

– Final positions of equipment shall be agreed with the Engineer on site, prior to installation.

– All equipment shall be securely mounted using propriety (i.e. suited to and manufactured for such use) fixtures and fittings.

– The method of equipment installation shall not adversely affect the function or structural integrity of the structure to which the equipment is attached.

– Equipment terminals and covers shall be readily and safely accessible after installation.

- The method of equipment installation shall not adversely affect the IP rating of the equipment.

- No horizontal chasing shall be allowed into brick or concrete work.

- It is the Contractor's responsibility to work closely together with the relevant parties responsible for the civil construction work to establish coordination in the installation program of components and conduits, as well as to establish a neat installation showing no indication of 'last minute changes'. Modification to existing structures shall be approved by the Engineer.

- Framework and Brackets

  - Site-fabricated framework and brackets shall not be used.
  - Framework and brackets shall be positioned so as not to adversely affect the removal and replacement of equipment.

  - Where it is necessary to modify on site any pre-fabricated galvanised mild steel framework, the cut edges shall be dressed and treated immediately with an approved cold-galvanising paint to prevent corrosion.

- Fasteners

  - Fasteners securing equipment to framework and brackets shall be independent of those securing framework and brackets to walls and floors.

  - No electroplated fasteners will be allowed. Only hot dipped galvanised or stainless steel fasteners will be allowed.

  - Positioning of Equipment

  - Equipment shall be positioned with due regard to the aesthetics of the installation.

  - Equipment (e.g. outlets, switches, distribution boards, etc.) shall be installed plumb. If an imaginary line is drawn from the vertical side of any such component, the deviation of such imaginary line from the vertical shall not exceed ± 5 mm for every 1 m increase in height, with a maximum deviation from the vertical of ± 10 mm.

  - The permissible deviation from the mounting heights indicated for equipment covered by this document shall be ± 10 mm, with a maximum of ± 5 mm deviation from the horizontal between adjacent outlets, isolators, luminaires, assemblies and / or switches.

  - Where a group comprises a number of items at different mounting heights, with not more than one item at any one height, then all items shall be sited on a common vertical centre line.

  - Where a group comprises a number of items mounted at the same height, then all items shall be sited on a common horizontal centre line.

  - Where a group comprises a number of different sized items, they shall be arranged with the largest item at one end of the group and a progressive reduction in size of the remaining items.

  - Where a group comprises a number of items at different mounting heights with more than one item at any height, then a common vertical centre line shall be established and the items arranged on, or symmetrically about, this centre line.

- Where a group comprises a number of items at the same mounting height with more than one item at the same position, then a common horizontal centre line shall be established and the items arranged on, or symmetrically about, this centre line.

– Mounting Height of Components

- Mounting heights shall be as follows unless otherwise specified:

Table 15: Mounting height of components

Distribution boards	**Top frame 2000 mm above finished floor level, except where the board may be accessible to infants, where then the bottom frame shall be 1200 mm above finished floor level**
Switches	All security controls and light switches shall be horizontally aligned with door handles and other fixtures and fittings (other than socket outlets) between 900 mm and 1,2 m above the finished floor level
Socket outlets	See 4.2
Telephone outlets	See 4.3

– All indoor switches and socket outlets shall be of the flush mounted type.

b) Installation of Socket Outlets

– General

- The Contractor should only start installation of power outlets in the conduit outlets after plasterers and painters have completed their work in the vicinity of the outlet.

- Socket outlets shall be installed at the following heights above finished floor level, measured to the underside of the outlet, unless otherwise specified:

  - 300 mm above finished floor level for general applications

  - 500 mm above fixed ground level where they are to be installed outside buildings
  - 1200 mm above finished floor level in kitchens

  - 300 mm above counter tops

– Connections to geysers

- Each geyser shall be connected to a separate circuit with a separate earth conductor.

- The conduit from the distribution board shall terminate in a 100 x 100 x 50 mm outlet box within 1 metre of the geyser. A suitably rated double pole isolator shall be installed in the outlet box. A flexible length of conduit shall be installed between the isolator and the geyser.

– Connections to heaters, fans, air conditioners and hand blowers

- A suitably rated double pole isolator shall be supplied and installed within 1 metre of heaters, fans and air conditioners. Where the equipment is out of reach the isolator, which must then be of the type capable of being locked in the open position, shall be installed 1.5 m above floor level, and a sign indicating location of the isolator shall be fixed onto or next to the equipment that it switches. Flexible cords may be used for the final connection to the equipment, provided the cables are correctly current rated.

- Where control units (for HVAC, BMS, etc.) are to be installed, the units shall be installed 1.5 m above the finished floor level.

c) Installation of Telecommunication Services and Accessories

– Telephone distribution boards

- Telephone distribution boards are to be installed with their bottom frames 1 200 mm above finished floor level.

- All conduits and sleeves to telephone outlets or telephone sub-distribution boards in the buildings or elsewhere on the site, as well as the main incoming sleeves, shall terminate at the main telephone distribution board, as shown on the relevant drawing.

– Separation of services

- Wireways provided for telecommunication or other related services shall under no circumstances be used for any other purpose.

- Power cables, conductors and accessories shall be installed at a minimum distance of 300 mm away from the routes reserved for telecommunication cables.

- Conduits and other channels shall be installed in such a way as to avoid telecommunication cables from crossing power cables.

d) Telecommunication outlets

– Telephone and / or data outlets in walls shall comprise of 100 x 100 x 50 mm deep wall boxes which shall be flush mounted in the wall, in the position shown on the relevant drawing, with the underside fixed 300 mm above the finished floor level, unless otherwise specified. The wall box shall be fitted with a white coloured blank cover plate.

– All outlet boxes shall align neatly with adjacent socket outlet wall boxes.
– Outlets in floors fitted with floor ducting shall be of the same type as the floor outlets for power socket outlets and shall be provided in the same outlet box.

– Outlets in power skirting shall be provided at the positions indicated on the relevant drawing, and the Contractor need only provide a separate short length power skirting cover at these positions. The cover for the fixing of outlet shall not exceed 250 mm in length and shall be secured in such a manner that adjacent cover plate sections can be removed without disturbing the telephone outlet.

C3.3.4.2.6.5 E200.6.5 WIREWAYS

a) Conduit

– Plain-end metallic conduit and accessories

- Plain-end conduit shall be manufactured from mild steel having a minimum wall thickness of 0.9 mm and shall comply with SANS 60614.

- Galvanised conduits shall be hot-dipped on both the internal and external surfaces, in accordance with SANS 121.

- Epoxy powder-coated metal conduit may not be used in installations where bending of conduit will be required (unless prior approval of use has been granted by the Engineer).

- Bending and setting of plain-end conduit shall be undertaken using the correct bending apparatus as recommended by the manufacturer of the conduit. After the bending of galvanized conduit, cold galvanizing paint shall be applied.

– PVC conduit and accessories

- PVC conduit shall comply with SANS 950 and shall bear the SABS mark.
- PVC conduit shall be constructed from rigid PVC. PVC conduit shall be white in colour and shall be non-flammable. The minimum softening temperature shall be 75°C.
- All PVC conduit accessories shall be fully in accordance with SANS 950 and shall bear the SABS mark.

– Flexible conduit

- Flexible steel conduit and adaptors shall comply with IEC 50086 where applicable.
- Flexible steel conduit shall be of a galvanised steel construction. It does not need to be waterproof but shall be vermin proof and suitable for protection of cables against mechanical damage.
- In moist or damp areas, flexible steel conduit shall be of the plastic sheathed galvanised steel type.
- Flexible polypropylene tubing shall only be fastened to PVC conduit installations.

– Conduit Accessories

- Earth clamps
  - Earth clamps shall comprise of copper strips having a minimum thickness of 1 mm and shall not be less than 12 mm wide. Earth clamps shall be provided complete with a 25 mm x 4 mm brass bolt, washer and nut and shall be constructed such that the clip can be firmly attached to the conduit without the need for any additional packing.
- Flush mounted wall boxes
  - Flush mounted PVC wall boxes shall be manufactured from rigid PVC and shall be white in colour. All PVC wall boxes shall comply with SANS 950. “Open-back” type wall boxes will not be accepted.
  - Flush mounted steel wall boxes shall be manufactured from heavy gauge sheet steel and shall be galvanised. All steel wall boxes shall comply with SANS 1085.
  - The boxes shall be provided with the necessary mounting lugs to suit the units for which the box is intended and be provided with 20 mm knock-outs.
  - Facilities shall be provided for the fixing of earth terminals to the box.
- Round group-type circular boxes
  - Steel round boxes shall be manufactured in accordance with SANS 1065 and shall be of the long spout pattern, constructed from either store enamelled jet black or galvanised steel, or from malleable cast iron.

- PVC round boxes shall be manufactured in accordance with SANS 950 and of the same dimensions but having web-reinforced spouts.
- The two cover fixing holes of both steel and PVC boxes shall be diagonally opposite each other and shall be drilled and tapped at 50 mm centres. Internal dimensions shall be approximately 60 mm in diameter by 60 mm deep for use in concrete work. Shallower boxes shall be used in open roof spaces.
- The cover screw pillars shall be provided with tapped brass inserts and provision shall be made for a brass earthing terminal adjacent to one or both of the pillars.
- PVC round box covers shall be of PVC and shall be secured by means of brass screws at 50 mm centres.

– Draw wires

- Draw wires for unused conduits shall either be galvanised steel wire or nylon, but shall have a minimum diameter of 2 mm.

– Conduit Installation

- General
  - The conduit installation shall comply with par. 6.5 of SANS 10142-1.
  - Where the conduit installation is surface mounted, space-bar saddles must be used in order to provide an air gap between the conduit and mounting surface.
  - The conduit system shall be mechanically continuous, secure and shall be able to be re-wired.
  - All unused, screwed entries shall be fitted with a blanking plug. Female PVC bushes shall be fitted to all free ends.
  - Conduits shall not be used to support the weight of fittings etc., except where specifically designed to do so. Conduit boxes supporting luminaires or accessory boxes shall be fixed to the fabric of the building independently of the conduit.
  - Sufficient conduit and drawing boxes shall be provided to facilitate cable installation and removal. In general, no more than 2 bends or off-sets or one coupling shall be permitted without a conduit box.
  - Steel conduit shall not be relied upon for earth continuity
  - All PVC conduits shall be installed in accordance with Appendix C, SANS 950.
  - Draw boxes should be as far as possible be placed out of sight and shall be indicated on the "as built" drawings.
  - The edge of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface. Where necessary, spacer springs shall be used under screws.
  - Oversize cover plates shall be provided on all flush mounted round conduit boxes, where required. Surface mounted boxes shall be provided with standard size cover plates.

– Flexible conduit

- In installations where the equipment has to be moved frequently to enable adjustment during normal operation, for the connection of motors or any other vibrating equipment, for the connection of thermostats and sensors on equipment, for stove connection and where otherwise required, flexible conduit shall be used for the final connection to the equipment.

- Flexible conduit shall be connected to the remainder of the installation by means of a draw box. The flexible conduit may be connected directly to the end of a conduit if an existing draw box is available within 2 m of the junction and if the flexible conduit can easily be rewired.

- Flexible conduit shall consist of metal reinforced plastic conduit or PVC covered metal conduit with an internal diameter of at least 15 mm, unless approved to the contrary. In false ceiling voids, flexible conduit of galvanised steel construction may be used. Connectors for coupling to the flexible conduit shall be of the gland or screw-in type, manufactured from either brass or mild steel plated with zinc or cadmium.

– Installation in concrete

- In order not to delay building operations, the electrical Contractor shall ensure that all conduits and accessories which are to be cast in concrete are placed in position in good time. The Contractor or his representative shall be in attendance when the concrete is cast.

- Draw boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw boxes shall be of the deep recessed type. In columns where flush mounted draw boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw box.
- Sharp bends and elbows for conduits of 32 mm diameter will not be allowed in concrete slabs.

- Draw boxes and/or inspection boxes shall, where possible, be grouped together under a common approved cover plate. The cover plate shall be secured by means of brass screws.

- All conduits shall be installed as close as possible to the neutral axis of concrete beams, slabs and columns. The conduits shall be rigidly secured to the reinforcing to prevent movement towards the surface of the concrete.

- All conduits, draw boxes, etc., shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw boxes and outlet boxes shall preferably be secured by means of a bolt and nut installed from the back of the box through the shuttering. Fixing lugs may also be used to screw the boxes to the shuttering where off-shutter finishes are required. Where fibre glass shuttering is used by the builder, the equipment shall be fixed to the steel only and no holes shall be drilled or made in shuttering. All draw boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

- As far as possible, conduits shall not be installed across expansion joints. Where this is unavoidable a conduit expansion joint shall be provided. The expansion joint shall consist of two draw boxes with an interlinking flexible conduit connection. The draw box shall be installed adjacent to the expansion joint of the structure and a conduit sleeve, one size larger than that specified for the circuit, shall be provided on the side of the draw box nearest to the joint. The one end of the sleeve shall terminate at the edge of the joint and the other shall be secured to the draw box. The circuit conduit passing through the sleeve shall be terminated 40 mm inside the draw box, and, in the case of

metallic conduit, the conduit end shall be fitted with a brass bush. The gap between the sleeve and the conduit at the joint shall be sealed with TiC-TaC (Titanium Carbide / Tantalum Carbide) or equal sealing compound, to prevent the ingress of wet cement. The other end of the circuit conduit shall be secured to the draw box by means of a standard bushed adaptor for other PVC types. The cover plates shall be installed before the ceiling is painted. Where a number of conduits are installed in parallel, they shall cross the expansion joint of the structure via a single draw box. A number of draw boxes adjacent to each other will not be allowed.

- The installation of conduits in floor screed shall be kept to a minimum. Where conduits are installed in screed, the top of the conduit shall be at least 20 mm below the surface of the screed. Where the screed is laid directly on the ground, galvanised conduits shall be used. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits. Conduits shall be secured to the concrete slab at intervals not exceeding 2,0 m. The Contractor shall ensure that conduits are not visible above the screed where the conduits leave the screed.

- All draw boxes, conduits, etc., which are installed in concrete shall be cleaned with compressed air and provided with draw wires two days after removal of the shuttering. Errors that occurred during the installation of the conduits, or any lost draw boxes or blocked conduits shall be reported to the Engineer immediately.

- Where it is necessary to cut or drill holes in the concrete structure, prior permission shall be obtained from the Engineer in writing.

– Installation in brickwork

- Recessed conduits and accessories installed in brickwork shall be built-in. In order not to delay building operations the Contractor shall ensure that all conduits and accessories which are to be built-in are placed in position in good time.

- Any conduit draw boxes, outlet boxes, etc., which have been damaged, lost or omitted, shall immediately be reported to the Engineer.

– Surface and roof space installations

- All conduits shall be installed horizontally or vertically as determined by the route. The electrical Contractor shall take all measures to ensure a neat installation.

- Conduits shall be firmly secured by means of saddles and screws and in accordance with SANS 10142, par. 5.4.2(b). Conduits shall be secured within 150 mm before and after each 90° bend.

- Only approved plugging materials, such as fibre plugs or plastic plugs, etc., and round head screws shall be used when fixing saddles, switches, plugs etc., to walls. Wood plugs are not acceptable, nor should plugs be installed in joints in brick walls.

– Chasing and builder's work

- Except where the project involves upgrading existing facilities, all flush mounted conduits, accessories, switchboard trays, bonding trays etc., shall be built-in and no chasing shall be allowed.

– Installation of Cables in Conduit

- The cable installation in the conduit shall conform to par. 6.5.6 of SANS 10142-1 and other portions of SANS, where applicable.

- Conduit shall be deburred and swabbed prior to cables being pulled in.
- Cables of other classifications and purpose (e.g. DC, Fire Detection, Audio, etc.) shall be installed in separate conduits.
- Circuits supplied from different distribution boards shall not be installed in the same conduit.
- Final sub-circuits shall not be installed in the same conduit as sub-mains circuits.

b) Power Skirting

– Construction

- Power skirting must comply with all relevant parts of SANS 61084.
- Except where room dimensions dictates shortening thereof, in which case only one length per wall may be trimmed, power skirting and covers shall be installed in their standard (manufactured) lengths.
- The covers shall either snap on or shall be fixed by means of toggle or swivel nuts.
- Only socket outlets that are compatible for use with the particular type of power skirting may be used.
- Propriety internal and external bends, and off-sets of the same manufacture and product range, shall be used.
- Over and above the requirements of SANS 10142-1, all conductive power skirting that will contain telecommunication and / or control wiring shall be bonded in accordance with NRS 083-2 (details bonding methods that provide enhanced protection against the effects of electromagnetic cross-interference).

– Installation

- The bottom of the power skirting shall be installed at finished floor level, unless otherwise specified.
- Conduits for the circuit wiring to the power skirting must terminate in flush conduit boxes behind the power skirting at the respective heights of the compartments for the telephone, power and other service compartments.
- Notwithstanding the requirement to provide adequate capacity for the installation of data and telecommunication cables, conduits installed to power skirting installations shall have a minimum of 50% spare capacity, to allow for future expansion
- The wiring shall pass through large diameter holes, suitably bushed, cut in the rear of the power skirting. Where metallic skirting is installed, the holes shall be provided with rubber grommets.
- Where power skirting is interrupted by doorways, bridging conduits shall be installed for each of the service compartments.

- To allow for the easy removal of plugs from outlets, in multi compartment installations the bottom compartment(s) shall be for telecommunication services and the top compartment(s) for power circuits.

c) Cable Trunking

– Construction

- Cable trunking shall comply with all relevant parts of SANS 61084.
- Trunking shall be manufactured from galvanised metal and shall be supplied complete with PVC covers. PVC trunking will not be accepted.
- Cable trunking and covers shall be installed in their standard (manufactured) lengths, except at the end of runs as dictated by room dimensions.
- The covers shall either snap on or shall be fixed by means of toggle or swivel nuts.
- Propriety internal and external bends, and off-sets of the same manufacture and product range, shall be used.

– Installation

- Horizontal trunking shall be suspended from the overhead structure, such as slab soffit or roof trusses/ purlins with hangers and suitable brackets, at distances not exceeding 1,2 m or as specified by the manufacturer. The hangers shall be galvanised threaded rods or galvanised steel cables, which shall be arranged to support the trunking rigidly in both directions. Where fixed to a concrete slab the hanger shall be fastened by a suitably sized expandable drop-in anchor, as specified by the supplier. Hangers fixed to an overhead steel roof structure, shall be fastened by supplier recommended standard catalogue products, designed for this purpose.
- All wiring exiting cable trunking into an adjacent trunking or electrical enclosure, shall pass through large diameter holes, suitably bushed or provided with grommets, with cut-outs at the rear of the trunking.
- Where innovative wiring enters/ exits cable trunking, it shall be provided with a neoprene compression gland.

d) Wiring inside wireways

– General

- All unarmoured conductors shall be installed in conduits, trunking or power skirting, and such conductors shall not be exposed to possible mechanical damage.
- Any debris and moisture inside of wireways shall be removed prior to the installation of conductors.
- In the event that lubrication of cables is required in order to facilitate their installation, the lubricant shall be suitable for use with the type of cable as well as the type of wireway. The Contractor shall take steps to ensure that only the minimum amount of lubrication is applied. Should any seepage of lubricants into building elements or fixtures occur, it shall be the responsibility of the Contractor to remove the oil and fix the damaged building elements or fixtures, regardless of whether he installed the wireways or not.

– Circuits

- The circuits for the installation are indicated on the relevant drawings. Where not indicated on the drawings, the maximum number of points to be connected to each type of circuit shall be:

Table 16: Circuits

Light points per circuit	**=**	**8**
Single socket outlets per circuit	=	4
Extraction fan, Air conditioner points per circuit	=	2
Stove points per circuit	=	1

– When determining the number of outlets per circuit, double socket outlets count as two single socket outlets.
– In kitchens, the number of socket outlets per circuit shall be reduced to 2.

– For “maintained”-type emergency light fittings, two live wires shall be installed to the luminaire:

- The normal, switchable, circuit
- An unswitched circuit, for battery charging only
- The two live wires shall originate from the same circuit breaker.

– For 20 mm or small diameter conduit only one circuit will be allowed, with the exception of the wiring from switch boards to fabricated sheet metal boxes located close to switchboards, in which case more than one circuit will be allowed. For larger conduit sizes the requirements of SANS 10142, par. 6.5.6, shall be met.

– Looping and joints

- A loop-in wiring system, where conductors are looped from outlet to outlet, shall be employed. Joints in conductors shall be avoided as far as possible, but where it becomes unavoidable, joints will be accepted in conduits. Joints shall be soldered or shall alternatively consist of approved crimped ferruling, properly covered with propriety heat-shrink sleeves. The use of PVC insulation tape is not acceptable.

– Channelled light fittings such as fluorescent fittings, shall not be used as a wireway. A t-off type draw box (dia 60mm round box, dia 60mm looping box or 100 x 50 x 50 mm wall box) shall be installed at each fitting, for circuit wiring to the relevant light fitting looping in and out.

– Grouping of conductors

– In cases where the conductors of more than one circuit are installed in the same wireway, the conductors of each separate circuit, including the circuit earth continuity conductor, shall be grouped at intervals of at least one metre using plastic cable ties. The conductors of different circuits shall however remain separate in order to ensure that any given circuit may be withdrawn from the wireway. Conductors entering distribution boards or control boards shall be grouped and bound by means of plastic cable bands. The use of PVC insulation tape for grouping conductors will not be accepted.

– Pulling-through of conductors

- The Contractor shall take utmost care whilst pulling conductors through conduit to ensure that the conductors are not kinked, twisted or strained in any manner. Care shall furthermore be taken to ensure that conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the insulation and durability of the conductor.

- Earth continuity conductors

  - Only stranded copper conductors, which shall be bare or PVC insulated (coloured green/yellow), shall be used as earth continuity conductors. Although it shall be terminated such that it can fulfil this function (except where inappropriate, as will be the case of single core cable installations), under no circumstances shall the armouring and/or shielding of cables be relied upon to provide protective earth continuity.

  - When earth continuity conductors are looped between the earth terminals of equipment, the looped conductor ends shall be twisted together and then crimp ferruled or soldered to ensure that continuity is maintained, even when the conductors are removed from any earth terminal.
  - Where bare copper earth wires are specified for circuits installed in power skirting and floor ducting, the Contractor shall provide a suitable length of PVC sleeve over the bare earth conductor where it passes behind or is connected to power outlets, to ensure that such an earth conductor does not come into contact with any live parts.

  - The earth pin of dedicated socket outlets will be provided with a green/ yellow earth continuity conductor, whereas the yoke of the dedicated socket outlet shall be provided with a separate bare earth continuity conductor.

- Wiring inside vertical wireways

  - Conductors installed in vertical wireways shall be secured at intervals not exceeding 5 m to support the weight of the conductors. Approved clamps shall be supplied and installed in suitable draw-boxes for this purpose.

- Conductor sizes

  - The following minimum conductor sizes shall be used:

Table 17: Conductor sizes

Circuit	Minimum Conductor (Size)	
	Phase (mm^2)	Earth (mm^2))
Lighting	2,5	2,5
Socket outlet	2,5	2,5
Stove	6	6
Bell	1,5	1,5
Clock	1,5	1,5
Air conditioner	4	2,5
Control Wiring	1,5	1,5

- Single pole switches

  - Single pole switches shall only be connected to the phase conductor (the neutral conductor shall NOT be switched by a single pole switch).

- Three phase outlets

- With the exception of three phase outlets, wiring to circuits connected to different phases shall not normally be present at lighting, switch or socket outlet boxes. Where this is unavoidable, barriers shall be provided between terminals or connections of the various phases and the box shall be suitably labelled internally to indicate the presence of line voltages.

- A separate neutral conductor shall be installed together with each three phase circuit to outlets intended for equipment connection by means of isolators or socket outlets, irrespective of whether the particular equipment may require a neutral or not.

C3.3.4.2.6.6 E200.6.6 DRAWINGS AND DOCUMENTATION

a) General

– All drawings, information, and documentation shall be in English, and each item shall be identified with:

- The Client's name and contact details
- Client's project / scheme / contract reference title and numbers
- The Engineer's name and contact details
- Engineers reference numbers
- Contractor's works / contract / order references.

– Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

b) Drawings for Approval

– The following documentation and drawings shall be submitted to the Engineer prior to the installation of cables and wireways and before civil construction have started on the areas where cable routes are required:

- Cable route layout drawings showing
  - Type of wireways
  - Trenching
  - Cable junction boxes

c) As-built Drawings

– Detailed "as-built" drawings, clearly labelled as such, and consisting of 3 sets of drawings printed to their original size, and, where the original drawings were larger than A3, 3 sets of drawings printed (with reduced scaling, but without omitting any information from the printed area), to A3, shall be provided by the Contractor, indicating positions of the following:

- Equipment (e.g. light fittings, draw boxes, outlets etc.)
- Wireways (e.g. trenches, conduit, cables ladder/trays, power skirting etc.); and
- Cable routes (including any cable joints)

- General arrangement drawings
- Single Line Diagrams

d) Operating and Maintenance Manual

– Three Operation Manuals, three Maintenance Manuals and three Certification copies shall be provided for all equipment supplied. The manuals shall be in A4 format.

– The operating and maintenance manuals shall include at least the following:

- A schedule of installed components and equipment, containing the following information:
  - Manufacturers name and contact details
  - Circuit number (DB name, circuit breaker e.g. DB01-CB08); and
  - Function (e.g. switching lighting circuit DB03-L1)
- A schedule of all installed cables, with the following information:
  - Circuit number (DB name, circuit breaker e.g. DB01-CB08)
  - Size
  - Installed length; and
  - Function (e.g. “Feeding Submersible pump IW-SP-01”)
- Description and details w.r.t:
  - Detailed description of the function of all operator controls
  - Procedures for fault finding
  - Maintenance instructions for all components and including repair, overhaul, change-out and installation procedures
  - Inspection schedules; and
  - Spare part information and recommended spares.

C3.3.4.2.6.7 E200.6.7 TESTING AND COMMISIONING

a) General

– The installation shall be inspected and tested in accordance with SANS 10142-1.

– Inspection and testing shall only be performed by personnel with approved, current qualifications. The Contractor shall provide qualified personnel for the supervision for all inspection and testing activities.

– The Contractor shall provide all necessary safety equipment and test instruments. All test instruments shall comply with SANS 61010 and be covered by a current test and calibration certificate.

- The Contractor's safe working arrangements shall comply with the safety management systems and procedures prevailing on site. Where there may be a risk of injury to personnel, the Contractor shall submit a risk assessment and method statement for approval, prior to starting work.

- Unless otherwise specified in the Particular Specification, all inspection and test results shall be recorded using pro-forma documentation (test certificates and schedules) complying with SANS 10142-1.

- The Contractor shall make provision for all inspection and testing activities to be witnessed. Unless otherwise specified in the Particular Specification, the period of notice for witness testing shall be 5 working days.

- Where most of the inspection and testing activities are not witnessed, the Contractor shall allow for 10% of the inspection and testing activities to be repeated for witness testing.

- If there is a requirement for additional inspection and test activities to be performed as part of process commissioning, this shall be specified in the Particular Specification.

- Unless otherwise agreed by the Employer, no part of the installation shall be commissioned until all defects or omissions revealed by inspection and testing have been rectified. Where a defect or omission renders all or part of the installation unsafe for use, the Contractor shall take approved precautions to ensure that no part of the installation can be commissioned.

b) Test Sequence

- Inspections before Testing

  - Before testing, inspections shall be performed to verify:

  - All equipment and material is of the correct type and complies with applicable SANS and IEC standards

  - All parts of the installation are correctly selected and erected

  - No part of the installation is visibly damaged or otherwise defective

  - The installation is suitable for the environmental conditions; and

  - The installation complies with this Specification

- Testing of Installation

- On satisfactory completion of the inspections specified in 5.2.1, the following tests shall be undertaken in the sequence listed as per SANS 10142-1:

  - Continuity of conductors

  - Resistance of earthing conductor

  - Continuity of ring circuits earth fault loop impedance at main switch

  - Elevated voltage on supply neutral earth resistance

  - Insulation resistance

- Voltage, main distribution board - no load
- Voltage, main distribution board - on load
- Voltage at available load
- Operation of earth leakage units
- Earth leakage test button
- Polarity at points of consumption
- Switching devices

C3.3.4.2.7 E200.7 LIGHTING

C3.3.4.2.7.1 E200.7.1 SCOPE

a) Application

– This document specifies the standard requirements for the design, installation, testing and commissioning of electrical installations operating on voltages up to 1 000 Volts AC / 1 500 Volts DC.

– The primary intention of this specification is to ensure the provision of an electrical installation, which has been designed and constructed to ensure safe, reliable, operation and to facilitate safe inspection, testing and maintenance.

– Note however that this specification only covers such installations (or sections of installations) that are covered by SANS 10142-1. Note also that certain provisions of this specification are inappropriate for direct application to installations where additional measures (such as earthing, intrinsic safe equipment, etc.) are required by SANS 10142-1 and SANS 10108 (i.e. medical and hazardous locations). For these types of installations, thorough reference must be made to the relevant statutory documentation.

b) Electrical System Characteristics

– The design of the installation shall comply with SANS 10142-1.

– The design of the installation shall consider the following supply characteristics:

- Voltage, frequency and number of phases
- Maximum prospective short circuit current (phase to phase and phase to neutral)
- Type of system, e.g. TN-S, TN-C-S
- Maximum earth loop impedance of the earth fault path external to the installation
- Type and rating of the cut-out or switch device
- Load capability of the supply source, particularly the effects on the supply voltage of the starting of new equipment and any fault contributions from new equipment

– The installation protective devices shall be correctly co-ordinated within the installation and with respect to existing installations. Discrimination studies shall be performed to validate the co-ordination of the installation.

- All equipment which requires operation or attendance by a person, or requires cleaning or maintenance in service, shall be constructed and installed to allow adequate and safe means of access and working space for such activities. Similarly, the positioning of equipment shall not impede access to, or working space at, non-electrical equipment and services for operation and maintenance activities.

- The installation shall be suitable for access and use by electrically unskilled persons.

- Where additions or alterations to an existing installation are to be performed, the rating and condition of existing equipment, including that associated with the supply, shall be verified to confirm its suitability to carry any additional load. The earthing and equipotential bonding arrangements shall also be verified. No addition or alteration shall have an adverse effect on the existing installation.

C3.3.4.2.7.2 E200.7.2 STANDARDS

a) Associated Documentation

- This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.

- Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.

- The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the installation.

b) Regulations, Specifications and Standards

- The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:

  - Occupational Health and Safety Act (Act 85 of 1993)
  - Construction Regulations 2003 issued in terms of Section 43 of the Act
  - Local Fire Regulations; and
  - Regulations and by-laws of the Local Supply Authority

  and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 18 Section 7: Reference standards

Standard Number	Description
SANS 32	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants
SANS 97	Electric cables – Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3kV to19/22kV (excluding pressure assisted cables)

Standard Number	Description
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 156	Moulded-case circuit-breakers
SANS 164	Two-pole and earthing-pin plugs and socket outlets
SANS 475	Luminaires for interior lighting, street lighting and floodlighting - Performance requirements
SANS 767	Earth leakage protection unit
SANS 950	Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1063	Earth rods, couplers and connections
SANS 1085	Wall outlet boxes for the enclosure of electrical accessories
SANS 1088	Luminaire entries and spigots
SANS 1091	National colour standards of Paint
SANS 1195	Busbars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1431	Weldable structural steels
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1700	Fasteners
SANS 1777	Photoelectric control units for lighting
SANS 1783	Sawn softwood timber
SANS 1973	Low-voltage switchgear and control gear Assemblies
SANS 2001	Construction Works
SANS 10155	Accuracy in buildings
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10177	Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 10400	The application of the National Building Regulations
SANS 60269	Low-voltage fuses
SANS 60309	Plugs, socket-outlets and couplers for industrial purposes
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
SANS 60669	Switches for household and similar fixed-electrical installations
SANS 60947	Low-voltage switchgear and control gear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements

Standard Number	Description
SANS 61238	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV)
SANS 61643	Low-voltage surge protective devices
Other Standards	**Description**
ARP 035	Guidelines for the installation and maintenance of street lighting
BS 88	Specification of supplementary requirements for fuses of compact dimensions for use in 240 / 415 V industrial and commercial electric installations
IEC 157	Low voltage switchgear and control gear
IEC 408	Low voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units
IEC 12373	Aluminium and aluminium alloys. Anodizing. Method for specifying decorative and protective anodic oxidation coatings on aluminium
IEC 50086	Conduit systems for cable management
IEC 60898	Specification for circuit-breakers for overcurrent protection for household and similar installations

- Standards are often tailored to the conditions of their country or origin (in terms of permissible voltages, expected ambient temperatures, etc.). Therefore, and unless normatively referenced to the contrary in a Standard of higher precedence, the decreasing order of precedence of Standards shall be:
    - South African National Standards (SANS, VC, etc.)
    - South African Sectoral Standards and Specifications (NERSA, CKS, ARP, NRS, PIESA, etc.)
    - ISO Standards
    - IEC Standards
    - Harmonized British Standards (BS EN)
    - Other Harmonized European National (EN) Standards (CEN, CENELEC, ETSI)
    - Non-Harmonized British Standards (BS)
    - Other international standards
- Where Standards of the same order are not in agreement with each other, the Standard with the most rigorous requirements shall apply.
- The installation shall also comply with:
    - This Specification, including all technical data sheets; and
    - Any documentation issued by, or on behalf of, the Employer in respect of the Installation.

C3.3.4.2.7.3 E200.7.3 COMPONENTS AND EQUIPMENT

a) Luminaires, Control Gear and Lamps

Locally manufactured luminaires and associated accessories, control gear, lamps, test, etc. shall be comply with the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 18: Reference Standards for luminaires, control gear and lamps

Standard Number	Description
SANS 215	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
SANS 890	Ballasts for fluorescent lamps
SANS 891	Reference ballasts for class B fluorescent lamps
SANS 1041	Tubular fluorescent lamps for general service
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1464-22	Safety of luminaires- Part 22: Luminaires for emergency lighting
SANS 1662	Self-ballasted LED tubular lamps for general lighting services of > 50 V — Safety requirements
SANS 1664:	Semi-luminaires for T5 fluorescent lamps — Safety requirements
SATS 1706	UVGI luminaires — Safety and performance requirements
SANS 1814	D.C. supplied luminaires for fluorescent lamps
SANS 10114	Interior lighting
SANS 10389	Exterior lighting
SANS 17576	Light-emitting diode products for interior lighting, streetlighting and floodlighting - Performance requirement
SANS 50285	Energy efficiency of electric lamps for household use - Measurement methods
SANS 60064	Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements
SANS 60188	High-pressure mercury vapour lamps - Performance specifications
SANS 60192	Low-pressure sodium vapour lamps - Performance specifications
SANS 60079	Explosive atmospheres- Parts 14 and 17
SANS 60155	Glow-starters for fluorescent lamps
SANS 60238	Edison screw lamp holders
SANS 60399	Barrel thread for lamp holders with shade holder ring
SANS 60400	Lamp holders for tubular fluorescent lamps and starter holders
SANS 60432	Incandescent lamps- Parts 1 to 3
SANS 60570	Electrical supply track systems for luminaires
SANS 60598-1	Luminaires- Part 1: General requirements and tests
SANS 60662	High-pressure sodium vapour lamps
SANS 60598-2 to 25	Luminaires- Part 2-1 to Part 2-25
SANS 60730-2-3	Automatic electrical controls for household and similar use Part 2-3: Particular requirements for thermal protectors for ballasts for tubular fluorescent lamps
SANS 60838-1	Miscellaneous lamp holders Part 1: General requirements and tests
SANS 60901	Single-capped fluorescent lamps - Performance specifications
SANS 60921	Ballasts for tubular fluorescent lamps - Performance requirements
SANS 60923	Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - Performance requirements

Standard Number	Description
SANS 60925	DC supplied electronic ballasts for tubular fluorescent lamps - Performance requirements
SANS 60927	Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements
SANS 60929	AC and/or DC-supplied electronic control gear for tubular fluorescent lamps - Performance requirements
SANS 60968	Self-ballasted lamps for general lighting services - Safety requirements
SANS 60969	Self-ballasted lamps for general lighting services — Performance requirements
SANS 61047	DC or AC supplied electronic step-down convertors for filament lamps - Performance requirements
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements
SANS 61049	Capacitors for use in tubular fluorescent and other discharge lamp circuits - Performance requirements
SANS 61195	Double-capped fluorescent lamps - Safety specifications
SANS 61199	Single-capped fluorescent lamps - Safety specifications
SANS 61347	Lamp control gear
SANS 61547:	Equipment for general lighting purposes — EMC immunity requirements
SANS 61549	Miscellaneous lamps
SANS 61195	Devices for the connection of luminaires for household and similar purposes- Parts 1 and 2
SANS 61231	International lamp coding system (ILCOS)
SANS 62031	LED modules for general lighting — Safety specifications
SANS 62034	Automatic test systems for battery powered emergency escape lighting
SANS 62035	Discharge lamps (excluding fluorescent lamps) - Safety specifications
SANS 62386	Digital addressable lighting interface- Parts 101 to 103 and Parts 201 to 210
SANS 62442	Energy performance of lamp control gear
SANS 62504	General lighting — Light emitting diode (LED)- products and related equipment — Terms and definitions
SANS 62532	Fluorescent induction lamps - Safety specifications
SANS 62560	Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specification
SANS 62612	Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
SANS 62733	Programmable components in electronic lamp control gear- General and safety requirement
SANS 62838	LEDsi lamps for general lighting services with supply voltages not exceeding 50 V a.c. r.m.s. or 120 V ripple free d.c. - Safety specifications

– Luminaires

- Luminaires shall be delivered within 12 months from being manufactured and shall be delivered to site unused with protective wrappings.

- Luminaires shall be delivered, stored and handled in accordance with the manufacturer's instructions. Where the performance of the luminaire is likely to be adversely affected, all necessary preventative precautions shall be undertaken.
- Luminaires shall be protected against mechanical damage.
- Upon the Engineer's request, electronic photometric data files shall be made available for each luminaire. These files shall be suitable for lighting simulation software such as Relux and Dialux.
- Luminaires to be connected to 6A socket outlets, such as recessed luminaires, shall be provided with 3m long cords, complete with moulded 6A plug top (cord-set).
- If required by the Employer, a sample of every luminaire offered shall be submitted to the Employer for approval. Acceptance of the samples by the Employer shall not place the Employer under any obligation.
- The contractor shall forward SANS 60598 compliant type-test certificates of luminaires, to the Engineer upon request.
- All imported luminaires shall through the Letter of Authority Process by the NRCS adhere to the relevant SANS requirements, as set out by the Compulsory Specification VC 8055.

– Control Gear and Enclosures

- High frequency, electronic control gear shall be used for tubular (double capped) and compact (single capped) fluorescent lamps, and, where appropriate, for discharge lamps. Electromagnetic control gear may not be used, unless no other alternative is available.

– Lamps

- All luminaires shall be supplied complete with lamps.
- All lamps of a specific type shall be of the same manufacturer.
- All fluorescent type discharge lamps shall be colour 840, unless otherwise specified.
- All metal halide lamps shall be "natural daylight" colour, unless otherwise specified.
- All LED's shall have a colour temperature of 4000K, unless otherwise specified.
- A service call shall be done on all lamps, ten working days before expiry of the manufacturer's guarantee period.

c) Switches

– Flush mounted switches

- Flush mounted switches shall comply with SANS 60669-1 and shall bear the SABS mark.

- All flush mounted switches shall be suitable for mounting in 100 x 50 x 50 mm galvanised steel or PVC wall boxes. “Open-back” type wall boxes will not be accepted.

- The switch mechanism shall be of the tumbler-operated micro-gap type with silent operation, and shall be rated for 16 A continuous loading at 50 Hz and 250 V.

- Switches shall have protected terminals for safe wiring. Multi-lever switches shall be constructed so as to enable individual defective switches to be removed and replaced without having to remove the remaining switches.
- The mounting holes provided on the yoke strap shall be slotted to allow for easy alignment. A brass earthing terminal shall furthermore be provided on the yoke to ensure the positive earthing of the switch assembly.

- Cover plates for flush mounted switches shall have levelled edges which overlap the wall box in order to conceal all wall imperfections.

– Surface mounted switches

- Surface mounted switches shall comply with SANS 60669-1 and shall bear the SABS mark.

- Surface mounted switches shall consist of single or multiple switches, not exceeding four, and shall be mounted in a pressed steel box of heavy duty construction.

- The switch mechanism shall be of the tumbler operated micro-gap type with silent operation and shall be rated for 16A continuous loading at 250V and 50Hz.

- A brass earthing terminal shall furthermore be provided on the switch construction to ensure the positive earthing of the switch assembly and enclosure.

- The covers of surface mounted switches shall have toggle protectors.

– Photo-Electric daylight switches

- The unit shall comprise a photo-cell, thermal actuator and change-over switch. The cover of the unit shall be manufactured from a tough, durable material providing protection against tampering. The cover shall have good weathering properties. It shall be ultraviolet resistant and shall not deteriorate when exposed to sunlight for prolonged periods.

- The units shall be capable of operating in dusty conditions, and over an ambient temperature range - 15°C to + 55°C.

- The units shall be designed to withstand damage by hail and stones thrown by vandals. If the units do not possess this quality, separate wire screens shall be provided for this purpose.

- All parts shall be treated to be corrosion-proof.

- The operation level shall be factory pre-set for "ON" at a light level of 60 lux and "OFF" at 90 lux, with a permissible deviation of 12 lux either way. Voltage variations shall not materially affect the operational levels.

- A time delay, of not less than 15 seconds, shall be provided to prevent the unit from functioning due short-duration changes in illumination, such as lightning.

- The unit shall be effectively safeguarded against voltage surges by means of a suitable surge protector, which shall preferably form an integral part of the unit.

- The unit shall be of the wall mounting type and shall be supplied complete with a suitable bracket.
- The change-over switch shall be capable of switching 10A AC at 250V.
- The unit shall be mounted inside an IP65 enclosure. The enclosure shall have a transparent lid.

– Dimmer modules

- Dimmer modules shall comply with SANS 60929.
- Units shall be rated at 250V, and capable of powering inductive (minimum power factor of 0.65 lagging) and capacitive (minimum power factor of 0.75 leading) loads.
- The efficiency of modules may not be less than 95%, and the harmonic current injection not more than 1% THD, at full load (where such load is resistive).
- Furthermore, the units shall be provided with automatic over-temperature, over-current and short-circuit cut-out features. Where over-current of short duration is expected (i.e. luminaire starting current), over-current protection may be by way of self-regulation (i.e. a reduction in output voltage).
- Dimmer modules shall be sound-attenuated, such that audible noise is limited to 30dB (all weightings) measured at a distance of 1 m from the module.
- The output of modules shall be controlled by propriety pushbutton-type switches. An additional switch, located in the same enclosure as the pushbutton, shall be provided for switching the input to the dimmer module.
- Unless prior approval in this regard has been gained from the Engineer, dimmer modules may not be paralleled.
- Dimmer modules shall be selected and installed such that 30% spare capacity will be available for future additions to the output circuitry.

– Occupancy sensors

- Occupancy (also referred to as motion or vacancy sensors), shall be installed in accordance with the manufacturer's requirements and specification.
- Sensors shall adhere to the latest amendment of IEC 62386-303: Digital addressable lighting interface - Part 303: Particular requirements – Input devices – Occupancy sensor.
- Surface mounted sensors on ceilings, shall be screw fixed to a round box installed on the inside of the ceiling.
- Where sensors are part of a surface mounted installed, such as against a soffit of a concrete slab, it shall be mounted on a 100 x 100 mm draw box fixed on a blanking plate.
- Sensors shall be selected to carry the full load of the circuit, with 30% spare capacity for future expansion. When selecting the sensor, the high start-up current of some lamps as well as LED's, shall be taken into account.
- Sensors shall be positioned optimally for its application. Cognisance shall be taken of the following:

- The mode of occupancy of the relevant area
- Sensing range
- Position sensors away from air ducts and windows
- Direction of motion
- Any obstructions by future furniture/ equipment
- When obstruction is problematic, sensors with infrared detection shall not be used. Technology such as active microwave or ultrasonic sensors shall be installed.

- Sensors shall be adjusted optimally, as part of the testing and commissioning procedure. The following items shall be set:
  - Sensing range
  - Daylight harvesting lux adjustment
  - Delay time

C3.3.4.2.7.4 E200.7.4 INSTALLATION OF COMPONENTS AND EQUIPMENT

a) Installation of Lighting and Accessories

– Mounting of light fittings

- Surface mounted down light holders, such as the bayonet / screw-in type lamp holders used for incandescent fittings, shall be screwed to the ceiling by means of at least two 4 mm diameter self-tapping screws. Plastic expansion plugs, of good quality, are to be used where the surface is concrete, plaster or brick. For suspended and soft ceilings, a solid timber backing strip of at least 40 x 40 mm timber must be supplied and installed between supports, with the screws fixed to these backing strips.

- Channelled fittings, such as fluorescent fittings, shall be firmly mounted to ensure close contact with the ceiling over the entire length of the fitting. On concrete slabs the fittings shall be mounted by means of two screws into the ceiling conduit box, as well as two round-headed 6 mm x 40 mm electroplated self-tapping screws and plastic expansion plugs, one at either end. Where fittings are to be installed underneath suspended ceilings, they shall be mounted in an equal manner, but timber backing strips of at least 40 x 40 x 450 mm (at both ends) shall be placed in position on top of the ceiling board and the end screws secured to these strips, such that the weights of the fittings distribute evenly.

- Channelled light fittings fixed to P2000 type trunking, shall be fixed to the trunking by means of a “fluorescent adaptor” specifically designed for this purpose. Wiring to and from the light fitting shall pass through this adaptor.

- Channelled light fittings such as fluorescent fittings, shall not be used as a wireway. A t-off type draw box (dia 60mm round box, dia 60mm looping box or 100 x 50 x 50 mm wall box) shall be installed at each fitting, for circuit wiring to the relevant light fitting looping in and out.

- Flat-back type wall mounted light fittings (such as bulkhead light fittings) shall be fixed to walls by means of two round-headed 6 mm x 40 mm electroplated self-tapping screws and plastic expansion wall plugs. The light fitting shall be positioned with the rear entry facility for wiring directly over a diameter 60mm flush round box.

- Positions of recessed down lights shall be set out for the ceiling contractor to cut the openings for the lights. Manufacturers recommended cut-out sized shall be communicated to the ceiling contractor.

- Recessed fluorescent light fittings, for installation in suspended ceiling grids shall be properly installed and seated in the relevant openings. Recessed fluorescent light fittings shall not be obstructed by any building elements such as partition walls.

- To ensure the safety of people below, where fittings are clamped or bolted directly to trusses or other building elements (as in the case of some high bay and floodlight installations) they shall be provided with an additional safety chain or safety cable of appropriate corrosion-proof material. This safety cable / safety chain assembly shall be connected independently of the luminaire-supporting clamps or bolts, such that either assembly can be loosened and removed without affecting the other. The safety assemblies shall have a load safety factor not less than 3.

- In the case where control gear is not part of the luminaire, it shall be installed adjacent to the light fitting. The control gear shall be provided with the same cable / safety chain assembly, as mentioned in item h) above.

- Specialized light fittings (i.e. types of fittings not mentioned in this specification) must be installed strictly in accordance with their manufacturer's requirements and guidelines.

C3.3.4.2.7.5 E200.7.5 DRAWINGS AND DOCUMENTATION

a) General

– All drawings, information, and documentation shall be in English, and each item shall be identified with:

i) The Client's name and contact details
ii) Client's project / scheme / contract reference title and numbers
iii) The Engineer's name and contact details
iv) Engineers reference numbers
v) Contractor's works / contract / order references.

– Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

b) Drawings for Approval

– The following documentation and drawings shall be submitted to the Engineer prior to the installation of cables and wireways and before civil construction have started on the areas where cable routes are required:
i) Cable route layout drawings showing:
- Type of wireways
- Trenching
- Cable junction boxes

c) As-built Drawings

– Detailed "as-built" drawings, clearly labelled as such, and consisting of 3 sets of drawings printed to their original size, and, where the original drawings were larger than A3, 3 sets of drawings printed (with reduced scaling, but without omitting any information from the printed area), to A3, shall be provided by the Contractor, indicating positions of the following:

i) Equipment (e.g. light fittings, draw boxes, outlets etc.)

ii) Wireways (e.g. trenches, conduit, cables ladder/trays, power skirting etc.); and
iii) Cable routes (including any cable joints)
iv) General arrangement drawings
v) Single Line Diagrams

d) Operating and Maintenance Manual

– Three Operation Manuals, three Maintenance Manuals and three Certification copies shall be provided for all equipment supplied. The manuals shall be in A4 format.

– The operating and maintenance manuals shall include at least the following:

i) A schedule of installed components and equipment, containing the following information:
ii) Manufacturers name and contact details
iii) Circuit number (DB name, circuit breaker e.g. DB01-CB08); and
iv) Function (e.g. switching lighting circuit DB03-L1)

b) A schedule of all installed cables, with the following information:
i) Circuit number (DB name, circuit breaker e.g. DB01-CB08)
ii) Size
iii) Installed length; and
iv) Function (e.g. “Feeding Submersible pump IW-SP-01”)

c) Description and details w.r.t:
i) Detailed description of the function of all operator controls
ii) Procedures for fault finding
iii) Maintenance instructions for all components and including repair, overhaul, change-out and installation procedures
iv) Inspection schedules; and
v) Spare part information and recommended spares

C3.3.4.2.6.7 E200.6.7 TESTING AND COMMISIONING

a) General

– The installation shall be inspected and tested in accordance with SANS 10142-1.

– Inspection and testing shall only be performed by personnel with approved, current qualifications. The Contractor shall provide qualified personnel for the supervision for all inspection and testing activities.

– The Contractor shall provide all necessary safety equipment and test instruments. All test instruments shall comply with SANS 61010 and be covered by a current test and calibration certificate.
– The Contractor’s safe working arrangements shall comply with the safety management systems and procedures prevailing on site. Where there may be a risk of injury to personnel, the Contractor shall submit a risk assessment and method statement for approval, prior to starting work.

– Unless otherwise specified in the Particular Specification, all inspection and test results shall be recorded using pro-forma documentation (test certificates and schedules) complying with SANS 10142-1.

- The Contractor shall make provision for all inspection and testing activities to be witnessed. Unless otherwise specified in the Particular Specification, the period of notice for witness testing shall be 5 working days.

- Where most of the inspection and testing activities are not witnessed, the Contractor shall allow for 10% of the inspection and testing activities to be repeated for witness testing.

- If there is a requirement for additional inspection and test activities to be performed as part of process commissioning, this shall be specified in the Particular Specification.

- Unless otherwise agreed by the Employer, no part of the installation shall be commissioned until all defects or omissions revealed by inspection and testing have been rectified. Where a defect or omission renders all or part of the installation unsafe for use, the Contractor shall take approved precautions to ensure that no part of the installation can be commissioned.

b) Test Sequence

- Inspections before Testing

  - Before testing, inspections shall be performed to verify:
  - All equipment and material is of the correct type and complies with applicable SANS and IEC standards
  - All parts of the installation are correctly selected and erected
  - No part of the installation is visibly damaged or otherwise defective
  - The installation is suitable for the environmental conditions; and
  - The installation complies with this Specification

- Testing of Installation

- On satisfactory completion of the inspections specified in 5.2.1, the following tests shall be undertaken in the sequence listed as per SANS 10142-1:

  - Continuity of conductors
  - Resistance of earthing conductor
  - Continuity of ring circuits earth fault loop impedance at main switch
  - Elevated voltage on supply neutral earth resistance
  - Insulation resistance
  - Voltage, main distribution board - no load
  - Voltage, main distribution board - on load
  - Voltage at available load
  - Operation of earth leakage units
  - Earth leakage test button
  - Polarity at points of consumption
  - Switching devices

C3.3.4.2.8 E200.8 STREET AND AREA LIGHTING

C3.3.4.2.8.1 E200.8.1 SCOPE

a) Application

- This document specifies the general requirements and related tests for Street and Area Lighting. It covers the classification, marking, mechanical and electrical construction of luminaires, poles and high masts.

- Installation Performance Requirements

- The installation shall be suitable for its intended duty with respect to the operating conditions of the electrical system and the electrical load requirements.

- The installation shall be suitable for the environmental conditions, particularly with respect to corrosion resistance and ingress protection.

C3.3.4.2.8.2 E200.8.2 STANDARDS

a) Associated Documentation

- This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.

- Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.

- The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the installation.

b) Regulations, Specifications and Standards

- The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:

  - Occupational Health and Safety Act (Act 85 of 1993)
  - Construction Regulations 2003 issued in terms of Section 43 of the Act
  - Local Fire Regulations; and
  - Regulations and by-laws of the Local Supply Authority

  and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 20 Section 8: Reference standards

Standard Number	Description
SANS 32	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants
SANS 97	Electric cables – Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3kV to19/22kV (excluding pressure assisted cables)
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 156	Moulded-case circuit-breakers
SANS 164	Two-pole and earthing-pin plugs and socket outlets
SANS 475	Luminaires for interior lighting, street lighting and floodlighting - Performance requirements
SANS 767	Earth leakage protection unit
SANS 950	Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1063	Earth rods, couplers and connections

Standard Number	Description
SANS 1085	Wall outlet boxes for the enclosure of electrical accessories
SANS 1088	Luminaire entries and spigots
SANS 1091	National colour standards of Paint
SANS 1195	Busbars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1431	Weldable structural steels
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1700	Fasteners
SANS 1777	Photoelectric control units for lighting
SANS 1783	Sawn softwood timber
SANS 1973	Low-voltage switchgear and control gear Assemblies
SANS 2001	Construction Works
SANS 10155	Accuracy in buildings
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10177	Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 10400	The application of the National Building Regulations
SANS 60269	Low-voltage fuses
SANS 60309	Plugs, socket-outlets and couplers for industrial purposes
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
SANS 60669	Switches for household and similar fixed-electrical installations
SANS 60947	Low-voltage switchgear and control gear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements
SANS 61238	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV)
SANS 61643	Low-voltage surge protective devices
Other Standards	**Description**
ARP 035	Guidelines for the installation and maintenance of street lighting
BS 88	Specification of supplementary requirements for fuses of compact dimensions for use in 240 / 415 V industrial and commercial electric installations
IEC 157	Low voltage switchgear and control gear
IEC 408	Low voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units

Standard Number	Description
IEC 12373	Aluminium and aluminium alloys. Anodizing. Method for specifying decorative and protective anodic oxidation coatings on aluminium
IEC 50086	Conduit systems for cable management
IEC 60898	Specification for circuit-breakers for overcurrent protection for household and similar installations

C3.3.4.2.8.3 E200.8.3 LUMINAIRES

a) General

- Luminaires shall be delivered within 12 months from being manufactured and shall be delivered to site unused with protective wrappings.
- Luminaires shall be delivered, stored and handled in accordance with the manufacturer's instructions. Where the performance of the luminaire is likely to be adversely affected, all necessary precautions shall be undertaken.
- They shall be protected against mechanical damage.
- Samples
- If required by the Employer, a sample of every luminaire offered shall be submitted to the Employer for approval. Acceptance of the samples by the Employer shall not place the Employer under any obligation.

b) Classification

- All luminaires shall have been type tested to SANS 60598-1 and 60598-2-3 by a SABS-approved certification authority (Contractor to furnish test certificates to the Engineer upon request to do so)
- All luminaires shall be of the totally enclosed type. Luminaires shall be adequately and securely fixed to the pole or bracket, allowing for adjustments and when adjusted shall be fixed and remain locked in the set position. Spigot entries shall comply with Table 1 of SANS 1088.
- Luminaires shall be constructed to inhibit the ingress of dirt, moisture and insects. The minimum IP rating for the lamp and control gear compartments shall be IP 65. IP rating shall comply with SANS/IEC 60529.
- All luminaires shall comply with the recommendations and references of Chapter 4 of ARP 035.

c) Marking

- Self-adhesive labels indicating the type and wattage of the lamp shall be stuck to the underside of the luminaire housing and shall be visible when the luminaire is mounted on a pole. Luminaires suitable for use with tubular lamps shall be indicated as such, with the letter "T" and luminaires for elliptical lamps with the letter "E", after the wattage. Letters shall be at least 40 mm in height and be black against the following background colours:

Table 19: Background colours to labels

Lamp	Colour
High pressure sodium vapour	orange
High pressure mercury vapour	blue
Metal halide	green

d) Construction

- The housing shall be robustly constructed, weatherproof, hail proof, corrosion proof and vandal resistant. It shall be manufactured from filled ultraviolet stabilized engineering polymer, aluminium or dough moulding compound (DMC).

- The diffuser shall be constructed from injection moulded high impact acrylic or otherwise toughened heat and impact resistant glass and shall not accumulate dirt reducing the light output. Polycarbonate shall not be used as it discolours and loses its impact resistance when exposed to the UV emitted by the sun or the light source.

- Luminaires with a sealed optical compartment allowing lamp replacement from above, which does not require opening the diffuser bowl for lamp replacement, shall be preferred. If the diffuser has to be opened for lamp replacement, the diffuser shall be held in place by stainless steel clips', ensuring the diffuser is closed even if one clip is broken. The diffuser shall remain attached to the housing when opened for maintenance or lamp replacement.

- A silicon rubber gasket shall be used to seal the lamp compartment. It shall be fitted into a groove in the housing and be kept in place to ensure the integrity of the IP rating. Neoprene or felt gaskets shall not be acceptable.

- An exterior lip shall be provided on the housing to ensure that there is no direct rainwater contact with the gasket between the housing and the diffuser, thus ensuring that no moisture is sucked into the diffuser when the luminaire is switched off and cools down.

- Anodized aluminium shall be used for a reflecting material, and the anodizing process shall comply with the requirements of BS 1615. The plate shall be thick enough not to become warped or distorted by the heat coming from the lamp. The reflector shall be permanently fitted into the housing. Luminaires shall preferably be of the semi-cut-off (SCO) distribution, unless the design requires a cut-off (CO) distribution. The luminaires shall be marked with the type of light distribution.

- If a luminaire has an adjustable light distribution, either by setting of the optical system, or orientation of reflectors or of the lamp-holder, adjustment markings shall be provided on the luminaire body, and information shall be provided by the manufacturer on the light distribution classification for each setting. The marking shall be made in a clear and indelible manner.

- The lamp-holder shall comply with VC 8011, shall be rated for 240 °C and shall not be susceptible to possible loosening of the lamp caused by vibrations. The lamp-holder and end caps shall be made of porcelain, having silver plated metal parts being of the GES type and able to withstand the high starting voltage. The centre contact of the lamp-holder shall be spring loaded and shall not deteriorate under normal working conditions.

- All control gear shall be housed within the body of the luminaire in a separate gear compartment sealed with a hinged, non-corrosive lid. Covers and other parts that provide protection against electric shock shall have adequate mechanical strength and shall be reliably secured so that they will not work loose whilst in service. For ease of maintenance, all control gear components shall be mounted on a removable gear tray. Luminaires that have a sealed optical compartment, with lamp replacement from above, shall also have a control gear compartment accessible from above.

- The control gear shall be removable and suitable for operation with the specified rating of the lamp on a 230 V ± 10% 50 Hz single-phase system. All internal wiring shall be protected against abrasion and heat, by using appropriate insulation or sleeve. All screws, bolts and metal parts shall be of stainless steel or non-corrosive materials.

- Lamp capacitors shall be manufactured fully in accordance with SANS 1250-1979 and shall be designed when used with the lamp and ballast provided to improve the overall power factor to at least 0.95 lagging. Capacitors shall be fitted with safety discharged resistors and shall be provided with approved nameplates setting out the details of the capacitors.

- Lamp ballasts shall comply with the requirements of SANS 1266 and shall be rated for the service required of them and shall be suitable for use with the lamps specified. Ballasts shall be of the totally encapsulated type having terminal blocks for ease of maintenance. The ballasts shall be provided with approved nameplates setting out the particulars of the ballast. The electronic ignition device shall be of the three wire type operating on the superposed pulse principle. The circuiting shall be such that shall a lamp fail the ignition shall not continue pulsing.

e) Area (Flood) Lights

- The luminaires shall be of the totally enclosed weatherproof type complete with a suitable lamp with integral mounted igniter and control gear.

- The housing shall be robustly constructed of die cast LM6 aluminium alloy or other corrosion proof and UV resistant material and be effectively sealed to inhibit the ingress of dirt, moisture and insects

- The front glass cover shall be constructed from heat resistant armoured glass having retaining clips, fasteners, etc., manufactured from stainless or ferritic steel. The fitting shall incorporate a protractor scale to allow for the correct and accurate adjustment of the downward to vertical aiming angle.
- The internal wiring shall be by means of high temperature grade silicone rubber insulated high quality flexible stranded cables not subject to deterioration. The low voltage wiring shall not be less than 660 volt grade and in the case of high voltage wiring the continuous voltage grade must be suitable for the open circuit voltage of the ballast.

- The compartment in which the control gear is located shall be accessible to provide ease of maintenance. This compartment shall be complete with earthing terminal and 660 volts insulated line connector block.

- Capacitors shall be metal clad, totally enclosed type complete with sealed in cable tails. Capacitors shall be manufactured fully in accordance with SANS 1250 and be capable of improving the overall power factor to at least 0.95 and be fitted with safety discharged resistors.

- Chokes shall be of the totally encapsulated type having terminal blocks for ease of maintenance.
- The electronic ignition device shall be of the three wire type operating on the superposed pulse principle.

- The circuiting shall be such that shall a lamp fail the ignition shall not continue pulsing.

- The lamp-holder end cap shall be porcelain, having silver plated metal parts being of the GES type and able to withstand the high starting voltage. The lamp-holder shall incorporate a spring wire type supporting device at the end of the lamp opposite the cap.

C3.3.4.2.8.4 E200.8.4 STREETLIGHT AND AREA LIGHTING POLES

a) General

- All poles shall be designed to withstand all static and dynamic loads on the fully equipped pole.
- Lighting columns shall be installed according to with the ARP 035.
- Unless otherwise specified poles having a luminaire mounting height less than 11,5 m shall be of glass filament wound (GRP) manufacture; poles having a luminaire mounting height more than 11,5 m shall be of steel.

b) Design parameters

- All poles shall comply with SANS 10225, under the following requirements:
  - Terrain category : 3
  - Design wind speed : 144 km/h
  - Altitude (above sea level) : 1000 m
  - Minimum safety factor : 1.5
- The horizontal and vertical deflections shall not exceed the requirements of SANS 10225.

c) Poles for streetlights

- The streetlight poles shall be manufactured from either steel or glass filament wound polyester and shall be of the round cross-section (tubular) tapered type. The poles shall have a luminaire mounting height as specified in the particular specification with or without a single or double outreach.
- The spigot for the mounting of the luminaire on the outreach arm shall be round with an external diameter of 40 mm and a length of 100 mm. The spigots shall be such that when the luminaires are mounted, they shall be at an angle of 15º to the horizontal or as otherwise specified.

d) Poles for area lighting

- The poles for the area lighting shall be manufactured from either steel or glass filament wound polyester and shall be of the straight round cross-section tapered type. The poles shall be suitable for the mounting of post top type luminaires at a mounting height as specified in the detail specification.
- The spigot for the mounting of the luminaire shall be round with an external diameter of 75 mm and shall have a length of 100 mm.

e) Cable entries

- The poles shall be provided with a cable access opening suitable for installing at least three 16 mm², 4-core street lighting cables.
- The edges of the access opening shall be smooth to prevent any damage to the cables.
- The access opening shall be positioned such that the opening is at least 500 mm below ground level after the pole has been erected.

f) Access Aperture

- At a height of at least 600 mm above ground level an opening, 240 mm high by 80 mm wide, shall be provided on the poles. The opening shall be covered with a weatherproof cover

plate with a profile similar to that of the pole. The cover plate shall be manufactured from the same material as that of the pole and the thickness thereof shall not be less than that of the pole. The cover plate shall be fixed to the pole by 10 mm hexagonal brass nuts.

- A mounting plate suitable for mounting equipment shall be fixed to the pole on the inside of the access opening. A clip tray / DIN-rail for two circuit breakers, a clip tray for four "Clip-on" type terminal blocks and a gland plate to take up to three cables shall be installed on the mounting plate. A 10 mm earth stud of adequate length shall be either installed on the mounting plate or shall be welded on the inside of the pole.

- The pole shall be fully equipped with the low voltage equipment specified in the detail specification.

g) Pole baseplates

- Each of the poles shall be provided with a steel baseplate with a diameter of at least 350 mm and a thickness not less than 4 mm.

- The baseplates shall be supplied complete with hook bolts and fasteners.

h) Finishing

- Steel poles

  - All welding on steel poles shall be smooth and neat in accordance with SANS 10225. No splatter, slag or blister shall be visible.

  - All parts of the streetlight pole, including cross-arms shall be hot dip galvanised in accordance with SANS 32 and SANS 121 and test certificates shall be provided if required. No welding, drilling, punching, bending or removal of burrs shall be carried out after galvanising.

  - For added protection against corrosion the pole shall be dipped in tar up to 500 mm above the finished ground level.

- Glass filament wound polyester poles

  - The pole shall be constructed by the filament winding process to achieve optimum results for strength and rigidity. The filament winding process shall be continuously applied with uniform tension onto a rotating mandrel and shall result in a minimum mass glass to resin ratio of 70:30. The surface shall be seamless, smooth and tapered.

  - The material of the finishing coat shall be a gel coat that shall comply with the requirements of SANS 141 and shall be applied to a uniform thickness of between 250 and 500 microns. It shall provide a weatherproof, UV resistant, and flame-resistant and impact strong surface in the colour specified.

  - The pole shall be manufactured in accordance with SANS 1749 under the ISO 9002 quality system and shall bear the applicable mark.
  - If an access opening is required, the cut-out shall be covered by an access door cover manufactured from glass filled nylon impregnated in the same colour as that of the surface coat. It shall be secured to the pole by two stainless steel Allen head captive screws into M4 brass inserts embedded in the pole.

- Concrete

  - Spun reinforced concrete poles shall be manufactured in accordance with SANS 470.

– Wood

- SANS 754 eucalyptus trees and SANS 753 pine trees comprises the specification for wooden poles used for electrical reticulation including streetlights.

C3.3.4.2.8.5 E200.8.5 HIGH MAST LIGHTING

i) General

– The mast shall be of octagonal cross section, tapered, with the mounting height of the luminaires specified in the detail specification. The mast shall be designed to SANS 10225 Code of Practice and when fully equipped with the luminaires shall withstand a wind velocity appropriate to the site conditions. The deflection at the top of the mast shall not exceed 2.5% of the mast height when subjected to two thirds of the maximum wind velocity.

– The masts shall be designed for mounting on a reinforced concrete foundation by means of a base plate secured to bolts casted into the foundation. Additional gussets shall be provided between the base plate and the mast. No steel used in the construction of the mast shall be less than 5 mm in thickness and all steel shall comply with the requirements of BS 4360 grade 43A.

– An aperture shall be provided on the side of the mast base compartment to afford ample and easy access to the equipment installed therein. The opening shall be fitted with a lockable, close fitting cover fully sealed against the weather. The perimeters of the opening shall be reinforced with fully welded sheet sections to restore the section modulus and to prevent buckling. Welding shall be in accordance with BS 135 and shall be carried out by qualified welders.

– Each mast shall be provided with a bracket to mount the luminaires as specified.

– All ferrous parts of the mast shall be hot dipped galvanized after fabrication in accordance with SABS 763.

– Each mast shall be provided with an internal distribution board with:

- 3-pole main switch
- a single phase earth leakage unit
- 10 x 10A SP circuit breaker
- 15 A, 3-pin switched socket outlet
- time switch or photocell
- contactors for control

– Additional power requirements for the rail row and hydro masts:

- One 15 amp 3 pin industrial type, switched socket outlet for the hydraulic unit
- One adequately rated triple pole isolator
- One 15 amp single pole and neutral moulded case breaker with integral 20 amp earth leakage protection device for control of the switched socket outlet
- Three adequately rated single pole circuit breakers for the control of the luminaires
- One 4 way neutral bar
- One 4 way earth bar

– All design calculations are to be submitted at time of tender for evaluation by an independent structural Engineer. Failure to submit this documentation will result in a disqualification from the tender.

- The mast manufacturer shall be ISO 9001 – 2000 certified. Failure to submit the proof of certification from your mast supplier may render your tender invalid.

j) Mid-hinge mast

- The mast shall be constructed to form a continuously tapered, totally enclosed, octagonal shaft.
- The mast must consist of a fixed lower part and a moving part hinged to the fixed part at approximately half the height of the mast. The moving part of the mast shall have the floodlight cross-arm mounted on it and must be adequately counterbalanced. The hinge must be made from stainless steel.
- The moving portion shall consist of sections fitted together on site by slip-joints. No welding on site is allowed.
- During raising and lowering and while in the horizontal position, the mast must withstand the wind forces from any direction as well as its own weight and any inertial effects due to sudden stoppage.
- An opening shall be provided in the base of the mast for access to the electrical distribution board. The opening shall only be accessible after the mast lid section has been hinged open. A safety chain must be provided which will ensure safe working conditions while work is conducted on the distribution board.
- The mast must be lowered and raised with a lightweight, manually operated but robust portable winch which can be stored in the base compartment.
- The winch unit must be securely attached to fixed lower part of the mast and the winch cable to the movable part.
- A spring-loaded gravity ratchet must ensure that when the operating handle is released during the raising and lowering operation, the moving part stops in whatever position it is in. The ratchet must be fitted with a lever which must be depressed with a constant pressure during the whole operation of lowering the mast. A round bracket must be welded into the top fixed part of the mast to prevent damage to the trailing cable while lowering or raising the mast.
- The luminaries must be permanently connected to the supply cable, to facilitate testing when the mast is in the lowered position. No additional cable or connections are allowed.
- Masts which require any form of power disconnection while being lowered will not be considered.
- Rail Row Masts
- The mast shaft shall be multi sectional. Each section is constructed from a steel plate, which is cut to size, bent into a 6-sided “half shell” and welded together. Rolled sections will not be accepted.
- Two “half shell” sections are then welded together by means of a continuous long seam weld, to form this section of the mast shaft.
- The floodlight luminaire Ring shall be manufactured in two half-sections, which are bolted together on site. The ring is of a welded steel construction and hot dipped galvanised for corrosion protection. The luminaire ring shall be manufactured from 76 x38 rolled channel section and shall be fitted with a 20mm diameter steel bumper ring below the rolled channel. The luminaire ring shall dock into three guides fixed to the top pulley assembly.

- The top pulley assembly consists of a fabricated steel housing, containing the 2 x 280 mm diameter; LM6 cast aluminium pulleys, over which the steel wire ropes pass. Separators – one between the pulleys and one on the outside of each pulley – are provided, to separate the wire ropes and trailing cables and to prevent these from wrapping together, shall the ring be lowered in windy conditions. Each external separator has two close-fitted guides on the outside, to prevent the wire ropes and cables from climbing off the pulleys. Additional deep-groove pulleys are fitted for the electrical trailing cables. All pulleys shall run on stainless steel shafts. The entire assembly is protected against the ingress of water, with a moulded fibreglass canopy, which is bolted to the assembly, with a bolt which incorporates a lightning spike.

- Two steel wire ropes shall be supplied for the purposes of lowering the luminaire ring. All rope connections are done by means of copper “TALURIT” ferrules and crimped with hydraulic crimping tools. The breaking load of the ropes shall be calculated and designed by an Engineer to adequately raise and lower the specified luminaires and luminaire mounting ring.

- The portable winch, used for the raising and lowering of the luminaire ring, shall be a double drum type, as this unit meets all International safety requirements, ensuring that, even in the event of one of the ropes breaking, the luminaire ring is still secured by the second rope. Single drum winch systems WILL NOT BE CONSIDERED. The worm and wheel of the winch are fully immersed in an oil bath and have a gear ratio of 50:1. The winch ropes are terminated in such a manner that distortion and twisting of the ropes is prevented and four turns of the rope remain on the drum, after the ring has been completely lowered. The driving spindle of the winch is automatically locked, when not in use.

- The standard power tool used to drive the winch is a single-phase, single speed electric motor, fitted with a reduction gear box. The power tool, which is slotted into the winch slide, when in use, is supplied complete with a 3 metre cable and remote forward/reverse control switch, for safe operation. The power tool is fitted with a torque limiting device, which is set to slip before any damage can be done to the wire ropes, in the event of over-winding. Hydraulic Power tools shall not be considered

- The following electrical equipment is to be included:

    - The electrical trailing cable, which supplies power to the floodlight luminaires, shall vary in size, depending on the electrical load to be carried and whether or not a photocell is installed on the luminaire ring. The cable shall be 4 mm flexible, multicore, and unarmoured, with “Nitral” insulation. The lower end of the cable terminates in a multi-pin male socket, which in turn, plugs into a multi-pin female socket, mounted in the mast distribution board. The upper end of the cable is fixed to the luminaire ring by means of a cast aluminium clamp and terminates directly in the junction box, mounted on the luminaire ring.
    - A weather-proof junction box shall be fixed to the luminaire ring and provides the termination point for the trailing cable, as well as for the cables which supply power to the floodlight luminaires. The junction box is also fitted with a multi-pin plug, which accepts a test lead, used to test the floodlights, with the ring in the lowered position.
    - If required, the mast can be fitted with a photocell (daylight switch) to switch the floodlights on and off.
    - The mast shall be fitted with a totally enclosed, fibreglass distribution board, fitted in a convenient position in the base of the mast and accessible through the mast access door. The equipment fitted to the distribution board shall vary.

- The mast shall be bolted to a chimney and pad type reinforced concrete foundation with cast in foundation bolts. The design and dimensions of the foundation shall depend on factors

such as wind velocity size of mast and soil conditions. Designs for foundations are to be signed off by a registered Engineer before construction is started.

k) Hydro Masts

- The mast is made up of two, three or four sections, each with a length of up to approximately 12 m for ease of galvanizing and transportation to site. Each section is constructed from a steel plate, which is cut to size, bent into a six-sided “half shell” and welded together. Two “half shell” sections are then welded together by means of a continuous long seam weld, to form a section of the mast.

- An opening of approximately 250 mm x 750 mm is cut out in the base of the mast. The top and bottom of the opening are curved to avoid stress-concentrations in the corners. The opening perimeter is strongly reinforced to maintain the section modulus of the mast shaft and to prevent buckling. The door provides easy access to the distribution board and ancillary equipment. A weather hood provides protection against ingress of water.

- The size and material thickness of the base plate and gussets depend on the Height and number and type of luminaires installed on the mast. The material is carefully inspected while being flame cut and if required an ultra-sonic inspection shall be carried out. The base plate is welded to the fixed lower section of the mast. Gussets disperse the stress concentrations between the bottom of the mast and the base plate. Two of these gussets (ram lugs) have holes to accept the pivoting pin for attachment of the hydraulic ram.

- One or two 100 mm cable sleeves must be cast in the concrete foundations. A hole in the base plate provides access to the mast for looping in and out of the supply cables.

- The hinge is situated approximately 1.25 m above the base of the mast. The mast, when lowered, shall remain in a horizontal position to facilitate easy maintenance to the luminaires. Fixing points (ram lugs) for the hydraulic rams are provide on the base and the movable upper section. The latter passes through the mast and is welded to the mast on either side. A self-locking mechanism is provided in the base of the mast, securing the upper section in the vertical position even in windy conditions with the wind blowing in any direction. The release handle can only be operated after the hydraulic ram has compressed the neoprene pads, situated between the base and the movable section of the mast.

- Lowering and raising is done with a portable, double acting hydraulic ram, pulling the mast down during lowering and pushing it up during raising. The hydraulic ram can only be operated when the control lever is pushed and held in the operating position; when the control lever is released, the mast stops in whatever position it is in. The ram is securely attached to the upper and lower sections of the mast and cannot be removed during the operation. The ram is fitted with a non-return valve with a limiting oil flow by-pass orifice, ensuring a carefully controlled, pre-determined speed of lowering and preventing any increase in speed in the unlikely event of a complete hydraulic failure or severing of hoses. Heavily loaded 25 m and 30 m masts require a double ram and the 40 m three rams. The hydraulic pump with electric motor is permanently fixed on a trolley which can easily be moved from mast to mast. The ram, when not in use, is firmly attached to the trolley. One unit shall serve any number of masts. With very large installations, it is recommended that a trailer, which can be towed by a vehicle be used, rather than a trolley.

- Cross arms or luminaire brackets are provided on the top of the mast to suit the required type and number of luminaires.

- The design and the dimensions of the concrete foundation depend on mast height, wind velocity, number and type of luminaires as well as the soil conditions. It is important to take into account the position of the luminaires and the direction in which the mast must be lowered when founding the foundation and foundation bolts. Foundation bolts are Hot-Dip galvanized. M39 bolts are normally used; the quantity and centres are determined by the

size of the mast and the number of luminaires installed. Lighting Structures shall design and construct the foundations on site if required.

- A 5-core flexible neoprene mains supply trailing cable is provided between the distribution board and the weatherproof junction box on the top of the mast. The junction box is fitted with an earth and neutral bars and the required number and size of the cable glands. Each luminaire is connected to the junction box with a 3 core 1.5 mm flexible neoprene cable. The luminaires can be tested in the lowered position without the need of extra cables or connections.

- An earthing stud is welded to the mast structure adjacent to the distribution board. Incoming cables can be connected to this stud.

- A totally enclosed fiberglass power distribution board is mounted in an easily accessible position in the base compartment of the mast. The board is provided with a front cover panel with only the operating toggles of the isolator and circuit breakers protruding.

- The distribution board shall be equipped as described above.

C3.3.4.2.8.6 E200.8.6 PHOTOCELL (DAY/NIGHT SWITCH)

a) General

- The switches are to be used to control streetlights or high mast lighting and shall be fitted with switch contacts able to carry not less than 6A. The current shall not exceed 50mA during no-load conditions.

- The units shall be suited to 240V ± 6%, 50Hz single-phase alternating current.

- The units shall be weatherproof and vibration-resistant as they are to be mounted on top of streetlight luminaires. The units shall be designed to withstand damage by either stone-throwers or hail. If the units do not possess this quality, separate wire screens shall be provided for this purpose. The units shall be supplied with a standard NEMA plug and socket. The socket shall have an arm for mounting on a pole. All parts shall be treated to be corrosion-proof. The units shall be capable of operating in dusty conditions between –5°C and + 55°C.

- The units shall switch on when the light intensity drops to 15 lx ± 20% and switch off when the light intensity reaches 40 lx ± 20%. When the unit is in the on position, there shall be a time delay of approximately one minute before it switches off due to a sudden increase in the light intensity.

- The design of the switch shall ensure a positive on and off switching at all times.

b) Mounting of photocell

- The photocell shall be mounted on the luminaire closest to the miniature substation the streetlight circuit is to be supplied from by making a hole in the luminaire and fixing the photocell base to the luminaire. The photocell shall be connected to the streetlight control equipment in the streetlight compartment by means of a 1.5 mm², 3-core, copper conductor, PVC, SWA, PVC, cable.

- Where streetlights are to be separately controlled, the photocell shall be mounted onto the luminaire and shall be directly connected to the luminaire.

C3.3.4.2.8.7 E200.8.7 INSTALLATION

a) General

- If not indicated on drawings, in multiphase street and area lighting installations the circuit arrangement shall be such that adjacent lighting columns are fed from different phases, i.e. staggered such that the neutral current after every third column measures 0A (ignoring here n-th order harmonics). Similarly, where two lighting columns are located opposite each other on a road or street, they shall be fed from different phases. Where road curvature makes this impossible to do and the road has an intersection, the circuit arrangement shall be such that the failure of a phase shall have the least possible effect on illuminance at the intersection. Furthermore, and not diminishing the requirement of above provisions, where multiple luminaires are connected to the same lighting column they shall be fed from separate phases.

- A loop-in cabling system, where single or multiphase cables are looped from source to lighting column to lighting column, shall be employed. Tee-offs will not be accepted (except for the wiring from terminals inside a lighting column to luminaire(s) mounted on the relevant column). Only Pratley or equivalent “end connectors with insulating sleeves” will be accepted.

- For TN-C-S-wired street or area lighting installations, the neutral conductor shall not be connected to the earth conductor downstream of the point of control. Only where required by the electrical supplier shall the circuit breaker inside lighting columns be deemed the point of control.

b) Setting of the works

- The Contractor shall set out the positions of the poles and the cable route as indicated on the drawings. The distance between the poles shall be maintained as specified.

- Where cable route drawings are not provided, cables shall be installed strictly in accordance with the requirements of the local government authority, and in the registered servitude made available for this usage to such authority by the Surveyor-General.

c) Excavations

- The holes for poles shall be excavated to the following depths:

Table 20: Depth of holes for poles

Description	Mounting Height (m)	Buried Depth (m)
Streetlight Poles	>10.5	2
Streetlight Poles	7.5 > 10.5	1.8
Area lighting Poles	> 3.5	1

- The holes for poles shall have minimum dimensions of 1 metre by 0.5 metres. Once the poles have been erected and aligned the excavations shall be backfilled and compacted in layers of 150 mm to 95% MOD AASHO using material free of stones and vegetation. Where the soil is sandy, loose or marshy, the poles shall be planted in a 12:1 sand/cement mixture.

- Where foundations are required, a minimum of 2 x 50 mm sleeves shall be installed for the installation of cables.

d) Planting of poles

- The steel and glass filament wound polyester poles shall be fitted with a base plate that shall be securely bolted with hook bolts before the pole is planted.

- The Contractor shall ensure that the poles are not strained or damaged in any way during erection.

- The structures shall be vertical to a tolerance of 0,5% after erection (i.e. the horizontal deviation of the centre of the cross section of the top of the pole from a vertical line originating from the centre of the cross section at the base of the pole shall not be more than 0,05% its height).

- The streetlight poles shall be planted with the luminaire outreach extended in the direction of the roadway and so that the outreach arm is perpendicular to the centre line of the road, except if otherwise specified by the Engineer.

- Where streetlights are installed, the access opening shall be on the opposite side of the direction of the oncoming traffic in the lane closest to the pole (such that any personnel conducting maintenance inside the access opening shall face oncoming traffic).

- Under no circumstances shall poles be shortened to create the impression that they have been planted to the correct depth.

e) Installation

- Each pole shall be fitted with an equipment mounting plate fixed inside the pole. The cables shall be terminated on the gland plate fitted to the mounting plate by means of cable glands.

- A 10A circuit breaker with a 6kA breaking capacity shall be installed for each luminaire in each pole.

- Terminals as specified elsewhere and suitable for the particular cable size shall be used.

- The cable armouring and the earth continuity conductors shall be terminated on the earth stud provided in the pole by means of crimped lugs.

- The connection between the terminals at the access opening and the terminal block of the luminaries shall be made using two PVC insulated 1.5 mm² copper conductors, red for the phase and black for the neutral conductor, and a 1.5 mm² bare copper earth wire for the earth connection.

- After the pole has been planted and the conductors have been drawn in, the streetlight luminaire shall be mounted on the spigot and securely fastened with the bolts and/or nuts to the pole.

- All the bolts, nuts, screws and clips of the fitting shall be properly screwed.

C3.3.4.2.8.8 E200.8.8 DRAWINGS AND DOCUMENTATION

a) General

- Drawings and documentation shall be provided in accordance with the general drawings and documentation standard specifications.

b) Drawings

- The following drawings shall be submitted with the tender:
  - Street and area lighting poles

- Dimensioned drawing of the poles
- Detail drawing of the equipment mounting plate
- Fixing detail of access opening cover plate

- Streetlight support arm

  - Dimensioned drawing of the support arm
  - Dimensioned drawing of fixing bracket

C3.3.4.2.8.9 E200.8.9 TESTING AND COMMISSIONING

a) General

– Testing of the streetlight luminaires and poles, area lighting luminaires and poles and high mast lighting shall be tested according to the relevant Testing and Commissioning specifications.

Johannesburg Water SOC Ltd

Johannesburg Water

CONTRACT JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 2B:

GENERIC SPECIFICATIONS

PREAMBLE TO SCOPE OF WORK

General

The Standard Specification for all associated civil work shall be the SANS 1200 and SANS 2001 – Standardized Specification for Civil Engineering Construction.

The Standardized Specifications applicable to this Contract are listed in the Project Specification.

These Specifications are not issued with this volume but are available at the Contractor's expense from: SA Bureau of Standards, Private Bag X191, Pretoria, 0001.

Scope

This Project Specification is set out in three portions:

Portion 1: SCOPE OF WORK covers a general description of the project, the facilities available and the requirements to be met.

Portion 2: GENERIC SPECIFICATIONS covers variations to the standardized specifications which are applicable to the contract.

Portion 3: PARTICULAR SPECIFICATIONS covers particular specifications which are applicable to the contract.

Status

Should any requirement of the Project Specification conflict with any requirement of the standardized or particular specifications, the requirements of the Project Specifications shall prevail.

C3.2 SPECIFICATIONS

C3.2.1 LIST OF APPLICABLE SPECIFICATIONS

C3.2.1.1 Applicable Standardized Specifications

For the purposes of this Contract, the following SANS 2001, SANS 1200, and other SANS Standardized Specifications for civil engineering construction are applicable:

SANS 1200 A	:	General
SANS 1200 AB	:	Engineer's Office
SANS 1200 C	:	Site clearance
SANS 1200 D	:	Earthworks (Genera)
SANS 1200 DB	:	Earthworks (Pipe trenches)
SANS 1200 DK	:	Gabion and Pitching
SANS 1200 DM	:	Earthworks (Roads, subgrade)
SANS 1200 HA	:	Structural Steelwork (Sundry items)
SANS 1200 L	:	Medium-pressure pipelines
SANS 1200 LB	:	Bedding (Pipes)
SANS 1200 LE	:	Stormwater drainage
SANS 1200 LG	:	Pipe Jacking
SANS 1200 ME	:	Subbase
SANS 1200 MF	:	Base

C3.2.1.2 Particular Specifications

The following Particular Specifications for work not covered by the SANS 1200 Standardized Specifications are also included hereunder: The engineering specifications below shall take precedence over any other SANS specification for the project.

C3.2.1.2.1 Civil

These additional specifications are included under section C.3.3.1 of this document.

C3.2.1.2.2 Mechanical

These additional specifications are included under section C.3.3.2 of this document.

C3.2.1.2.3 Structural

These additional specifications are included under section C.3.3.3 of this document.

C3.2.1.2.3 Electrical

These additional specifications are included under section C.3.3.4 of this document.

C3.2.2 VARIATIONS AND ADDITIONS TO THE SANS 1200 STANDARDIZED SPECIFICATIONS

Variations and additions to the following SANS 1200 Standardized Specifications were made.

SANS 1200 A	:	Preliminary and General
SANS 1200 AB	:	Engineer's Office
SANS 1200 C	:	Site clearance
SANS 1200 D	:	Earthworks (General)
SANS 1200 DB	:	Earthworks (Pipe trenches)
SANS 1200 DK	:	Gabion and Pitching
SANS 1200 DM	:	Earthworks (Roads, subgrade)
SANS 1200 HA	:	Structural Steelwork (Sundry items)

SANS 1200 L	:	Medium-pressure pipelines
SANS 1200 LB	:	Bedding (Pipes)
SANS 1200 LE	:	Stormwater drainage
SANS 1200 ME	:	Subbase
SANS 1200 MF	:	Base

The following variations and additions to the SANS 1200 Standardized Specifications referred to above apply to this Contract. The prefix PS indicates an amendment to SANS 1200. The letters and numbers following these prefixes respectively indicate the relevant Standardized Specification and clause numbers in SANS 1200 to which the variation or addition thereto applies.

C3.2.2.1 PSA GENERAL

C3.2.2.1.1 PSA 1 SCOPE

REPLACE THE CONTENTS OF SUBCLAUSE 1.1, INCLUDING THE NOTES, WITH THE FOLLOWING:

"1.1 This specification covers requirements, principles and responsibilities of a general nature which are generally applicable to civil engineering construction and building works contracts, as well as the requirements for the Contractor's establishment on the Site."

C3.2.2.1.2 PSA 2 INTERPRETATIONS

C3.2.2.1.2.1 PSA 2.3 DEFINITIONS

IN THE OPENING PHRASE BETWEEN THE WORDS "specification" *AND* "the following", *INSERT THE WORDS* "the definitions given in the Conditions of Contract and".

(a) General

ADD THE FOLLOWING DEFINITIONS:

" 'General Conditions' and 'Conditions of Contract': The General Conditions of Contract specified for use with this Contract, together with the Contract Data (GCC 2015).

'Specified': As specified in the Standardized Specifications, the Drawings or the Project Specifications. 'Specifications' shall have the corresponding meaning."

(c) Measurement and payment

REPLACE THE DEFINITIONS FOR "Fixed charge", "Time-related charge" *AND* "Value-related charge" *WITH THE FOLLOWING:*

“ 'Fixed charge': A charge that is not subject to adjustment on account of variations in the value of the Contract Price or the time allowed in the Contract for the completion of the work.

'Time-related charge': A charge, the amount of which varies in accordance with the Time for Completion of the Works, adjusted in accordance with the provisions of the Contract.

'Value-related charge': A charge, the amount of which varies pro rata with the final value of the measured work executed and valued in accordance with the provisions of the Contract.' "

C3.2.2.1.2.2 PSA 2.4 ABBREVIATIONS

(a) Abbreviations relating to standard documents

ADD THE FOLLOWING ABBREVIATION:

"CKS: SANS Co-ordinating Specification."

C3.2.2.1.3 PSA 3 MATERIALS

C3.2.2.1.3.1 PSA 3.1 QUALITY

ADD THE FOLLOWING AT THE END OF SUBCLAUSE 3.1:

"All manufactured materials supplied shall be new materials unless the contrary is specified. All materials specified to be in accordance with SANS Specifications shall bear the SABS mark, where such a mark is available for the type of product."

C3.2.2.1.3.2 PSA 3.3 DELAY DUE TO SUPPLY OF MATERIALS

ADD THE ABOVE SUBCLAUSE TO CLAUSE 3:

If there are delays in the work because the required materials are unavailable, the Contractor must prove to the Engineer what the reasons for those delays are. To do so, the Contractor must submit to the Engineer:

- copies of the written orders the Contractor sent to suppliers to request the required materials
- copies of the written enquiries the Contractor sent to suppliers to follow up on orders they had placed with them.

The Engineer will then assess the information contained in the copies they receive from the Contractor. If the Engineer finds that the materials are unavailable because the Contractor did not order the materials in time, or did not properly follow up on orders they placed with suppliers, the Engineer will consider the Contractor to have been negligent in carrying out their duties. In such a case, the Contractor will not get an extension of time. But if the Engineer finds that Contractor carried out all their duties properly, and the materials are unavailable simply because the suppliers could not provide the necessary materials in time, the Contractor may get an extension of time.

C3.2.2.1.4 PSA 4 PLANT

C3.2.2.1.4.1 PSA 4.1 SILENCING OF PLANT

REPLACE THE CONTENTS OF SUBCLAUSE 4.1 WITH THE FOLLOWING:

"The Contractor's attention is drawn to the applicable regulations pertaining to noise and hearing conservation, framed under the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) as amended.

The Contractor shall at all times and at his own cost, be responsible for implementing all necessary steps to ensure full compliance with such regulations, including but not restricted to the provision and use of suitable and effective silencing devices for pneumatic tools and other plant which would otherwise cause a noise level in excess of that specified in the said regulations.

Where appropriate, the Contractor shall further, by means of temporary barriers, effectively isolate the source of such noise in order to comply with the said regulations."

C3.2.2.1.4.2 PSA 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES

ADD THE FOLLOWING PARAGRAPH BEFORE THE EXISTING FIRST PARAGRAPH IN SUBCLAUSE 4.2:

"The Contractor's buildings, sheds and other facilities erected or utilised on the Site for the purposes of the Contract shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. as may be required by the Contractor. The facilities shall always be kept in a neat and orderly condition.
No personnel may reside on the Site. Only night-watchmen may be on the Site after hours."

DELETE "and first-aid services" *IN THE SECOND PARAGRAPH OF SUBCLAUSE 4.2 AND ADD THE FOLLOWING:*

"The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 10 workers, which toilets shall be effectively screened from public view and their use enforced. Such toilets shall be relocated from time to time as the location of the work being executed changes, so as to ensure that easy access to the toilets is maintained.

The Contractor shall, where applicable, make all necessary arrangements and pay for the removal of night soil."

C3.2.2.1.5 PSA 5 CONSTRUCTION

C3.2.2.1.5.1 PSA 5.1 SURVEY

C3.2.2.1.5.1.1 PSA 5.1.2 Preservation and replacement of survey beacons and pegs subject to the Land Survey Act

DELETE THE WORDS "in the vicinity of boundaries" *IN THE SECOND SENTENCE OF SUBCLAUSE 5.1.2 AND REPLACE THE WORDS* "under the direction of" *IN THE SAME SENTENCE WITH* "in consultation and liaison with".

ADD THE FOLLOWING AFTER THE SECOND SENTENCE OF SUBCLAUSE 5.1.2:
"The Contractor and the Engineer shall record on the said list, their concurrence or disagreement (as the case may be) regarding the completeness and accuracy of the details recorded therein."

REPLACE THE THIRD SENTENCE OF SUBCLAUSE 5.1.2 WITH THE FOLLOWING:

"At the completion of the Contract, the Contractor shall expose all pegs that were listed at the commencement of the construction as being in order and the Contractor shall arrange with a registered Land Surveyor for the checking of the positions of all such pegs and the replacement of those that the Land Surveyor's check reveals have become disturbed or damaged. The Contractor shall, as a precedent to the issue of the Certificate of Completion, provide to the Engineer, a certificate from the registered land surveyor, certifying that all the pegs listed at the commencement of construction in accordance with the provisions of this clause, have been checked and that those found to have been disturbed, damaged or destroyed have been replaced in their correct positions, all in accordance with the provisions of the said Act.

The costs of all checking, replacement and certification as aforesaid shall be entirely for the Contractor's account. This, with the provision always that the Contractor shall not be held liable for the cost of replacement of pegs which:

(a) cannot reasonably be re-established in their original positions by reason of the finished dimensions of the permanent works, and

(b) the Contractor can prove beyond reasonable doubt to the satisfaction of the Engineer, were disturbed, damaged or destroyed by others beyond his control."

C3.2.2.1.5.2 PSA 5.3 PROTECTION OF EXISTING STRUCTURES

REPLACE "Machinery and Occupational Safety Act, 1983 (Act No 6 of 1983)" *WITH* "Occupational Health and Safety Act, 1993 (Act No 85 of 1993), as amended," *AND INSERT THE FOLLOWING AFTER* "(Act No. 27 of 1956)": "as amended".

C3.2.2.1.5.3 PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES

REPLACE THE HEADING AND THE CONTENTS OF SUBCLAUSE 5.4 WITH THE FOLLOWING:

"PSA 5.4 LOCATION AND PROTECTION OF EXISTING SERVICES

C3.2.2.1.5.3.1 PSA 5.4.1 Location of existing services

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services which can reasonably be expected by an experienced and competent Contractor to be present on, under, over or within the Site.

Without in any way limiting his liability in terms of the Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Engineer, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where he intends to work. Neither the Employer nor the Engineer offers any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site.

Thereafter, the Contractor shall, by the use of appropriate methodologies, carefully expose the services at such positions as are agreed to by the Engineer, for the purposes of verifying the exact location and position of the services. Where the exposure of existing services involves excavation to expose underground services, the further requirements of subclauses 4.4 and 5.1.2.2 of SANS 1200 D shall apply.

The aforesaid procedure shall also be followed in respect of services not shown on the plans, but which may reasonably be anticipated by an experienced Contractor to be present or potentially present on the site.

All services, the positions of which have been determined as aforesaid at the critical points, shall henceforth be designated as 'known services' and their positions shall be indicated by the Contractor on a separate set of drawings, a copy of which shall be furnished to the Engineer without delay.

As soon as any service which has not been identified and located as described above is encountered on, under, over or within the site, it shall henceforth be deemed to be a known service and the aforesaid provisions pertaining to locating, verifying and recording its position on the balance of the site shall apply. The Contractor shall notify the Engineer immediately when any such service is encountered or discovered on the Site. Whilst he is in possession of the Site, the Contractor shall be liable for all loss of or damage as may occur to

(a) known services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognizance being taken of such deviations in line and level which may reasonably be anticipated, and

(b) any other service which ought reasonably to have been a known service in accordance with the provisions of this clause.

The Contractor shall also be liable for consequential damage in regard to (a) and (b), whether caused directly by the Contractor's operations or by the lack of proper protection.

No separate payment will be made to the Contractor in respect of his costs of providing, holding available on the Site and utilising the said detecting and testing equipment, nor for any costs incurred in preparing and submitting to the Engineer the Drawings as aforesaid. These costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.
Payment to the Contractor in respect of exposing services at the positions agreed by the Engineer and as described above will be made under the payment items (if any) as may be provided for in the respective sections of the specifications pertaining to the type of work involved.

C3.2.2.1.5.3.2 PSA 5.4.2 Protection during construction

The Contractor shall take all reasonable precautions and arrange its operations in such a manner as to prevent damage occurring to all known services during the period which the Contractor has occupation and/or possession of the Site.
Services left exposed shall be suitably protected from damage and in such a manner as will eliminate any danger arising therefrom to the public and/or workmen, all in accordance with the requirements of the prevailing legislation and related regulations.

Unless otherwise instructed by the Engineer, no services shall be left exposed after its exact position has been determined and all excavations carried out for the purpose of exposing underground services shall be promptly backfilled and compacted. In roadways, the requirements of subclause 5.9 of SANS 1200 DB should be observed. In other areas compaction is to be to 93% modified AASHTO density.

C3.2.2.1.5.3.3 PSA 5.4.3 Alterations and repairs to existing services

Unless the contrary is clearly specified in the Contract or ordered by the Engineer, the Contractor shall not carry out alterations to existing services. When any such alterations become necessary, the Contractor shall promptly inform the Engineer, who will either make arrangements for such work to be executed by the owner of the service or instruct the Contractor to make such arrangements himself.

Should damage occur to any existing services, the Contractor shall immediately inform the Engineer, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs. In urgent cases, the Contractor shall take appropriate steps to minimise damage to and interruption of the service. No repairs of telecommunication cables or electric power lines and cables shall be attempted by the Contractor.

Wayleaves should also be consulted regarding contact numbers for relevant service authorities.

C3.2.2.1.5.4 PSA 5.5 DEALING WITH WATER ON WORKS

The Contractor shall in particular keep free from water the entire working area. The temporary works should divert the bulk of the water. The Contractor shall supply, operate and maintain such pumping plant as may be necessary to remove, control and dispose any water, including seepage, that may enter the Works. The Engineer may take or order the Contractor to take additional precautions where he is not satisfied with the Contractor's arrangements. The Contractor shall not be relieved of his responsibility by reason of the Engineer taking or ordering additional precautions, or by reason of the engineer failing to do so. All expenditure incurred by Johannesburg Water in taking any additional precautions or otherwise in remedying the default of the Contractor and making good of the Works shall be recovered from the moneys due to the Contractor. The Contractor shall be responsible to effect all dewatering to enable the Contractor to access and execute the Works.

The Contractor shall be responsible for the full adequate protection of the works against damage due to storms, rain, floods, stormwater, subsoil water and seepage from whatever source. The Contractor shall take over the site where the works has to be executed at the beginning of the Contract Period and the full risk and cost of dealing with all water shall be borne by the Contractor.

The Contractor shall also provide all necessary pipe work, pumps and other appliances necessary for adequate dewatering of all excavations and shall maintain these in good condition and provide adequate standby equipment to ensure that no disruption of work will ensue as a result of possible breakdown of equipment.

C3.2.2.1.5.5 PSA 5.7 SAFETY

REPLACE THE CONTENTS OF SUBCLAUSE 5.7 WITH THE FOLLOWING:

"Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations thereunder, the Contractor shall at his own expense (except only where specific provision (if any) is made in the Contract for the reimbursement to the Contractor in respect of particular items), provide the following:

(a) Provide to its Employees on the site of the works, all safety materials, clothing and equipment necessary to ensure full compliance with the provisions of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) as amended (hereinafter referred to as the Act) at all times, and shall institute appropriate and effective measures to ensure the proper usage of such safety materials, clothing and equipment at all times;

(b) Provide, install and maintain all barricades, safety signage and other measures to ensure the safety of workmen and all persons in, on and around the site, as well as the general public;

(c) Implement on the site of the works, such procedures and systems and keep all records as may be required to ensure compliance with the requirements of the Act at all times;

(d) Implement all necessary measures so as to ensure compliance with the Act by all Subcontractors engaged by the Contractor and their employees engaged on the works;

(e) Full compliance with all other requirements pertaining to safety as may be specified in the Contract.

The Employer and the Engineer shall be entitled, although not obliged, to make such inspections on the site as they shall deem appropriate, for the purpose of verifying the Contractor's compliance with the requirements of the Act. For this purpose, the Contractor shall grant full access to the site of all parts of the site and shall co-operate fully in such inspections and shall make available for inspection all such documents and records as the Employer's and/or Engineer's representative may reasonably require. Where any such investigations reveal, or where it comes to the Engineer's attention that the Contractor is in any way in breach of the requirements of the Act or is failing to comply with the provisions of this clause, the Engineer shall, in accordance with the provisions of Clause 5.11 of the Conditions of Contract, be entitled to suspend progress on the works or any part thereof until such time as the Contractor has demonstrated to the satisfaction of the Engineer, that such breach has been rectified.

The Contractor shall have no grounds for a claim against the Employer for extension of time and/or additional costs if the progress on the works or any part thereof is suspended by the Engineer in terms of this clause, and the Contractor shall remain fully liable in respect of the payment of penalties for late completion in accordance with the provisions of Clause 5.13.1 should the Contractor fail to complete the Works on or before the specified due completion date in consequence of the suspension. Persistent and repeated breach by the Contractor of the requirements of the Act and/or this clause shall constitute grounds for the Engineer to act in terms of Clause 9.2.1.3.6 of the Conditions of Contract and for the Employer to cancel the Contract in accordance with the further provisions of the said Clause 9.2.

ADD THE FOLLOWING SUBCLAUSES TO CLAUSE 5:

C3.2.2.1.5.6 "PSA 5.9 SITE MEETINGS

The Contractor or his authorised agent will be required to attend regular site meetings, which shall normally be held once a month on dates and at times determined by the Engineer, but in any case whenever reasonably required by the Engineer. Unless otherwise indicated in the Contract or instructed by the Engineer, such meetings shall be held at the Contractor's offices on the site. At such monthly meetings, matters such as general progress on the works, quality of work, problems, claims, payments, and safety shall be discussed, but not matters concerning the day-to-day running of the Contract.

C3.2.2.1.5.7 "PSA 5.10 SANITARY FACILITIES

The Contractor shall provide, maintain and finally remove from site adequate sanitary facilities. The sanitary facility shall be properly ventilated and clean at all times. The use of the sanitary facilities shall be strictly enforced.

C3.2.2.1.6 PSA 6 TOLERANCES

ADD THE FOLLOWING SUBCLAUSE TO CLAUSE 6:

C3.2.2.1.6.1 "PSA 6.4 USE OF TOLERANCES

No guarantee is given that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified, or when clearly not applicable, all quantities for measurement and payment shall be determined from the 'authorised' dimensions. These are specified dimensions or those shown on the Drawings or, if changed, as finally prescribed by the Engineer, without any allowance for the specified tolerances. Except if otherwise specified, all measurements for determining quantities for payment will be based on the 'authorised' dimensions.

If the work is constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the calculation of quantities will be based on the 'authorised' dimensions, regardless of the actual dimensions to which the work has been constructed.

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the Engineer may nevertheless, at his sole discretion, accept the work for payment. In such cases no payment shall be made for quantities of work or material in excess of those calculated for the 'authorised' dimensions, and where the actual dimensions are less than the 'authorised' dimensions minus the tolerance allowed, quantities for payment shall be calculated based on the actual dimensions as constructed."

C3.2.2.1.7 PSA 7 TESTING

C3.2.2.1.7.1 PSA 7.1 PRINCIPLES

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.1.7.1.1 PSA 7.1.3 Cost of Testing

The cost of all testing to be carried out by the Contractor in terms of the requirements of the relevant SANS 1200 standards shall be included in the rates for the various work items listed in the Schedule of Quantities. No separate payments shall be made in this regard.

The Engineer may order the Contractor to arrange special check tests to be carried out by an approved independent laboratory. The cost of special check tests ordered by the Engineer shall be

borne by the Employer if the test results indicate compliance with the specification and by the Contractor if the results indicate non-compliance with the specification.

C3.2.2.1.7.2 PSA 7.2 APPROVED LABORATORIES

REPLACE THE CONTENTS OF SUBCLAUSE 7.2 WITH THE FOLLOWING:

"Unless otherwise specified in the relevant specification or elsewhere in the Project Specification, the following shall be deemed to be approved laboratories in which design work, or testing required in terms of a specification for the purposes of acceptance by the Engineer of the quality of materials used and/or workmanship achieved, may be carried out:

(a) Any testing laboratory certified by the South African National Accreditation Systems (SANAS) in respect of the nature and type of testing to be undertaken for the purposes of the Contract;

(b) Any testing laboratory owned, managed or operated by the Employer or the Engineer;

(c) Any testing laboratory established and operated on the Site by or on behalf of the Employer or the Engineer.

(d) Any other laboratory that the Engineer approves in his absolute discretion."

C3.2.2.1.8 PSA 8 MEASUREMENT AND PAYMENT

C3.2.2.1.8.1 PSA 8.1 MEASUREMENT

C3.2.2.1.8.1.1 PSA 8.1.1 Method of measurement, all sections of the Schedule

DELETE THE WORDS "and South West Africa".

C3.2.2.1.8.1.2 PSA 8.1.2 Preliminary and General item or section

C3.2.2.1.8.1.2.1 PSA 8.1.2.1 Contents

REPLACE THE LAST SENTENCE OF SUBCLAUSE 8.1.2.1(b) WITH THE FOLLOWING:

"Separate items will be scheduled to cover the fixed, value-related and time-related components of the Contractor's preliminary and general costs."

C3.2.2.1.8.1.2.2 PSA 8.1.2.2 Tendered sums

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Except only where specific provision is made in the Specifications and/or the Bill of Quantities for separate compensation for any of these items, the Contractor's tendered sums under items PSA 8.3 and PSA 8.4 shall collectively cover all charges for:

- risks, costs and obligations in terms of the Conditions of Contract and of this standardized specification;
- head-office and site overheads and supervision;
- profit and financing costs;
- expenses of a general nature not specifically related to any item or items of the permanent or temporary work;

- providing such facilities on site as may be required by the Contractor for the proper performance of the Contract and for its personnel, including, but without limitation, providing offices, storage facilities, workshops, ablutions, services such as water, electricity, sewage and rubbish disposal, access roads and all other facilities required, as well as for the maintenance and removal on completion of the works of these facilities and cleaning-up of the site of the Contractor's establishment and reinstatement to not less than its original condition, and

- providing the facilities for the Engineer and his staff as specified in the Contract and their removal from the site on completion of the Contract."

C3.2.2.1.8.2 PSA 8.2 PAYMENT

C3.2.2.1.8.2.1 PSA 8.2.1 Fixed-charge and value-related items

REPLACE THE CONTENTS OF SUBCLAUSE 8.2.1 WITH THE FOLLOWING:

C3.2.2.1.8.2.1.1 PSA 8.2.1.1 Fixed-charge items

"Payment of fixed charges in respect of item 8.3.1 will be made as follows:

(a) EIGHTY PER CENT (80%) of the sum tendered will be paid when the facilities have been provided and approved;

(b) The remaining TWENTY PER CENT (20%) will be paid when the works have been completed, the facilities have been removed and the site of the Contractor's establishment has been cleared and cleaned to the satisfaction of the Engineer.

No adjustment will be made to the sum tendered in respect of item 8.3.1 should the value of the works finally executed or the time for completion vary in any way from that specified in the tender.

C3.2.2.1.8.2.1.2 PSA 8.2.1.2 Value-related items

Payment for the sum tendered under item 8.3.2 will be made in three separate instalments as follows:

(a) The first instalment, which is 40% of the sum, will be paid when the Contractor has fulfilled all his obligations to date under this specification, the General Conditions of Contract and the Special Conditions of Contract, and when the value of work certified for payment, excluding materials on site and payments for preliminary and general items, is equal to not less than 5% of the total value of the work listed in the Bill of Quantities.

(b) The second instalment, which is 40% of the sum, will be made when the amount certified for payment, including retention moneys but excluding this second instalment, exceeds 50% of the tender sum.

(c) The final payment, which is 20% of the sum, will be made when the works have been certified as completed and the Contractor has fulfilled all his obligations to date under this Specification, the General Conditions of Contract and the Contract Data.

No adjustments will be made to the final Contract price, should the value of the measured work finally completed be more or less than the tender sum."

C3.2.2.1.8.2.2 PSA 8.2.2 Time-related items

REPLACE THE CONTENTS OF SUBCLAUSE 8.2.2 WITH THE FOLLOWING:

"Subject to the provisions of subclauses 8.2.3 and 8.2.4, payment under item 8.4.1 (time-related item) will be made monthly in equal amounts, calculated by dividing the sum tendered for the item

by the tendered Contract period in months, provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the Works as a whole."

C3.2.2.1.8.3 PSA 8.3 SCHEDULED FIXED-CHARGE AND VALUE-RELATED ITEMS

REPLACE THE CONTENTS OF SUBCLAUSE 8.3.1 WITH THE FOLLOWING:

C3.2.2.1.8.3.1 "PSA 8.3.1 Fixed preliminary and general charges…….Unit: sum

The sums tendered shall include full compensation for all fixed-charge preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.1.1.

ADD THE FOLLOWING NEW SUBCLAUSES TO CLAUSE 8.3

C3.2.2.1.8.3.1 "PSA 8.3.5 Additional Contractual Obligations

C3.2.2.1.8.3.1.1 PSA 8.3.5.1 Notice and warning to consumers……Unit : Sum

The sum shall cover the full compensation and cost of supply and delivery of the notices and warnings to customers at least 3 days before a shutdown is to take place in each section of work.

C3.2.2.1.8.3.1.2 PSA 8.3.5.2 OHS Act Obligations……..Unit: Sum

The sum shall cover the full compensation and fixed costs for the compliance with the Occupational Health and Safety Act, Construction Regulations 2014 and all the requirements stipulated in the Employer's Health and Safety Specifications."

C3.2.2.1.8.3.1.2 PSA 8.3.5.3 EMP Obligations…….Unit: Sum

The sum shall cover the full compensation and all fixed costs for compliance with the requirements of The Employer's Environmental Management Plan or applicable regulations.

C3.2.2.1.8.4 PSA 8.4 SCHEDULED TIME-RELATED ITEMS

REPLACE THE CONTENTS OF SUBCLAUSE 8.4 WITH THE FOLLOWING:

C3.2.2.1.8.4.1 "PSA 8.4.1 Time-related preliminary and general charges……Unit: month

The sum tendered shall include full compensation for all time-related preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.2."

ADD THE FOLLOWING NEW SUBCLAUSES TO CLAUSE 8.4.

C3.2.2.1.8.4.2 PSA 8.4.6 Additional Obligations

C3.2.2.1.8.4.2.1 PSA 8.4.6.1 OHS Act Obligation……Unit: Sum

The sum shall cover the full compensation and all time related costs for the duration of the contract, for the compliance with the Occupational Health and Safety Act, Construction Regulations 2014 and all the requirements stipulated in the Employer's Health and Safety Specifications.

C3.2.2.1.8.4.2.2 PSA 8.4.6.2 Security services cost……Unit: Month

The sum shall cover the full compensation and all costs for a sufficient 24 hour guarded services for the duration of the contract. This sum shall also cover the security requirements of the relevant privately owned properties impacted upon by the construction works, as well as negotiations with the owners of the properties in this regard.

C3.2.2.1.8.4.2.3 PSA 8.4.6.3 Electrical Safety Officer……..Unit: Month

The stated sum shall cover full compensation and all costs payable on a monthly basis, to provide a full time qualified and suitable experienced Electrical Safety Officer for the duration of the contract. The stated sum shall also cover for the ESO cellphone airtime. The ESO must provide proof that he has the necessary qualifications, competencies and registrations to carry out the required work.

C3.2.2.1.8.4.2.4 PSA 8.4.6.4 Community Liaison Officer…….Unit: Prov Sum

The stated sum shall cover full compensation and all costs payable on a monthly basis, to provide a full time qualified and suitable experienced Community Liaison Office for the duration of the contract. The stated sum shall also cover for the CLO cellphone airtime.

C3.2.2.1.8.5 PSA 8.5 SUMS STATED PROVISIONALLY BY THE ENGINEER

REPLACE THE CONTENTS OF SUBCLAUSE 8.5 WITH THE FOLLOWING:

C3.2.2.1.8.5.1 "PSA 8.5.1 Works executed by the Contractor……..Unit: Prov Sum

The Contractor will be reimbursed in substitution of the Provisional Sums (if any) allowed in the Bill of Quantities for work to be executed by the Contractor, in the amounts determined in accordance with the provisions of Clause 6.6 of the Conditions of Contract.

C3.2.2.1.8.5.2 PSA 8.5.2 Works executed by Nominated Subcontractors:

(a) Work to be executed by a Nominated Subcontractor……...Unit: Prov sum

(b) Overheads, charges and profit on item (a) above…….Unit: % or sum

Subitems (a) and (b) will be provided in the Schedule of Quantities for each different Nominated Subcontract included in the Contract.

The Contractor shall be reimbursed under subitem (a), in substitution of the respective Provisional Sums (if any) allowed in the Schedule of Quantities, the amounts actually paid or payable by the Contractor to the respective Nominated Subcontractors, in accordance with the provisions of Clause 6.6.

The Contractor shall be paid under subitem (b), either:

(a) where the unit of measurement for subitem (b) was specified as being a percentage, the respective percentage, as stated by the Contractor in his tender, of the amount certified by the Engineer for payment under the related subitem (a), all in accordance with the provisions of Clause 6.6.1.2.1, or

(b) where the unit of measurement for subitem (b) was specified as being a lump sum, an amount which is in the same proportion to the amount certified for payment under subitem (a) and the tendered lump sum is to the amount of the Provisional Sum stated under subitem (a) in accordance with the provisions of Clause 6.6.1.2.2., provided always that where the Contractor has failed for any reason to insert a percentage or sum (as applicable) for subitem in its tender, or

(c) where no provision was made in the tender documents for tenderers to make any such entry, the Contractor will be paid an amount equal to SEVEN AND ONE HALF PER CENT (7.5%) of the amount actually certified by the Engineer for payment under subitem (a).

The percentage or sum (as applicable) paid under subitem (b) as aforesaid, shall be deemed to include for full and final compensation to the Contractor for all costs as may be incurred and all charges and profits associated with the engagement, supervision, administration and management of the Nominated Subcontractor required of him in fulfilling its obligations under the Contract as the Principal Contractor."

The Contractor is responsible for both the cost of normal testing as described in the Project Specifications and for the cost of any additional test that indicates that the Specifications have not been complied with.

These Provisional Sums are at the disposal of the Engineer and will be paid if and when the need arises.

C3.2.2.1.8.6 PSA 8.6 PRIME COST ITEMS

REPLACE SUBCLAUSE 8.6 WITH THE FOLLOWING:

"PSA 8.6 PRIME COST SUMS

(a) Description of item to which Prime Cost Sum applies ……...Unit: PC Sum

(b) Charge required by Contractor on subitem (a) above ……Unit: %

Subitems (a) and (b) will be provided in the Bill of Quantities for each different item to which a Prime Cost Sum applies. The Contractor shall be reimbursed under subitem(s) (a) in substitution of the respective Prime Cost Sums included in the Contract, the actual price(s) paid or payable by him in respect of the goods, materials or services supplied, but excluding any charges for the Contractor's labour, profit, carriage, establishment or other charges related to such goods, services or materials.

The Contractor shall be paid under subitem (b), the respective percentage, as stated by the Contractor in his tender, of the amount certified by the Engineer for payment under the related subitem (a). The percentages tendered by the Contractor for each respective subitem (b) included in the Bill of Quantities shall be deemed to be in full and final compensation to the Contractor in respect of any charge by the Contractor for labour, carriage profit, establishment and for any other charges related to the goods, services or materials supplied under the related subitem (a).

If the Contractor shall have omitted within his tender to insert a tendered percentage under subitem (b), or tendered a zero percentage, the Contractor's tendered rate for subitem (b) shall be deemed to be zero and the Contractor shall not be entitled to any payment under subitem (b).

Note in connection with additional tests required by the Engineer:

When a PC sum is included in the Bill of Quantities for additional tests required by the Engineer, the Contractor shall be responsible for both the cost of normal testing and for the cost of any additional test that indicates that the specifications have not been complied with."

C3.2.2.1.8.7 PSA 8.7 DAYWORK

ADD THE FOLLOWING NEW SUB CLAUSES:

C3.2.2.1.8.7.1 PSA 8.7.1 Scope

This section covers the method of measurement and payment for work carried out on a day work basis.

C3.2.2.1.8.7.1.1 PSA 8.7.1.1 General Requirements

Work will be classified as day work only if the Engineer considers no other rate in the Bill of Quantities appropriate for payment purposes.
An instruction regarding all work to be carried out under day work in terms of Clause 6.5 of the General Conditions of Contract will be issued at the discretion of the Engineer. Some or all of the items priced under day work in the Bill of Quantities may possibly not be required for this Contract.

Before ordering any material, the Contractor shall submit quotations to the Engineer for his approval and shall submit such receipts or vouchers to the Engineer as may be necessary for proving the amount claimed.

C3.2.2.1.8.7.1.2 PSA 8.7.1.2 Measurement and Payment - Day works

"Measurement and payment shall be in accordance with the provisions of Clause 6.5 of the Conditions of Contract."

The day work rates submitted for vehicles and construction equipment, in the Bill of Quantities shall be a hire charge for the use of the vehicle and driver or constructional plant/equipment and operator (excluding VAT) and shall apply only to vehicles and construction equipment approved in writing by the Engineer. The rate shall include for maintenance, fuels and oils and other operating costs, establishment, insurance and other contingency costs relating to the running of the vehicle, plant or equipment.

Where there is ambiguity between the power developed at the flywheel and mass of a machine, the power shall govern the measurement category.

The Contractor and the Engineer will agree on the method of recording the working hours prior to the commencement of the work. Any long period of idling at any one time which in the opinion of the Engineer or his representative is beyond that required for normal operating conditions will not be paid for as working time. Non-working hours for any reason shall not be measured for payment.

The ten percent allowed for overheads etc. as per Clause 6.5.1.2.3 of the General Conditions of Contract shall include full compensation for all administrative costs, supervision, overheads, liabilities and obligations related to the running of the vehicles, constructional plant and equipment. The tendered percentage shall also include for profit and shall be subject to the Contract Price Adjustment factor laid down in the Contract Data.

C3.2.2.1.8.8 PSA 8.8 TEMPORARY WORKS

C3.2.2.1.8.8.1 PSA 8.8.4 Existing Services

AMEND THE SUB CLAUSE AS FOLLOWS:

PSA 8.8.4 a) Supply or hire of specialist equipment…...…….Unit: Prov Sum

The sum shall cover the cost for the supply, operation and/or hire of specialist equipment for detection of underground services as ordered by the Engineer.

PSA 8.8.4 b) Excavate by hand in soft material to expose existing services……Unit: m³

The rate shall cover the cost for removal of premix or other surfacing where necessary, excavating in all materials, shoring, backfilling, compaction and reinstatement of surfaces except for asphalt.

PSA 8.8.4 c) Temporary protection of exposed services……Unit: Sum

The sum shall cover the cost of the protection of temporarily exposed existing services, such that the services are not damaged or subject to deterioration while they are exposed. The exposed services shall be adequately barricaded. All Health and Safety aspects shall be fulfilled.

C3.2.2.1.8.8.2 PSA 8.8.5 Cost of Survey

DELETE THE EXISTING SUBCLAUSE AND REPLACE WITH:

a) Survey and setting out works……...……..……..Unit: Sum

Provision must be made to cover the complete survey of the route – water services and placement of line and level pegs by a professional surveyor every 50m and at all changes of direction and grade. The associated costs will be for the account of the Contractor. The survey shall form part of the construction programme.

The Survey shall include:

(a) Confirmation of cadastral boundaries and road reserves (whether marked by existing structures and fences or not). Setting out of pegs of cadastral boundaries

(b) Setting out of the pipe centre line as directed by the Engineer within available space, considering above

(c) Survey of as-built pipeline and production of as built record drawings showing coordinates (X; Y; Z) at:

   a. Each change of direction

   b. Each valve chamber

   c. Beginning and end of road crossings

   d. Connection to existing pipes

   e. 50m spacing in straight sections and at every change in direction of the pipe.

(d) Verifying existing servitudes including:

   a. Indicating the servitudes on maps

   b. Verification of ownership of servitudes

(e) Confirming that the survey corresponds with benchmarks that may have been used by the Engineer during the design stage of the works.

The tendered rate includes all costs associated with the survey (establishment, accommodation, travel, title deeds, etc.). Payment shall be effected on the completion and acceptance of the survey and setting out.

C3.2.2.1.8.8.3 PSA 8.8.6 Special Water Control……..…...……..…..Unit: Sum

The tendered rate shall include all cost to ensure that no water enter or stand in excavated trenches, low laying areas or portions of the site under construction.

The tendered rate shall also include all cost to ensure that ingress of sub-surface water is controlled and pumped out of the excavated areas. All plant, labour and operation costs as well as equipment required to secure a dry working area and pumping of water shall be included in the tendered rate.

C3.2.2.1.8.8.4 PSA 8.8.7 Dealing with other Service Authorities, obtaining of wayleaves, etc.
……..…….Unit: Sum

The Engineer has obtained some of the wayleaves from identified authorities (attached to Portion 3). By the time of contract award, some of the wayleaves may have expired. The contractor will be responsible to:

- Submit applications and re-issue all wayleaves which have expired into his name;
- Submit applications and issue wayleaves that have not yet been issued into his name;
- For wayleaves that are still valid (and issued in Zutari's name), the contractor shall issue a legal letter to Zutari (Pty) Ltd. that he takes full responsibility for compliance with wayleave conditions;
- Maintain wayleaves throughout the duration of the contract and
- Comply with conditions.

The tender rate shall include all costs for dealing with the following service authorities and for fulfilment of way leave requirements:

- Johannesburg Water
- City Power
- City Parks
- Eskom
- Openserve / Telkom
- Rand Water
- Egoli Gas
- Sasol
- Liquid Telecom / Neotel
- Dark Fibre Africa
- MTN
- Metro Trading Company
- Johannesburg Roads Agency
- Transnet / Petronet
- Others which may be identified.

The Contractor shall also arrange for metered connections for electricity and water for the guardhouse and a connection to the nearest sewer system.

ADD THE FOLLOWING ITEMS:

C3.2.2.1.8.9 "PSA 8.9 COMPLIANCE WITH OHS ACT AND CONSTRUCTION REGULATIONS (INCLUDING THE CONSTRUCTION REGULATIONS 2014)……..……...Unit: sum

The tendered sum shall include full compensation to the Contractor for compliance with all the requirements of the OHS Act and Regulations (including the Construction Regulations 2014) at all times for the full duration of the Contract. The successful tenderer shall provide the Engineer with a complete breakdown of this tendered sum.

This sum will be paid to the Contractor in equal monthly amounts subject to proper/substantial compliance.

C3.2.2.1.8.10 PSA 8.10 QUALITY ASSURANCE AND MANAGEMENT PLAN……..Unit: sum

The tendered sum shall include full compensation for compiling and submitting an ISO9000 quality assurance and management plan to the Engineer and for maintaining, implementing, monitoring, recording and complying to the approved plan for the full duration of the Contract. The sum shall include for all specialists required to fulfil the above functions.

Payment will be made on a successful and approved progress basis.

C3.2.2.1.8.11 PSA 8.11 COMPLIANCE WITH RECORD OF DECISION ISSUED BY GDARD AND THE ENVIRONMENTAL MANAGEMENT PLAN……Unit: sum

The tendered sum shall include full compensation for implementing, monitoring and complying with the environmental management plan for the full duration of the Contract. The sum shall also include for all specialists required to fulfil the above functions.

Payment will be made on a successful and approved progress basis.

C3.2.2.2 PSAB ENGINEER'S OFFICE

C3.2.2.2.1 PSAB 3 MATERIALS

C3.2.2.2.1.1 PSAB 3.1 NAMEBOARDS

REPLACE THE ENTIRE CLAUSE AND REPLACE WITH THE FOLLOWING:

"The name board shall be of either tempered hardboard at least 12mm thick or steel sheeting so braced on the reverse side as to prevent warping or buckling and shall be mounted on two or more firmly planted poles as necessary. The quality of the paint shall conform to SANS Standard Specification CKS 193. The colour of the paint shall conform to SANS 1091-1975 colour F11, strong blue. The Employer's SOC Ltd logo shall be in colour. The height of the larger name board shall be 2400mm and the width 4800mm, whilst the height of the smaller name board shall be 800mm and the width 1600mm".

C3.2.2.2.1.2 PSAB 3.2 OFFICE BUILDING(S)

DELETE THIS SUBCLAUSE AND RE-TITLE THE SUBCLASE "FACILITIES FOR THE ENGINEER":

ADD THE FOLLOWING SUBCLAUSE:

C3.2.2.2.1.2.1 "PSAB 3.2.1 OFFICE BUILDING (S)

The contractor shall provide, furnish and equip one or more offices (as scheduled) for the use of the Engineer.

Buildings for the office shall be constructed of timber, metal sheeting or other approved materials. The building shall have double walls filled with insulating material and lined on the inside with timber or other approved material. Ceiling shall be provided and offices shall have timber or concrete floors with edge carpeting with foam-backed needle punch carpeting.

Office building shall be painted with an approved paint after erection and the paintwork shall be maintained during the contract period.

Each door shall be provided with a lock and two keys.

The siting of all offices shall be to the Engineer's satisfaction and shall be decided upon in consultation with him/her and confirmed in writing before erection.

All office buildings shall include the provision of access roads where required, fresh clean portable water and sewerage, which will be considered as part and parcel of the office building provided and will not be paid for separately.

All office buildings shall meet with the approval of the Engineer.

The offices shall comply with the following requirements.

Dimensions	Type 1 Container (Portioned into 3No offices)	Type 2 Container (Boardroom)	Type 3 Container (Partitioned into 2No offices)
Minimum floor area	30 m^2	36 m^2	30 m^2
Minimum window area	8.0 m^2	8.0 m^2	8.0 m^2
Minimum clear height	2.4 m	2.4 m	2.4 m

Parking for vehicles	6	N/A	4

Furniture and Equipment

Type 1 Container (Portioned into 3No offices)

Each office forming part of the 3No offices for the type 1 container shall be equipped with the following:

(i) Two office desks with a surface area of at least 1.5m^2 each with at least 3 drawers one of which can be locked.

(ii) Four office chairs.

(iii) Sufficient racks and hangers for hanging contract drawings. The hangers shall be of the "Barhold" type, with one hanger to five drawings.

(iv) Double 80-watt fluorescent light fittings complete with ballast and tubes (2 No per office).

(v) One Lockable cabinet, 2m high x 1m wide x 0.5m deep

(vi) Air conditioner

Type 2 Container (Boardroom)

The boardroom shall be equipped with the following:

(i) Conference table large enough to accommodate twenty-four people.

(ii) Twenty-four office chairs

(iii) Air-conditioner

(iv) Mountable Samsung 65-inch Smart TV.

Type 3 Container (Portioned into 2No offices)

Each office forming part of the 2No offices for the type 3 container shall be equipped with the following:

(i) One office desk with a surface area of at least 1.5m^2 each with at least 3 drawers one of which can be locked.

(ii) Two office chairs.

(iii) Sufficient racks and hangers for hanging contract drawings. The hangers shall be of the "Barhold" type, with one hanger to five drawings.

(iv) Double 80-watt fluorescent light fittings complete with ballast and tubes (2 No per office).

(v) One Lockable cabinet, 2m high x 1m wide x 0.5m deep.

(vi) Air conditioner

The larger office (21m2 in floor area) shall have an area demarcated for a small boardroom shall be equipped with the following:

(i) Boardroom table large enough to accommodate six people.

(ii) Six office chairs

(iii) Air-conditioner

(iv) Mountable Samsung 65-inch Smart TV.

(v) Small kitchenette with a fridge, microwave, toaster, kettle, and utensils.

The Contractor shall provide a fully equipped kitchen equipped with a fridge, microwave, toaster, kettle, table large enough to accommodate five people, five kitchen chairs, and utensils enough for five people.

The Contractor must provide basic survey instruments: dumpy level, tripod stand and staff.

On completion of the Works, ownership of the buildings, furnishings and equipment shall revert to the Contractor who shall remove them from the Site.

C3.2.2.2.1.3 "PSAB 3.3 CARPORT

The Contractor shall construct the number of carports specified in C3.1.4.2.2 of the Scope of Work for the sole use of the Engineer and his staff. Each carport shall be constructed so that the vehicle parked under it is always protected against the direct rays of the sun. The carport area shall be at least 20m² and the floor shall be covered with a layer of crushed stone to alleviate dusty and muddy conditions. The carport(s) shall be positioned so as to provide easy and convenient access to the Engineer's office."

C3.2.2.2.2 PSAB 4 PLANT

C3.2.2.2.2.1 PSAB 4.1 TELEPHONE

REPLACE SUBCLAUSE 4.1 OF SANS 1200 AB WITH THE FOLLOWING:

"The Contractor shall at his own cost, arrange for the provision of airtime and data bundles for the duration of the contract, for the Engineer's representative. The Contractor at the tendered rates under the relevant scheduled item shall recover the associated charges and telephone calls and data bundles associates with the contract.

The Contractor shall also provide, insure, protect, secure and maintain computer facilities, for the duration of the contract, including the following:

- A Dell laptop with a processor similar or equal to an Intel ® i7 processor, at least 4 GB Ram, a hard disk drive of at least 1TB;
- two external hard disk drives of similar or larger capacity as the internal hard disk drive of the laptop for backups of at least 1TB;
- Additional 5 No wireless mice, 5 No wireless keyboards, 5 No wireless earphones, and 5 No 23.8-inch Dell computer screen;
- an A3 Colour printer with sufficient ink / toner, capable to scan, print, copy and fax;
- Wireless data modem with uncapped data plan per month;
- Software to include Microsoft Office, Microsoft Project and a .pdf viewer.

All the equipment mentioned above will be handed back to the Contractor at the conclusion of the project."

C3.2.2.2.2.2 "PSAB 4.2 SURVEY EQUIPMENT

The Contractor shall provide on site and make available for the exclusive use of the Engineer and his staff, the survey equipment listed in C3.1.4.2.2 of the Scope of Work.

All survey equipment provided by the Contractor shall be in good condition, properly calibrated and fit for the purpose.

In addition to survey equipment provided by the Contractor for the exclusive use of the Engineer and his staff, the Contractor shall make available for use by the Engineer, the further survey equipment listed in C3.1.4.2.2 of the Scope of Work, at all times when such is reasonably required by the Engineer and his staff for the purposes of the Contract."

C3.2.2.2.3 PSAB 5 CONSTRUCTION

C3.2.2.2.3.1 PSAB 5.4 TELEPHONE

REPLACE THE CONTENTS OF SUBCLAUSE 5.4 OF SANS 1200 AB WITH THE FOLLOWING:

C3.2.2.2.3.1.1 PSAB 5.4.2 Cellphones

The Contractor shall ensure that airtime is provided for cellphone calls. The Contractor shall, on production of proof of purchase of airtime, be reimbursed for the cost of the Engineer's airtime purchased."

ADD THE FOLLOWING NEW SUBCLAUSES TO CLAUSE 5 OF SANS 1200 AB:

C3.2.2.2.3.2 "PSAB 5.6 COMPUTER EQUIPMENT

All computer equipment provided shall be kept fully serviceable at all times by the Contractor. The Contractor shall have any defective equipment repaired or replaced at his own cost within 12 hours after notification by the Engineer's staff.

A data connection with a minimum speed of 10 Megabytes/second should also be provided.

The Contractor shall further provide at his own cost, all paper and black ink cartridges and other consumables reasonably required by the Engineer."

ADD THE FOLLOWING NEW SUBCLAUSES TO CLAUSE 5 OF SANS 1200 AB:

C3.2.2.2.3.3 "PSAB 5.7 SURVEY EQUIPMENT

All survey equipment provided by the Contractor shall be kept fully serviceable at all times by the Contractor. The Contractor shall have any defective equipment repaired or replaced at his own cost within 12 hours after notification by the Engineer's staff.

Where required by the Engineer, the Contractor shall, at his own cost, promptly arrange for the recalibration of survey equipment provided."

C3.2.2.3 PSC SITE CLEARANCE

C3.2.2.3.1 PSC 3 MATERIALS

C3.2.2.3.1.1 PSC 3.1 DISPOSAL OF MATERIAL

ADD THE FOLLOWING:

"The Contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance."

C3.2.2.3.2 PSC 5 CONSTRUCTION

C3.2.2.3.2.1 PSC 5.1 AREAS TO BE CLEARED AND GRUBBED

ADD THE FOLLOWING:

“Small diameter pipeline routes shall be cleared to a distance of 1,0m on both sides of the pipeline centre line and large diameter pipeline routes shall be cleared to a distance of 2,0m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations.”

C3.2.2.3.2.2 PSC 5.2 CUTTING OF TREES

C3.2.2.3.2.2.1 PSC 5.2.3 Preservation of trees

C3.2.2.3.2.2.1.1 PSC 5.2.3.2 Individual trees

REPLACE THE LAST SENTENCE WITH THE FOLLOWING:

"An amount of R5000,00 will be deducted from moneys due to the Contractor as a penalty for every tree that is damaged or removed unnecessarily."

C3.2.2.3.2.3 PSC 5.5 RECLEARING OF VEGETATION

ADD THE FOLLOWING:

"When areas have to be recleared on the written instructions of the Engineer, such reclearing shall be carried out at the Contractor's own cost and the Contractor is therefore advised not to clear the areas too soon."

C3.2.2.3.3 PSC 8 MEASUREMENT AND PAYMENT

C3.2.2.3.3.1 PSC 8.1 BASIC PRINCIPLES

ADD THE FOLLOWING:

"Levels to be used for earthworks quantity calculations will be surveyed prior to clearing and grubbing, and again once the clearing operation has been completed."

C3.2.2.3.3.2 PSC 8.2 PAYMENT

C3.2.2.3.3.2.1 PSC 8.2.1 Clear and grub

REPLACE THE FIRST LINE WITH THE FOLLOWING:

"The area designated by the Engineer to be cleared and grubbed will be measured in square metre to the nearest square metre,"

C3.2.2.3.3.2.2 PSC 8.2.5 Take down existing fences

REPLACE ITEM 8.2.5 WITH THE FOLLOWING:

PSC 8.2.5 Take down existing fences:

(a) Description of fence ……..……..……...…….... Unit: m or km

(d) Etc for other items

The unit of measurement shall be the metre or kilometer of fence taken down and removed from the site.

The rate shall cover the cost of taking down the complete fence (fence height up to 2.2m) as scheduled and removing all fence material from the site, filling of holes, leveling ground surfaces and cleaning the site as well as providing temporary fence during construction."

C3.2.2.3.3.2.3 PSC 8.2.8 Demolish and remove structures/buildings and dismantle steelwork, etc.

REPLACE "Unit: sum" WITH "Unit: sum or number of m²".

REPLACE THE LAST SENTENCE WITH:

"The rate shall cover the cost of all such separate items as scheduled in the Schedule of Quantities."

ADD THE FOLLOWING ITEMS:

C3.2.2.3.3.2.4 PSC 8.2.11a Temporary fencing or hoarding:

(a) Indicate temporary usage, description and type ……..…… Unit: m

(b) Etc for other usage and types.

The unit of measurement shall be the linear meter of fence or hoarding supplied and erected, and in the case of temporary fencing for maintaining and removing on completion of the works or part of the works.

The tendered rate shall include full compensation for the cost of supplying and erecting the complete fence as specified or scheduled and in the case of temporary fencing for taking down the fences, removing from the site, filling of holes, leveling ground surfaces and cleaning the site.

Seventy per cent (70%) of the tendered rate shall be payable on completion and approval of the temporary fences, and the remaining thirty per cent (30%) on completion of the removal of the fences.

C3.2.2.3.3.2.5 PSC 8.2.11b Removal of man-made surfaces

The rate shall cover all plant, labour, material, saw cutting (asphalt and concrete), breaking up, lifting, loading, transportation, off-loading surfacing and storing (where applicable).

Unit: m²

a) Roadways, Asphalt and other layers
i) Asphalt (50mm thick) and including base, sub-base and subgrades layers up to 800mm deep.

ii) Asphalt (> 50 _ 100mm thick) and including base, sub-base and subgrades layers up to 800mm deep.

b) Footways and driveways

i) Asphalt _ 50mm thickness

ii) Asphalt > 50 _ 100mm thickness

iii) Interlocking concrete segmental paving blocks (all colours)

iv) Concrete slabs (450 x 450mm)

v) Brick paving

vi) Unreinforced concrete _75mm thick

vii) Reinforced concrete _75mm thick

viii) Grassing

ix) Kerbing (all types of kerbing)

…….…….... (Unit: m)

C3.2.2.3.3.2.6 PSC 8.2.12 Backfilling and reinstatement of man-made surfaces

The rate shall cover the cost of all associated plant, labour, material, loading, transportation from storage, off-loading and placing (levelling and compacting where applicable) the following materials in roadways, footways and driveways in accordance with the COP:

C3.2.2.3.3.2.7 PSC 8.2.12.1 Backfilling and reinstatement of roads…….Unit:m²

a) Scenario A

i) 150mm base – G2 Graded crushed stone to 102% Mod AASHTO density

ii) 150mm subbase – G5 Graded crushed stone to 97% Mod AASHTO density

iii) 150mm Fill – G7 material compacted to 95% Mod AASHTO density

iv) 150mm selected subgrade – Insitu material compacted to 90% Mod AASHTO

b) Scenario B

i) 150mm base – G2 material compacted to 97% Mod AASHTO density

ii) 150mm subbase – C4 Stabilised gravel material to 95% Mod AASHTO density*

iii) 150mm selected subgrade - Insitu material compacted to 93% Mod AASHTO
***Rate shall include stabilization agent.**

c) Scenario C (Foot paths)

i) 150mm base – Recovered material compacted to 93% Mod AASHTO

ii) 150mm selected subgrade – Insitu material compacted to 90% Mod AASHTO

d) Surfacing

i) 30mm Bitumen hot –mix: Fine

ii) 70mm Bitumen hot –mix: BTB

C3.2.2.3.3.2.8 PSC 8.2.12.2 Backfilling and reinstatement footways

Unit:m²

a) Using removed materials:

i) Interlocking concrete segmental paving blocks (all colours)

ii) Concrete slabs (450 x 450mm)

iii) Brick paving

iv) Grassing

v) Kerbing……...……..... (Unit: m)

b) Using new supplied materials: ..... Unit: m²

i) 30mm Bitumen hot –mix: Fine

ii) Interlocking concrete segmental paving blocks, including a 20mm river sand bedding layer, jointing sand (plaster sand) and mortar infill between edge restraint and blocks
   1) Grey blocks
   2) Coloured blocks

iii) Concrete slabs (450 x 450mm) including a 20mm river sand bedding layer, jointing mortar.

iv) Brick paving including a 20mm river sand bedding layer, jointing sand (plaster sand) and mortar infill between edge restraint and bricks.

v) Unreinforced concrete _ 75mm thick (15MPa)

vi) Reinforced (395 mesh) concrete _ 75mm thick (15MPa)

vii) Grassing

viii) Concrete channeling, including formwork, leveling and compacting 300 x 125mm cast in situ concrete of 15MPa.

ix) Kerbing, including a 50mm bedding (cement and river sand), jointing mortar and 15MPa concrete haunching at all joints..... (Unit: m)
   1) Figure 1
   2) Figure 7
   3) Figure 8
   4) Figure 12

C3.2.2.3.3.2.9 PSC 8.2.13 Reinstatement of existing masonry walls and steel palisade fences

The rate shall cover the cost of reinstating existing masonry walls, plastered or unplastered, and steel palisade fences (including any gates) including plant, labour, material, on-loading, transporting, off-loading and cleaning for the following: ……...Unit: m²

a) Face brick

i) 110mm wall

ii) 220mm wall
iii) 330mm wall

b) Plastered

i) 110mm wall

ii) 220mm wall

iii) 330mm wall

iv) 440mm wall

c) Steel palisade fences (height = 2.2m)

C3.2.2.4 PSD EARTHWORKS

C3.2.2.4.1 PSD 2 INTERPRETATIONS

C3.2.2.4.1.1 PSD 2.1 SUPPORTING SPECIFICATIONS

REPLACE SUBCLAUSE 2.1.2 *WITH THE FOLLOWING:*

"PSD 2.1.2 Any of the other SANS 1200 specifications may form part of the Contract documents."

C3.2.2.4.1.2 PSD 2.3 DEFINITIONS

REPLACE THE WORD AND THE DEFINITION FOR "Borrow" *WITH THE FOLLOWING:*

"**Borrow material**: Material, other than material obtained from excavations required for the works, obtained from sources such as borrow pits or the authorised widening of excavations. 'Borrow' shall have a corresponding meaning."

REPLACE THE DEFINITION FOR "Specified density" *WITH THE FOLLOWING:*

"**Specified density**: The specified dry density expressed as a percentage of modified AASHTO dry density."

REPLACE THE DEFINITION FOR "Stockpile" *WITH THE FOLLOWING:*

"**Stockpile** (verb): The process of selecting and, when necessary, loading, transporting and off-loading material in a designated area for later use for a specific purpose"

ADD THE FOLLOWING DEFINITIONS:

"**Commercial source**: A source of material provided by the Contractor, not the Employer, and including any borrow pit, provided by the Contractor

Fill: An embankment or terrace constructed of material obtained from excavations or borrow pits. In roads it includes the earthworks up to the underside of the selected subgrade level.

Fill (material): Material used for the construction of an embankment or terrace.

Roadbed: The natural in situ material on which the fill or, in the absence of fill, the pavement layers are constructed"

C3.2.2.4.2 PSD 3 MATERIALS

C3.2.2.4.2.1 PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES

C3.2.2.4.2.1.1 PSD 3.1.1 Method of classifying

ADD THE FOLLOWING:

"The classification of material other than 'soft excavation' shall be agreed upon before excavation may commence.

The Contractor shall immediately inform the Engineer if and when the nature of the material being excavated changes to such an extent that a new classification is warranted for further excavation. Failure on the part of the Contractor to advise the Engineer in good time shall entitle the Engineer to reclassify, at his discretion, such excavated material."

C3.2.2.4.2.1.2 PSD 3.1.2 Classes of excavation

REPLACE THE CONTENTS OF SUB-CLAUSE 3.1.2 WITH THE FOLLOWING:

(a) "Rock excavation shall mean material, other than in restricted excavation that cannot, before removal, be efficiently ripped by a bulldozer of mass approximately 35t, fitted with a single tine ripper suitable for heavy ripping, and of flywheel power of approximately 220kW.

(b) Rock shall be material that cannot be efficiently removed without blasting or without wedging or splitting.

(c) Soft excavation shall be excavation in all material other than rock as defined above, whether the material is suitable for use in the Works, or to be spoiled. The classification includes excavation in earthworks or any pavement layers of an existing pavement regardless of the nature of the material excavated, other than rock excavation.

(d) The Engineer shall decide under which one of the above classes any excavation shall be classified for purposes of payment. In the event of a disagreement between the Contractor and the Engineer, the Contractor shall, at its own cost, make available such mechanical plant as required by the Engineer in order to determine whether or not the material can reasonably be removed. The decision of the Engineer as to the classification shall be final and binding.

(e) Individual boulders greater than one cubic meter in volume shall be classified as rock when their nature and size are such that, in the opinion of the Engineer, they cannot be removed without recourse to one of the methods described under rock excavation. Where a portion of excavation contains 50% (fifty per cent) or more by volume of boulders of this order, such portion shall be considered as rock excavation throughout."

ADD THE FOLLOWING NEW SUB CLAUSE:

C3.2.2.4.2.1.3 PSD 3.1.3 CLASSIFICATION FOR HAND EXCAVATION

Classification of material for various types of hand excavation will be based on the results of a dynamic cone penetrometer. The category of material shall be determined by testing the material at regular intervals and at various depths along the centre line of the trench. A minimum of 5 tests shall be done at each location and the average number of blows of the tests shall be used to determine the category of material.

The interval between test locations shall be determined by the variation of material type but shall not exceed 50m. The depth of testing shall be determined by the variation of material type and can increase or decrease in hardness with increasing depth of excavation. Table PSD 3.1.3 indicates the categories:

TABLE PSD 3.1.3: Classification for Hand Excavation

Category of Material	Consistency		DCP Blows to Penetrate 100mm	
	Granular	Cohesive	Granular	Cohesive
Soft Soft excavation shall be excavation in material that can be efficiently removed from the trench using a pick and shovel but not requiring prior breaking using mechanical equipment such as pavement breakers	Up to medium dense	Firm to stiff	0-6	1-5
Intermediate Intermediate excavation shall be excavation in material that require loosening with a hand spike (gwala) before being removed from the trench	Dense	Stiff to very stiff	7-15	6-8
Hard Hard excavation shall be excavation in material that requires prior breaking using mechanical equipment, such as pavement breakers with clay spades, before being removed from the trench.	Very dense		16-50	-15
Rock Rock excavation shall be excavation in material other than described above which by nature of the material requires prior breaking using mechanical equipment, such as pavement breakers with moil points, before being removed from the trench	-	-	>50	>15

C3.2.2.4.2.2 PSD 3.2 CLASSIFICATION FOR PLACING PURPOSES

C3.2.2.4.2.2.1 PSD 3.2.1 Materials suitable for embankments and terraces

REPLACE THE CONTENTS OF SUB-CLAUSE 3.2.1 WITH THE FOLLOWING:

"Materials types used for embankments and terraces are as indicated on the drawings and shall comply with the material types as specified in TRH 14.

The material type required for embankments and terraces shall be as stated on the construction drawings. Excavated material may be used as backfill only with the approval of the Engineer, provided the Contractor conducts sufficient on-site tests of excavated material to prove its compliance."

C3.2.2.4.2.2.2 PSD 3.2.3 Material suitable for backfill or fill against structures

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Material used for backfill behind structures shall generally be the material excavated, subject to the following conditions:

(a) The material shall not contain an excessive number of stones retained on a 50mm sieve;

(b) The material shall not contain large clay lumps that do not break up under the action of the compaction equipment; and

(c) The liquid limit of the material shall not exceed 40, neither shall the PI exceed 18."

C3.2.2.4.2.3 PSD 3.3 SELECTION

ADD THE FOLLOWING SUBCLAUSE:

C3.2.2.4.2.3.1 "PSD 3.3.3 Selection in borrow pits and excavations

Approval of a borrow area for a certain purpose does not necessarily mean that all the material in that area is suitable for the specified purpose. What it does mean is that the borrow area contains some suitable material. The onus shall rest on the Contractor to ensure that only material that is indeed suitable is removed and used for the specified purpose.

When the Contractor has to select excavated material for a specific purpose, the above provisions relating to borrow areas shall apply mutatis mutandis to excavations.

The Contractor shall not waste or contaminate material that has been selected for a specific purpose."

C3.2.2.4.3 PSD 4 PLANT

C3.2.2.4.3.1 PSD 4.4 DETECTORS

REPLACE THE CONTENTS OF SUBCLAUSE 4.4 WITH THE FOLLOWING:

"The Contractor shall, for the purposes of detecting and locating underground services in accordance with the provisions of subclause 5.4 of SANS 1200 A and subclause 5.1.2 of SANS 1200 D, at his own cost, provide and use detecting equipment which is suitable for the detection of underground cables and pipes."

C3.2.2.4.4 PSD 5 CONSTRUCTION

C3.2.2.4.4.1 PSD 5.1 PRECAUTIONS

C3.2.2.4.4.1.1 PSD 5.1.1 Safety

C3.2.2.4.4.1.1.1 PSD 5.1.1.1 Barricading and lighting

REPLACE "Machinery and Occupational Safety Act, 1983 (Act 6 of 1983)" *WITH* "Occupational Health and Safety Act, 1993 (Act 85 of 1993)".

REPLACE SUB-PARAGRAPH (a) AND (b) WITH THE FOLLOWING AND ADD SUBPARAGRAPH c):

(a) adequately protected by a barrier or fence comprising fluorescent orange plastic netting of height at least 1 000mm and as close to the excavation as practicable; and

(b) provided with notice boards marked "CLOSED – GESLUIT" at each end of closed or partially closed roads; and

(c) provided with flashing orange lights, placed at 15m intervals along the barricading at night.

ADD THE FOLLOWING TO THIS SUBCLAUSE:

Should the Contractor fail to provide adequate lighting, signing and barricading, access to properties, or leave the site in a dangerous condition, the Engineer shall be entitled to suspend all

work under the Contractor until in the Engineer's opinion the Contractor's obligation in these respects have been fulfilled and/or arrange for any emergency work to be carried out by some other agency and to deduct the cost of this work from any monies due to the Contractor.

C3.2.2.4.4.1.1.2 PSD 5.1.1.2 Safeguarding of excavations

REPLACE "Machinery and Occupational Safety Act" *WITH* "Occupational Health and Safety Act, 1993 (Act 85 of 1993)".

ADD THE FOLLOWING TO SUB PARAGRAPH (d):

Loose ground, materials, tools and appliances shall be kept clear of the edge of the excavations and a pathway at least 0,30 m shall be left clear along the edge of the excavation.

C3.2.2.4.4.1.1.3 PSD 5.1.1.3 Explosives

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

Where blasting is resorted to, it shall be carried out strictly according to Explosives Act and Regulations 1956 (Act No. 26 of 1956, as amended). However, in no case will blasting be allowed if a reasonable possibility exists of injury to any foundation, wall, pipe, cable or any structure, complete or partly complete. Where the Engineer considers blasting to be dangerous, the same shall not be permitted and his decision shall be final and binding.

Wherever blasting is permitted and resorted to in the vicinity or within the limits of existing townships, roads, etc., it shall only be executed under the cover of sufficient earth backfill, heavy wire mesh screens or rubber matting of adequate weight and area to prevent the blasted material from being ejected from the trench. If any damage should occur, the Contractor shall carry out remedial work arising from such damage and will be held to have allowed therefore in his price.

The Contractor shall undertake such blasting so that the Peak Particle Velocity (PPV) as measured at the closest point to the existing outfall sewer and or building structure shall not exceed 25mm/s. Each blast shall be monitored and the findings recorded by an appropriately qualified explosives expert using a suitably calibrated apparatus. The Contractor shall also timeously inform the relevant inspectorate and obtain the required blasting permit from the South African Police Services, Division of Explosives before proceeding with any blasting on site. If in the opinion of the Engineer, the Contractor makes careless use of explosives, he may forbid the Contractor the use of explosives.

It is a condition that should blasting result in the disturbing of material outside the trench, the Engineer will require the Contractor to remove the disturbed material and backfill it to a compaction standard of the natural in-situ material. All this work for correcting areas of disturbed material will be done at the Contractor's cost.

The schedule rate for hard rock excavation shall cover all costs incurred in connection with supply, transportation, storage and handling of explosives, the related blasting costs and any remedial work should this be required.

C3.2.2.4.4.1.1.4 PSD 5.1.1.4 Hard rock excavation without using explosives

ADD THE FOLLOWING TO THIS CLAUSE:

It is a condition that should blasting result in the disturbing of structures outside the trench, the Engineer will require the Contractor to remove the rock material by means of pneumatic or hydraulic breakers, e.g. jack-hammers or wood-peckers.

The schedule rate for hard rock excavation without using explosives shall cover all costs incurred in connection with supply of specialist equipment, the transportation to and from the site as well as the removal and disposal of the hard material should this be required.

C3.2.2.4.4.1.2 PSD 5.1.2 Existing services

C3.2.2.4.4.1.2.1 PSD 5.1.2.2 Detection, location and exposure

REPLACE THE CONTENTS OF SUBCLAUSE 5.1.2.2 WITH THE FOLLOWING:

"The exposure by the Contractor of underground services, as required in terms of subclause 5.4 of SANS 1200 A (as amended) shall be carried out by careful hand excavation at such positions and to such dimensions as are agreed to by the Engineer.

Unless otherwise instructed or agreed by the Engineer, no service shall be left exposed after its exact position has been determined and all excavations carried out for the purposes of exposing underground services shall be promptly backfilled and compacted to the following densities:

(a) In roadways: 93% Mod AASHTO density; and

(b) In all other areas: 90% Mod AASHTO density.

Where hand excavations to expose underground services have to be carried out in roadways, the Contractor shall reinstate the road layerworks in accordance with the provisions of subclause 5.9 of SANS 1200 DB.

Payment in respect of exposing the services by means of hand excavation as described above, will be made in accordance with subclause PSD 8.3.8.1.

Payment in respect of reinstating layerworks in roadways will be made in accordance with sub-clause 8.3.6.1 of SANS 1200 DB (as amended) should it be required."

C3.2.2.4.4.1.2.2 PSD 5.1.2.3 Protection of cables

REPLACE SUBCLAUSE 5.1.2.3 WITH THE FOLLOWING:

"PSD 5.1.2.3 Protection during construction

Further to the requirements of subclause 5.4.2 of SANS 1200 A (as amended), major excavating equipment and other plant shall not be operated dangerously close to known services. Where necessary, excavation in close proximity to known services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. No additional payment will apply to such more difficult work.

Should any service not being a known service be discovered or encountered during the course of the Contract, the Contractor shall, in addition to complying with the requirements of subclause 5.4.2 of SANS 1200 A (as amended), immediately notify the Engineer thereof and implement such measures as will prevent damage of such service or, if it was damaged in the course of discovery, will prevent and minimise the occurrence of any further damage occurring."

C3.2.2.4.4.1.2.3 PSD 5.1.2.4 Negligence

DELETE SUBCLAUSE 5.1.2.4.

C3.2.2.4.4.1.3 PSD 5.1.3 Stormwater and groundwater

ADD THE FOLLOWING:
"The Contractor shall, where applicable and at the earliest practicable opportunity, install the permanent drainage specified or shown on the Drawings and shall at his own cost provide the temporary drainage required to protect the works."

C3.2.2.4.4.1.4 PSD 5.1.4 Nuisance

C3.2.2.4.4.1.4.1 PSD 5.1.4.3 Excavated material not to endanger or interfere

AMEND THE CLAUSE AS FOLLOWS:

"A safe, clear path shall be kept open at all times for pedestrians. Equipment, materials and waste shall be stored, stockpiled or removed in such a manner that pedestrians are not endangered and that the nuisance level is kept to a minimum. If construction activities occupy the whole footway and verge area so that pedestrians are forced to walk in the traffic lane, adequate protection from traffic shall be provided.

Where instructed by the Engineer or where the Works impose a danger to traffic or pedestrians, the Contractor shall at his own cost remove off Site excavated material to temporary stockpiles (approved by the Engineer) and the return to Site, excavated material for use as backfill or bedding."

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.4.4.1.4.2 PSD 5.1.4.4 Open Trenches

Unless otherwise permitted and where relevant, not more than the 100 m of trench in one place shall be opened ahead of the completed and backfilled pipeline."

C3.2.2.4.4.1.5 PSD 5.1.5 Reinstatement and maintenance of roads

ADD THE FOLLOWING:

"Where crossings have been made, the roads shall be reinstated in accordance with the details specified in subclause 5.9 of SANS 1200 DB."

C3.2.2.4.4.1.4 PSD 5.1.6 Road traffic control

DELETE THE SECOND SENTENCE OF SUBCLAUSE 5.1.6.

C3.2.2.4.4.2 PSD 5.2 METHODS AND PROCEDURES

C3.2.2.4.4.2.1 PSD 5.2.2 Excavation

C3.2.2.4.4.2.1.1 PSD 5.2.2.1 Excavation for general earthworks and for structures

ADD THE FOLLOWING TO PARAGRAPH (b):

"When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. The tendered rate for item 8.3.5 will be deemed to include the cost of a working width of 600mm, but the Contractor may excavate a greater working width at no additional cost to the Employer."

REPLACE THE FIRST SENTENCE OF PARAGRAPH (e) WITH THE FOLLOWING:

"Where excavations have been carried below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel compacted to 93% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density.
Where excavations for structures have been carried out in hard material, the Engineer may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall retrim the excavations if necessary and, unless other remedial measures are agreed to by the Engineer, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account."

C3.2.2.4.4.2.1.2 PSD 5.2.2.3 Disposal

REPLACE THE SECOND SENTENCE WITH THE FOLLOWING:

"The Contractor shall provide all necessary spoil sites for the spoiling of all surplus and unsuitable materials and shall make the necessary arrangements with the owner of the site where the material is disposed of, and pay all charges and levies as may be applicable for the use of such spoil sites.

Every spoil site provided by the Contractor shall be approved by the local authority in whose area it is located, and the spoiling shall comply with the applicable statutory and municipal regulations as well as the requirements of the owner of the spoil site.

Payment to the Contractor in respect of locating and making arrangements for suitable spoil sites and spoiling material at the such sites will be made separately in the applicable items as scheduled."

ADD THE FOLLOWING SUBCLAUSE IN SUBCLAUSE 5.2.2:

C3.2.2.4.4.2.1.2 "PSD 5.2.2.4 Selection and stockpiling

Approval or designation of the material in a particular borrow pit or excavation for a particular purpose does not imply that all the material in the borrow pit or excavation is suitable for the particular purpose to which the said approval or designation relates, nor that all material in the borrow pit or source should be used for the particular purpose. The Contractor shall select suitable material from that borrow pit or source, discard unsuitable material and reserve material for other purposes as necessary.

The Contractor shall organise and carry out his operations in such a manner as will prevent the contamination of suitable embankment and backfill material with unsuitable materials. Any excavated material which becomes, in the Engineer's opinion, unsuitable for use in embankments or backfill as a result of contamination, shall be disposed of in a manner acceptable to the Engineer and shall be replaced by the Contractor with materials acceptable to the Engineer, all at the Contractor's cost.

When required, or when ordered by the Engineer, material shall be stockpiled for later use. The additional costs for stockpiling material shall be separately paid to the Contractor in the applicable items as scheduled."

C3.2.2.4.4.2.2 PSD 5.2.3 Placing and Compaction

ADD THE FOLLOWING SUBCLAUSE IN SUBCLAUSE 5.2.3:

C3.2.2.4.4.2.2.1 "PSD 5.2.3.3 Treatment of in-situ material

Prior to the backfilling of embankments, if in the opinion of the Engineer the in-situ material at the bottom of the excavation (this excavation occurs after the topsoil material has been removed) is suitable for use in place, the in-situ material shall be scarified to a depth of 150mm (one hundred and fifty millimeters), watered, shaped, and compacted to 90% (ninety per cent) of modified AASHTO maximum density. (100% (one hundred per cent) for sand)

In-situ treatment of soil shall be by means of Impact Compaction (Impact roller)."

C3.2.2.4.4.2.3 PSD 5.2.4 Finishing

ADD THE FOLLOWING SUBCLAUSES IN SUBCLAUSE 5.2.4:

C3.2.2.4.4.2.3.1 "PSD 5.2.4.6 Grassing

(a) Hydroseeding

Mulch shall be added to the hydro-seeding mix at a rate of 2,000kg/ha."

C3.2.2.4.4.2.3.2 PSD 5.2.4.7 Planting and maintaining the plants

(a) Watering, weeding, mowing and replanting

The mowing of grass to control weeds shall not be measured and paid for.

C3.2.2.4.4.2.4 PSD 5.2.5 Transport for earthworks

REPLACE THE CONTENTS OF SUBCLAUSE 5.2.5 WITH THE FOLLOWING:

"The transport of all excavated materials, irrespective of the distance and source, shall be deemed to be free-haul, the cost of which is included in the Contractor's tendered rates and prices for the excavation of the materials. No separate compensation shall apply for the transportation of excavated materials."

C3.2.2.4.5 PSD 7 TESTING

C3.2.2.4.5.1 PSD 7.2 TAKING AND TESTING OF SAMPLES

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The Contractor shall arrange with the approved independent laboratory engaged by the Contractor in terms of C3.4.2.5(b) of the Project Specifications to carry out sufficient tests on a regular basis as agreed between him and the Engineer to determine whether the degree of compaction, and, where applicable, the quality of materials used, comply with the Specifications and shall submit the results of these tests to the Engineer in a form approved by him.

The compaction requirements for fills shall be deemed complied with when at least 75% of the dry-density tests on any lot show values equal to or above the specified density and when no single value is more than five percentage points below the specified value."

C3.2.2.4.6 PSD 8 MEASUREMENT AND PAYMENT

C3.2.2.4.6.1 PSD 8.3 SCHEDULED ITEMS

C3.2.2.4.6.1.1 PSD 8.3.1 Site preparation

REPLACE SUBCLAUSES 8.3.1.1 AND 8.3.1.2 WITH THE FOLLOWING:

"Where site preparation such as clearing, grubbing, the removal of large trees or the removal and stockpiling of topsoil is required, the provisions and scheduled items of SANS 1200 C shall apply."

C3.2.2.4.6.1.2 PSD 8.3.2 Bulk excavation

REPLACE THE CONTENTS OF ITEM WITH THE FOLLOWING:

"(a) Excavate in all materials and use for embankment or backfill as ordered, from:

(1) Necessary excavations……...Unit: m³

(2) Designated borrow pits……Unit: m³

(3) Commercial sources……Unit: m³

The unit of measurement shall be the cubic metre measured in place in accordance with subclause 8.2 of SANS 1200 D.

Separate items will be scheduled for embankments and backfills for different parts of the works.

The tendered rates shall cover the cost of complying with all the precautions required in terms of subclause 5.1 of SANS 1200 D (as amended), in addition to the cost of excavating in all materials, basic selecting, loading, transporting, off-loading, spreading or backfilling, watering, compacting, final grading, complying with the requirements for tolerances, providing for testing, finishing and tidying, all in accordance with the specifications.

In addition to the aforegoing, the tendered rate for subitem (b) shall further include for the costs of royalties (if applicable), whilst the tendered rate for subitem (c) shall also include for the costs of finding a source of suitable material, for making arrangements with the owner of the source, for procuring the material, for the payment of all requisite royalties, charges or damages, and for transporting the material to the site regardless of the distance involved. No payment will be made for the removal of overburden or stockpiling at the commercial source and no extra over payment shall apply for excavating in intermediate, hard or boulder material."

(b) Excavate in all materials to spoil……Unit: m³

The unit of measurement shall be the cubic metre of material excavated, measured in place in accordance with subclause 8.2 of SANS 1200 D.

The tendered rates shall cover the cost of complying with all the precautions required in terms of subclause 5.1 of SANS 1200 D (as amended), in addition to the cost of excavating, basic selecting, loading, transporting, off-loading at the spoil site, maintaining and finishing the spoil site, all in accordance with the specifications.

(c) Extra over subitems PSD 8.3.2(a)(1), PSD 8.3.2(a)(2) and PSD 8.3.2(b) for:

(1) Intermediate excavation……..Unit: m³

(2) Hard rock excavation……..Unit: m³

The rate shall cover the additional cost of the operations enumerated in subclauses 8.3.2.(a) and 8.3.2.(b) above for any portion of the excavation that is classified as intermediate, hard rock, boulder excavation class A or boulder excavation class B as applicable. (See Drawing D-2.).

(d) Extra over item PSD 8.3.2(c)(2) for hand excavation or other method (excluding blasting) to remove rock outcrops or rock underbreak after bulk excavation to form level site (alternative for soilcrete backfilling in rock overbreak) ……..Unit: m³

The unit shall be the cubic metre (including bulking of volume) of rock outcrops removed by hand or other labour intensive method.

The rate shall cover all additional costs of the operations including labour, plant, equipment, transport etc to break, excavate, load and removal off site of small rock outcrops not successfully removed during the bulk excavation operations.

C3.2.2.4.6.1.3 PSD 8.3.3 Restricted excavation

REPLACE THE WORDS "in 1 m increments" *AT THE END OF THE FIRST SENTENCE OF SUBITEM (a) WITH* "in the increments indicated in the Bill of Quantities".

REPLACE "in 5.2.2.1 – 5.2.2.3 (inclusive)" *AT THE END OF SUBCLAUSE (a) WITH* "in subclauses 5.2.2.1 to 5.2.2.5 (inclusive)".

ADD THE FOLLOWING SUB-SUBITEM:

"(c) Extra over subitem 8.3.3 (a) for hand excavation…….Unit: m³

This item shall apply to hand excavation ordered by the Engineer or when the Engineer considers that, owing to circumstances, excavation by mechanical excavators is not practicable. It shall not apply to hand excavation for trimming or finishing an excavation made by mechanical means.

The tendered rate shall include full compensation for the additional cost of excavating by means of hand tools."

C3.2.2.4.6.1.4 PSD 8.3.4 Importing of materials

DELETE SUBITEM (a) OF 8.3.4.

C3.2.2.4.6.1.5 PSD 8.3.6 Overhaul

DELETE SUBCLAUSE 8.3.6.

C3.2.2.4.6.1.6 PSD 8.3.8 Existing services

C3.2.2.4.6.1.6.1 PSD 8.3.8.1 Location

REPLACE ITEM 8.3.8.1 WITH THE FOLLOWING:

"8.3.8.1 Hand excavation for locating and exposing existing services:

(a) In roadways ……..Unit: m³

(b) In all other areas ……..……..Unit: m³

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised or actual dimensions of the excavation, whichever is the lesser.

The tendered rates shall cover the cost of excavating in all materials by means of hand tools within authorised dimensions and at locations approved by the Engineer in accordance with the requirements of subclause PSA 5.4.1 for all precautionary measures necessary to protect the services from damage during excavation and backfilling, and for subsequent backfilling and compacting. Compaction of material in all areas except in roadways shall be to 93% of the modified AASHTO density.

The tendered rate for hand excavation in roadways shall include compensation for compacting excavated or selected backfill material to 93% of modified AASHTO density. Reinstating layerworks and surfacing shall be measured and paid for in terms of SANS 1200 DB.
The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water, for removing surplus excavated material from the site, for transporting all material and for supplying adequate supervision during both excavation and backfilling operations."

C3.2.2.4.6.1.7 PSD 8.3.10 Topsoiling

CHANGE THE UNIT TO "m³" *AND REPLACE THE CONTENTS OF THIS ITEM WITH THE FOLLOWING:*

"The unit of measurement shall be the cubic metre and the quantity shall be calculated from the authorised dimensions.

The tendered rate shall include loading of the topsoil from stockpiles, transporting, off-loading, spreading, shaping and lightly compacting the topsoil."

C3.2.2.4.6.1.8 PSD 8.3.11 Grassing or other Vegetation Cover

ADD THE FOLLOWING AFTER THE SECOND SENTENCE:

"The tendered rate shall be irrespective of the number of applications required to obtain the required spread rate."

C3.2.2.4.6.1.9 PSD 8.3.12 Road traffic signs and markings

REPLACE THE WORD "SEPARATE" IN THE FIRST SENTENCE OF ITEM 8.3.12 WITH THE FOLLOWING:

"Where the Engineer requires the provision of road traffic signs and/or road markings and/or any other measures additional to those to be provided by the Contractor in accordance with subclause 5.1.6, separate …".

ADD THE FOLLOWING ITEMS IN SUBCLAUSE 8.3:

C3.2.2.4.6.1.10 "PSD 8.3.14 Extra over items PSD 8.3.2 (a)(1) and PSD 8.3.3 for temporary stockpiling…….Unit: m³

The unit of measurement shall be the cubic metre of material from necessary excavations, temporarily stockpiled by the Contractor on the instructions of the Engineer, before being used in embankments or backfill. Measurements shall be taken in place in compacted embankment or backfill as the case may be.

The tendered rate shall include for the costs, additional to those provided for in PSD 8.3.2(a)(1) and PSD 8.3.3, of off-loading, forming and maintaining the stockpile for as long as is required, reloading and transporting.

Payments to the Contractor under this item will only be made in respect of that material stockpiled on the instructions of the Engineer (which instruction shall state specifically that payments for such stockpiling will be paid for under this item) and no payments will be made to the Contractor under this item in respect of materials stockpiled by the Contractor on his own volition, nor for materials necessarily stockpiled by the Contractor in consequence of the sequence of operations adopted by him in the course of executing the works, whether such stockpiling was avoidable or otherwise."

C3.2.2.4.6.1.11 "PSD 8.3.15 Extra over items PSD 8.3.2(b) and PSD 8.3.3 for disposing of spoil material on a site provided by the Contractor……..Unit: m³

The unit of measurement shall be the cubic metre measured in accordance with subclause 8.2 of SANS 1200 D of surplus and/or unsuitable material disposed of, on the instruction of the Engineer, at a spoil site or spoil sites provided by the Contractor.

The tendered rate shall include full compensation for the additional cost of providing a spoil site or other means of disposing of surplus spoil material, for transporting the material regardless of the distance involved, for acceptance charges for such material and for all other incidental costs to dispose of the spoil material."

C3.2.2.4.6.1.12 "PSD 8.3.16 Temporary works: Control ground water inflow and ground water level around structures……..Unit: Sum

Where this item is provided in the Bill, the tendered rate shall include all cost associated to keep the excavations dry, and the groundwater table low to prevent the structure from floating for the duration of the Contract. A drainage system form part of the construction scope and could be utilised to assist. In general the drainage system drains to a sump which shall be pumped down when the structure is at risk.

C3.2.2.5 PSDB EARTHWORKS (PIPE TRENCHES)

C3.2.2.5.1 PSDB 3 MATERIALS

C3.2.2.5.1.1 PSDB 3.1 CLASSES OF EXCAVATION

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The excavation of material for the purpose of measurement and payment will not be classified as intermediate excavation nor as boulder excavation Class A or Class B. Soft excavation will hold to include any material classified in Sub-clause 3.1.2 as intermediate excavation, or boulder excavation as Classes A or B.

The now combined soft excavation will be excavation in material that can be ripped and efficiently be removed or loaded with the following plant.

(3) bulldozer of mass approximately 35 tonne fitted with a single tine rip-per suitable for heavy ripping, and of flywheel power approximately 220kW, or

(4) a track type excavator of mass approximately 32 tonne and of flywheel power approximately 200kW."

C3.2.2.5.1.2 PSDB 3.5 BACKFILL MATERIALS

ADD THE FOLLOWING PARAGRAPHS TO SUBCLAUSE 3.5:

"(c) Cement-stabilized backfilling

Backfilling shall, where directed by the Engineer, be stabilized with 5% cement. The aggregate shall consist of approved soil or gravel containing stones not bigger than 38mm and with a plasticity index not exceeding 10. The soil or gravel shall be mixed with 5% cement and shall be compacted in layers of 100mm thick to 93% of modified AASHTO density.

(d) Soilcrete backfilling

The aggregate for soilcrete shall be mixed with 5% cement and shall consist of approved soil or gravel containing stones not bigger than 38mm and with a plasticity index not exceeding 10. The soil or gravel shall be mixed in a concrete mixer with the cement and enough water to acquire a consistency that allows the mixture to be placed with vibrators to fill all voids between the pipe and the sides of the trench. Shuttering shall be used where necessary."

C3.2.2.5.1.3 PSDB 3.7 SELECTION

REPLACE THE WORDS "if he so wishes" *IN THE FIRST LINE OF THE SECOND PARAGRAPH WITH THE WORDS* "at his own cost".

C3.2.2.5.2 PSDB 5 CONSTRUCTION

C3.2.2.5.2.1 PSDB 5.1 PRECAUTIONS

C3.2.2.5.2.1.1 PSDB 5.1.2 Stormwater, Seepage and Dewatering of Excavation

C3.2.2.5.2.1.1.1 PSDB 5.1.2.3 Sloping ground

ADD THE FOLLOWING SENTENCE AT THE END OF THE PARAGRAPH:

"All trench excavations on sloping embankments shall be backfilled in accordance with 5.6.2 over the full extent of the actual trench excavation and to the original embankment ground level."

C3.2.2.5.2.1.2 PSDB 5.1.3 Accommodation of traffic and access to properties

*REPLACE THE SEMICOLON AND THE WORD "*and*" AT THE END OF SUBCLAUSE 5.1.3(a) WITH A FULL STOP AND REPLACE ITEM (b) WITH THE FOLLOWING:*

"(b) Where necessary to achieve compliance by the Contractor with his obligations in terms of subclause C3.4.2.5(f). Scope of Works to provide and maintain pedestrian and vehicular access to properties affected by the works, the Contractor shall construct and maintain to the satisfaction of the Engineer, such temporary access roads around, and/or steel or timber bridges over excavations in roads, pavements, entrances or accesses to properties.

Temporary pedestrian access bridges shall be at least 1.2m wide and temporary access bridges for vehicles shall be at least 3.6m wide. All temporary access bridges shall be fitted with handrails as well as protective mesh fencing on both sides.

On completion of the work, the Contractor shall dismantle and remove all such temporary constructions and reinstate these areas to their former condition.

Except only where the Engineer has included in the Schedule of Quantities, particular payment items specifically therefor, the Contractor will not be paid directly for the construction and maintenance of temporary access roads and/or the provision and maintenance of bridges as aforementioned, and the costs thereof shall be deemed included in the Contractor's tendered rates for excavation."

ADD THE FOLLOWING NEW SUBCLAUSE TO SUBCLAUSE 5.1:

C3.2.2.5.2.1.3 "PSDB 5.1.5 Removal of existing pipelines

Where existing pipes have to be removed, they shall be carefully opened up by machine excavation to 300mm above the pipes after which the whole pipe shall be fully exposed by means of hand excavation. The excavation width shall comply with subclause 8.2.3.

The pipes shall be removed from the trench in a manner approved by the Engineer, and brought to the surface for inspection by the Engineer.

Pipes that are declared suitable for reuse and pipes declared unfit for reuse shall be dealt with in an applicable manner described in the specifications, or on the Drawings or on the Engineer's instructions, as relevant."

C3.2.2.5.2.2 PSDB 5.2 MINIMUM BASE WIDTHS

REPLACE PARAGRAPH (A) WITH THE FOLLOWING:

"Where two pipes are placed in the same trench, they shall be 300mm apart or as indicated on the Drawings and the specified side allowance shall still be applicable."

ADD THE FOLLOWING AFTER PARAGRAPH (B):

"The above is not applicable to trenches for subsurface drains.
Trenches for subsurface drains shall be excavated to the dimensions and gradients shown on the Drawings or directed by the Engineer.

The specified width of trenches and the width of the excavation measured for payment shall not be less than 0.5m, but the Contractor may reduce the actual width with the Engineer's permission."
ADD THE FOLLOWING SUB PARAGRAPH:

(c) Should the excavated trench width exceed the specified side allowance on each side of the pipe of 300mm by a value greater than 300mm, remedial measures shall be as directed and shall be provided at the Contractor's cost unless it can be shown that such excess width is due to factors beyond the Contractor's control.

Trench widths should be as near vertical as possible in order to minimize the quantity of selected fill material to be provided."

C3.2.2.5.2.3 PSDB 5.4 EXCAVATION

ADD THE FOLLOWING:

"Except where otherwise specified, trenches shall be of such a depth that the minimum cover over the pipes shall be 700mm except at road-crossings where the minimum cover shall be 1,000mm."

ADD THE FOLLOWING SUB CLAUSES:

C3.2.2.5.2.3.1 PSDB 5.4.1 Principles

(a) "The cost of trimming excavations by hand or machine shall not be paid for separately but shall be included in the rates tendered for excavation.

(b) All excavated material shall be kept within defined limits and shall, wherever possible, be deposited alongside the trench. The material shall be deposited so as to leave a clear strip of at least one metre between the edge of the trench and the excavated material and shall not cause undue inconvenience to traffic and property owners. The material shall be placed and kept well clear of all manhole covers, culvert in- and outlets, fire hydrants, benchmarks, stand pegs, fences, etc.

(c) To prevent vertical trench walls from collapsing, excavated material shall, wherever possible, not be stacked on the side of any underlying strata sloping down towards the trench.

(d) Excavations more than 1,5 m deep shall be adequately shored or braced to support the overhanging material and other loads which may occur. If the Contractor is of the opinion that shoring or bracing for an excavation of depth of more than 1,5 m is not necessary, he shall notify the Engineer accordingly in writing, including a report from a professional engineer or a professional technologist competent in excavations. The report shall include the relevant laboratory tests.

(e) The Contractor shall provide all the open and close timbering, strutting and shoring required for the safety of the excavations and structures adjacent to the trenches and shall be solely and wholly responsible for ensuring the adequacy of these measures for this purpose.

Without in any way affecting or detracting from the Contractor's responsibility, the Engineer shall have the right to instruct the Contractor to provide additional or improved timbering, shoring or strutting where he considers this to be necessary. The Contractor shall have no claim for additional payment on this account.

The shoring method adopted shall be compatible with the soil type and the excavating, backfilling and pipe-laying methods adopted and shall not place any undue restrictions on the laying of the pipes.

Timbering and shoring shall be left in position until the Engineer has authorised their removal.

(f) Shoring and bracing may not be necessary where the Contractor elects to slope the sides of the excavation to at least the maximum angle of repose measured relative to the horizontal plane, as determined by laboratory tests. Sloping of the sides could be combined with steps. The Contractor will submit the proposed excavation profile to the Engineer for approval.

(g) The cost for shoring, bracing and sloping of the sides will be included in the rates tendered for excavation. The cost for the services of a professional engineer or a professional technologist, including the relevant laboratory costs, shall be included in the tendered rates.

(h) The Safety officer, or another competent person appointed by the Contractor in writing, shall inspect every excavation, including bracing and shoring:

i. daily, prior to each shift;

ii. after every blasting operation;

iii. after an unexpected fall of ground;

iv. after substantial damage to supports; and

v. after rain,

in order to pronounce the safety of the excavation to ensure the safety of persons, and those results are to be recorded in a register kept on site and made available to an inspector, the Employer, Employer's agent, contractor or employee upon request;

(i) Each excavation which is accessible to the public or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered, shall be:

i. adequately protected by a barrier or fence of at least one metre in height and as close to the excavation as is practicable; and

ii. provided with warning illuminants or any other clearly visible boundary indicators at night or when visibility is poor."

C3.2.2.5.2.3.2 PSDB 5.4.2 Hand Excavatability

C3.2.2.5.2.3.3 PSDB 5.4.3 Excavation of Asphalt Surfaces

The existing asphalt road surfacing shall be saw-cut prior to excavation commencing for the full width of the trench as specified on the construction drawings so as to ensure a neat finish to the reinstated surfacing.

C3.2.2.5.2.4 PSDB 5.6 BACKFILL

C3.2.2.5.2.4.1 PSDB 5.6.1 General

ADD THE FOLLOWING AFTER THE FIRST PARAGRAPH:

Trenches shall be backfilled level with adjacent surfaces immediately after completion of pipe laying and successful pressure testing. Should pipe laying not be completed before work is due to cease for the day, the Engineer shall be entitled to instruct the Contractor to backfill the trench and re-excavate it the following day in order to complete pipe laying. The cost of the above activity shall be included in the Contractor's rates for excavation.

C3.2.2.5.2.4.2 PSDB 5.6.3 Disposal of soft excavation material

DELETE THE EXISTING CLAUSE AND REPLACE WITH:

"The Contractor shall locate and negotiate for tipping sites for the disposal of surplus material and bear all costs in connection therewith. Arrangements for the consent of the owner of a property to deposit spoil and or temporary spoil thereon shall be confirmed in writing. Such arrangements shall

be approved before being implemented. All spoil sites shall be neatly finished off and compacted to 90% of MOD.AASHTO density."

C3.2.2.5.2.4.3 PSDB 5.6.6 Completion of Backfilling

ADD THE FOLLOWING:

Backfilling should not lag more than 50m behind the laying operation.

C3.2.2.5.2.5 PSDB 5.7 COMPACTION

ADD THE FOLLOWING:

"Where pipelines cross existing gravel roads, backfilling shall be carried out as specified in Subclause 5.7.2 and payment therefore will be made under sub item 8.3.3.3."

C3.2.2.5.2.6 PSDB 5.9 REINSTATEMENT OF SURFACES

ADD THE FOLLOWING TO THIS SUB CLAUSE:

C3.2.2.5.2.6.1 PSDB 5.9.2 Private Property and Commonage

The ground and paved surface of servitudes, parks, driveways, roadways and sidewalks shall be reinstated to at least the standard and conditions as existed previously.

Grass sods shall be cut out from the grassed areas to be excavated and shall be set aside, preserved and kept damp until used for reinstatement. All other material to be used for reinstatement shall be suitably stored for such purpose.

The rate for reinstatement of block paved surfacing shall include all costs for the supplying and laying of the surfacing. The rate shall also cover for taking brick paving out carefully, stockpiling and replacement with new if bricks are broken or damaged. The rate must furthermore provide for all plant, labour and material costs associated with the work.

The rate for reinstatement of asphalt or concrete paved surfacing shall include all costs for the saw cutting, supplying and laying of the surfacing. The rate shall also cover for removal and spoiling of the material. The rate must furthermore provide for all plant, labour and material costs associated with the work.
The width of any trench through an area paved with bricks or precast concrete units shall be the minimum practicable width that, in the opinion of the Engineer, can be removed without cutting bricks or precast units.

ADD THE FOLLOWING NEW SUB CLAUSES:

C3.2.2.5.2.6.3 PSDB 5.9.8 Existing Kerbs and Channels

"Where excavations have to cross existing kerbs and channels, then:

(a) In the case of a precast kerb and channel the kerb, segmented paving blocks and channel shall be carefully removed and stored so as to avoid any damage to or theft of the kerb and channel, and replaced after the excavation has been backfilled. Any damage to or theft of the kerb and channel shall be made good by the Contractor at his expense.

(b) In the case of cast insitu or extruded insitu kerb and channel the kerb and channel shall be cut with a diamond tipped saw and carefully removed so as to avoid any damage to the remaining kerbs and channels. After the excavation has been backfilled the portion of kerb and channel removed shall be replaced with a cast insitu kerb and channel of the same profile as the existing kerb and channel."

ADD THE FOLLOWING NEW SUB-CLAUSE:

C3.2.2.5.2.7 PSDB 5.11 LOCATION OF EXISTING SERVICES

Positions and details of known existing services as received from the various Departments are indicated on the Construction Drawings. Exact positions cannot be guaranteed by The Employer who will not be held responsible for any damages to any services. The Contractor shall excavate by hand to locate any such services and ensure that care is taken not to damage these services.

ADD THE FOLLOWING NEW SUB-CLAUSE:

C3.2.2.5.2.9 PSDB 5.12 DEALING AND PROTECTING EXISTING SERVICES

All existing services, underground as well as above ground level, shall be protected by the Contractor in an appropriate manner, for the duration of the construction or as deemed necessary by the Engineer, such that no damage to or interruption of the services shall occur.

ADD THE FOLLOWING NEW SUB-CLAUSE:

C3.2.2.5.2.10 PSDB 5.13 GAS MAIN, ELECTRICITY AND TELECOMMUNICATION POLES

Gas mains, electricity and telecommunication poles along the pipe route are to be stabilized and protected prior to excavation and for the duration of construction.

ADD THE FOLLOWING NEW CLAUSE:

C3.2.2.5.2.11 PSDB 5.14 TREES IN CONSTRUCTION PATH

Whenever possible any trees that lie within the construction path, shall not be removed and care shall be exercised to avoid damaging them. If the Contractor considers the removal of any tree unavoidable, he/she shall obtain in writing the approval of the Engineer and the Environmental Consultant prior to removal of any trees. Rates to cover removal and replacement where practical are provided in the schedule of quantities. A penalty of R1, 000.00 will be applied for any unauthorized or unnecessary damage to any tree which in the opinion of the Engineer could have been avoided.

C3.2.2.5.3 PSDB 7 TESTING

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.5.3.1 PSDB 7.2 Inspection at Intermediate Stages of Construction

The Contractor shall call the Engineer, giving him reasonable notice, to inspect the works at the following intermediate stages of construction:

(a) After completion of the trench excavation and preparation of the trench bottom and before any pipe is laid.

(b) After the selected backfill material has been placed around the pipe and before the remainder of the trench is backfilled.

(c) Before placing of premix on roads or any final surfacing on constructed footways. Work shall not progress through the specified stages without the approval of the Engineer or his representative on site.

Failure to comply with the provision of this clause shall result in the suspension of the backfilling work until the testing has been approved by the Engineer."

C3.2.2.5.4 PSDB 8 MEASUREMENT AND PAYMENT

C3.2.2.5.4.1 PSDB 8.1 BASIC PRINCIPLES

ADD THE FOLLOWING PARAGRAPH:

"The basic principle of measurement and payment for earthworks for a pipe trench is that the rates tendered for excavation shall also cover the cost of trimming, handling and shoring or bracing as specified in clause PSDB 5.4".

C3.2.2.5.4.2 PSDB 8.2 COMPUTATION OF QUANTITIES

REPLACE THE CONTENTS OF SUB-CLAUSE 8.2.3 WITH THE FOLLOWING:

"**PSDB 8.2.3** Wherever volumetric measurement is required, the volume will be computed according to the depths indicated on the drawings, or to the bottom of the specified bedding cradle, whichever is the greater, and the width determined from the applicable side allowance set out below (see drawing DB-4) plus the nominal width of the pipe. Side allowance shall be measured from the outside of the pipe. No allowance shall be made for the extra thickness of the collars or couplings.

Table 4: Pipe trench side clearances

All Pipes Excluding Ducts		
Nominal Diameter, mm		Side clearance on each side, mm
From	To	
0	125	200
125	700	300
700	1000	400
1000	2000	500
2000	-	600

The side allowance for ducts shall be 150mm (one hundred and fifty millimeters) and there shall be 300mm (three hundred millimeters) between a Telkom duct and any other duct/service placed in the same trench.

Where two or more pipes/ducts are to be placed in one trench, the specified base width shall be calculated as follows:

The trench width for the deeper service shall be calculated according to above specifications. The effective trench width for the shallower service shall then be the difference between its specified base width and the overlap with the trench of the deeper service.

The trench width for subsurface drains shall be as shown on the drawings."

C3.2.2.5.4.3 PSDB 8.3 SCHEDULED ITEMS

C3.2.2.5.4.3.1 PSDB 8.3.2 Excavation

(a) Excavate in all materials, for trenches, backfill compact and dispose of surplus material

*REPLACE "*of 1.0m" *IN THE FIRST SENTENCE OF 8.3.2(a) WITH:*

"as specified in the Bill of Quantities."
ADD THE FOLLOWING SUB-ITEM:

The rate shall also cover the cost of excavating for trenches using labour intensive construction methods. The rate shall exclude the cost of removal of grass sods and compaction but shall include for the disposal of surplus/unsuitable material. The rate shall, in addition, cover the costs for compliance with the requirements of PSDB 5.4.1.

(b) Extra over item (a) above for:

ADD THE FOLLOWING AT THE END OF THE EXISTING SUBITEM 2:

"No payments will be made under subitems (1) and (2) in respect of any materials measured and paid for under subitem 3 below."

AND ADD THE FOLLOWING NEW SUBITEMS IN 8.3.2(b):

"(3) Hand excavation where ordered by the Engineer in:

(a) Soft material……..Unit: m³

(b) Intermediate material……..…Unit: m³

(c) Hard material……Unit: m³

The unit of measurement shall be the cubic metre of material, measured in place according to the authorised dimensions, which was excavated by hand on the specific prior written instructions of the Engineer; provided always that the Engineer's said instruction shall have stated that measurement and payment for such hand excavation will be in accordance with this item.

The tendered rate shall include full compensation for the additional cost, effort and time resulting from excavating in the respective materials using hand methods only. The Engineer shall not be obliged to authorise payment under this item in respect of any hand excavation carried out (whether ordered in writing or otherwise), which hand excavation was in any case necessary to achieve compliance by the Contractor with his obligations under the Contract to:

(i) utilise construction appropriate to the nature of the specific parts of the works; and/or

(ii) protect existing structures and/or services; and/or

(iii) comply with all prevailing legislation and regulations.

(4) Cutting of premix and concrete surfaces…..……..Unit: m²

The cutting of premix and concrete surfaces shall be measured per square metre of cut as scheduled. Cutting of premix and concrete surfaces shall be done with a diamond tipped saw or by some other approved method. The depth of the cut shall be such that the adjoining premix and concrete surfaces are not disturbed when excavation takes place. The cutting of surfaces shall be done 100mm on either side of the trench.
(5) Backfill stabilized with 5% cement where directed by the Engineer …….Unit: m³

The unit of measurement shall be the cubic metre of backfill material, measured in place after compaction according to the authorised dimensions, which was stabilized on the Engineer's instructions in accordance with subclause PSDB 3.5(c).

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing, backfilling and compacting the stabilized material to 93% of modified AASHTO density.

(6) Soilcrete backfill where directed by the Engineer ……Unit: m³

The unit of measurement shall be the cubic metre of soilcrete placed on the Engineer's instructions in accordance with subclause PSDB 3.5(d), measured in place according to the authorised dimensions.

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing and placing the soilcrete as well as for the cost of shuttering if required."

ADD THE FOLLOWING SUBITEMS IN 8.3.2 AFTER SUBITEM 8.3.2(c):

"(d) Excavate in all materials for stormwater inlet and outlet structures and for manholes, catchpits, valve chambers and the like, irrespective of depth, and backfill around structures:Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised dimensions, and excluding the volume of material excavated and paid for under subitem (a).

The tendered rate shall include for the costs of excavating in all materials, backfilling, compacting, trimming and tidying the final surface around the structure, disposing of surplus and unsuitable materials within the free-haul distance and, where applicable, selecting and keeping separate, excavated material suitable for use as backfill.

(e) Excavate open drains in all materials.....Unit: cubic metre (m³)

The tendered rates shall include full compensation for excavating in all materials within the dimensions specified or authorised by the Engineer and to the specified lines and profiles, for the disposal of surplus and unsuitable excavated material where applicable, and in the case of item (d), for backfilling with suitable approved material compacted to 90% of modified AASHTO density around the structures.

(f) Extra over subitems (d) and (e) for excavating in:

(1) Intermediate material .....Unit: cubic metre (m³)

(2) Hard rock material .....Unit: cubic metre (m³)

Measurement and payment shall be in accordance with the provisions of 8.3.2(b) of SANS 1200 D (as amended)."

C3.2.2.5.4.3.2 PSDB 8.3.3 Excavation ancillaries

C3.2.2.5.4.3.2.1 PSDB 8.3.3.3 Compaction in road reserves

REPLACE THE HEADING OF THIS SUBITEM WITH THE FOLLOWING:

"PSDB 8.3.3.3 Compaction in road crossings"
REPLACE THE SENTENCE, "The volume will be measured as specified in 8.2.2, 8.2.3 and 8.3.3.1", *WITH THE FOLLOWING:*

"To determine the volume in the case of gravel roads, the depth will be measured from the underside of the gravel wearing course to the top of the fill blanket, and in the case of bitumen roads, from the underside of the subbase to the top of the fill blanket.

The rest of the trench shall be backfilled as specified in clauses 5.9.3, 5.9.4 and 5.9.5, as applicable, and payment will be made under item 8.3.6.1."

C3.2.2.5.4.3.2.2 PSDB 8.3.3.4 Overhaul

REPLACE THE CONTENTS OF THIS ITEM WITH THE FOLLOWING:

"Measurement and payment shall be in accordance with subclause PSD 5.2.5."

C3.2.2.5.4.3.3 PSDB 8.3.4 Particular items

(a) Shore trench opposite structure or service

REPLACE THE HEADING OF THIS SUBITEM WITH THE FOLLOWING:

(a) Shore trench opposite structure or service for depths:"

ADD THE FOLLOWING AFTER THE LAST SENTENCE:

"Separate items will be measured for depths of trenches in increments of 1 m. The rate for each stated category shall cover the cost of shoring from ground level up to the full depth of the stated category. Payment for this item will only be made if written instructions were issued by the Engineer over and above the Standard Specifications for safety of excavations as specified in SANS 1200 DB, subclause 5.1."

(b) Temporary works: Control water inflow from …….. to ……..

REPLACE THIS SUBITEM WITH THE FOLLOWING:

(b) Accommodation of existing flows for temporary or permanent connections or construction of new structures or pipe trenches:

1) (Description of item stated) …… Unit: Sum

2) Etc for other structures

The tendered sums shall include full compensation for any inconvenience suffered, for normal and exceptional risks, for unforeseen eventualities and for maintaining the accommodated flow as long as necessary and shall include for the design and construction of all necessary temporary measures such as additional clearing, grubbing, earthworks, culverts, structures, pipework, pumping, cleaning up and any other associated work that may be required as specified in Clause PS1.5. Where a temporary structure for the accommodation of an existing flow has been designed by the engineer and is to be constructed by the Contractor, payment for such structure shall, unless otherwise stated in the scheduled item, be made under the applicable sub items in this payment item."

C3.2.2.5.4.3.4 PSDB 8.3.5 Existing services that Intersect or Adjoin a Pipe Trench

(a) Services that intersect a trench

ADD TO THE FIRST SENTENCE OF THIS SUB CLAUSE AS FOLLOWS:

After "Except where water pipes are to be recovered" add "and water leads for erf connections need to be renewed"

ADD THE NEW SUBCLAUSE PSDB 8.3.5 c) TO CLAUSE 8.3.5 AS FOLLOWS:

(c) Services that require special care

1) Description of service……..……..……...……Unit: No

2) Etc for other items……..……..……..……..……..……Unit: No

The Unit of measurement shall be the number of each service described. Electricity, telecommunication poles and water mains along the pipe route are to be stabilised and protected prior to excavation and for the duration of construction. The rate shall cover the temporary stabilization and protection of electricity and telecommunication poles.

ADD THE NEW SUBCLAUSE PSDB 8.3.6.2 TO CLAUSE 8.3.6 AS FOLLOWS:

C3.2.2.5.4.3.5 PSDB 8.3.6 Finishing

C3.2.2.5.4.3.5.1 PSDB 8.3.6.2 Reinstatement of surfacing for footways

(a) Brick paving ……..…….. Unit: m²

(b) Concrete paving ……..…… Unit: m²

(c) Concrete slabs …… Unit: m²

The Unit of measurement shall be square meter of a reinstated surface. The rate for reinstatement of footway surfacing shall include all costs for careful removal, replacement of damaged sections and laying of the surfacing using labour intensive construction methods.

The rates shall include for the lifting, stockpiling and replacement of broken or damaged bricks, blocks or slabs and shall provide for all plant, labour and material costs associated with the work. The width of any trench through an area paved with bricks or precast concrete units shall be the minimum practicable width which, in the opinion of the Engineer, can be removed without cutting bricks or precast units.

ADD THE NEW SUBCLAUSE PSDB 8.3.6.3 TO CLAUSE 8.3.6 AS FOLLOWS:

C3.2.2.5.4.3.5.2 PSDB 8.3.6.3 Reinstatement of kerbs and channels……Unit: m²

The unit of measurement shall be square metre of area reinstated. The rate shall cover the cost of all labour, plant and material required and shall also include for the disposal of all unsuitable materials.

ADD THE NEW SUBCLAUSE PSDB 8.3.6.3 TO CLAUSE 8.3.6 AS FOLLOWS:

C3.2.2.5.4.3.5.3 PSDB 8.3.6.4 Reinstatement of grassed surfaces ……Unit: m²

The unit of measurement shall be square metre of area reinstated. The rate shall cover the cost of careful removal of grass sods to a minimum depth to a minimum depth of 100mm, stockpiling, maintenance for later re-use and reinstatement thereof."

DELETE THIS SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

C3.2.2.5.4.3.5.4 PSDB 8.3.6.5 Reinstatement of fence

(a) Description of fence……..……..……Unit: m

(b) Etc for other items

The unit of measurement shall be the metre of fence reinstated complete. The rate shall cover the full compensation, labour, material and ancillary works for the reinstatement.

C3.2.2.5.3.2.3 PSDB 8.3.7 Accommodation of traffic

DELETE ITEM 8.3.7.

REPLACE THE HEADING AND CONTENTS OF ITEM 8.3.7 WITH THE FOLLOWING

"PSDB 8.3.7 Accommodation of traffic ……Unit: sum

The tendered sum shall, (except where particular items are scheduled to cover particular costs) include full compensation for compliance with the requirements of 5.1.3 of SANS 1200 DB (as amended), including the construction and maintenance of bypasses and the use of existing roads as bypasses during the construction period.

It shall also include full compensation: for the provision, maintenance and removal of all traffic control measures, including temporary traffic signs, road markings, lighting, barricading, flagmen and, where necessary, communications equipment to regulate traffic; for the construction of temporary drainage works; for the maintenance of drainage works; and for arrangements for moving and subsequently reinstating services for the purposes of accommodating traffic, attending to traffic problems and complying with the requirements of the Road Traffic Ordinance and the relevant local authorities.

The tendered lump sum shall be adjusted to a time-related item, in the event of any extension of time for completion being granted by the Engineer in accordance with the Conditions of Contract with the Preliminary and General costs. This item will then form part of the Preliminary and General costs to be adjusted.

Payment shall be made in equal monthly instalments over the entire period allowed for completion, provided that where any extension of time for completion is granted, the amount which shall be payable under this item in any subsequent monthly payment certificate shall be the outstanding unpaid amount of the lump sum, divided by the number of months remaining until the due completion date of the Contract, as revised in accordance with the Conditions of Contract."

C3.2.2.6 PSDK GABIONS AND PITCHING

C3.2.2.6.1 PSDK 3 MATERIALS

C3.2.2.6.1.1 PSDK 3.2 PITCHING

C3.2.2.6.1.1.1 PSDK 3.2.1 Stone

REPLACE THE CONTENTS OF TABLE 2 WITH THE FOLLOWING:

"Table 2: Size and Mass of Individual Stones for Pitching

1	2	3	4
Size/mass of pitching	Thickness of pitching mm, min	Least dimension mm, min	Mass kg, min
Extra heavy	600	300	180
Heavy	400	190	50
Medium	300	150	27
Light	200	110	11

"

C3.2.2.6.2 PSDK 5 CONSTRUCTION

C3.2.2.6.2.1 PSDK 5.3 PITCHING

C3.2.2.6.2.1.1 PSDK 5.3.3 Grouted pitching

REPLACE THE WORDS "(table 4)" IN THE SECOND LINE OF THE FIRST PARAGRAPH WITH "(table 2)".

C3.2.2.7 PSDM EARTHWORKS (ROADS, SUBGRADE)

C3.2.2.7.1 PSDM 3 MATERIALS

C3.2.2.7.1.1 PSDM 3.2 CLASSIFICATION FOR PLACING PURPOSES

C3.2.2.7.1.1.1 PSDM 3.2.3 Selected layer

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The following requirements shall apply in respect of the selected layer:

(a) Maximum particle size: 60% of compacted layer thickness

(b) Unstabilized selected layer

(i) Upper selected layer

Minimum CBR at 93% of modified AASHTO density: 15
Maximum PI: 12 (the Engineer has the right to alter this requirement to 3 x the grading modulus + 10)

(ii) Lower selected layer

Minimum CBR at 90% of modified AASHTO density: 7
Maximum PI: 12 (the Engineer has the right to alter this requirement to 3 x the grading modulus + 10)

(c) Stabilized selected layer
Minimum grading modulus of natural material: 0,75
UCS of stabilized material 300 kPa - 500 kPa at 93% of modified AASHTO density
Maximum PI for stabilized material: 10"

C3.2.2.7.2 PSDM 5 CONSTRUCTION

C3.2.2.7.2.1 PSDM 5.2 METHODS AND PROCEDURES

C3.2.2.7.2.1.1 PSDM 5.2.2 Cut and borrow

C3.2.2.7.2.1.1.1 PSDM 5.2.2.3 Use of material

ADD THE FOLLOWING PARAGRAPH:

"(e) Commercial sources

The provisions of subclause PSD 5.2.2.5 of SANS 1200 D as amended shall apply."

C3.2.2.7.2.1.1.2 PSDM 5.2.2.7 Catchwater mounds and channels and mitre banks and channels

ADD THE FOLLOWING SENTENCE:

"Catchwater mounds and mitre banks shall be compacted to a minimum density of 90% of modified AASHTO density."

C3.2.2.7.2.1.2 PSDM 5.2.3 Treatment of the road-bed

C3.2.2.7.2.1.2.1 PSDM 5.2.3.2 Removal of unsuitable ground

REPLACE THE SECOND SENTENCE OF PARAGRAPH (A) WITH THE FOLLOWING:

"The excavated spaces shall then be backfilled with approved imported material compacted to the required density."

ADD THE FOLLOWING SENTENCE TO PARAGRAPH (b):
"Unsuitable excavated material will be paid for as cut to spoil."

C3.2.2.7.2.1.2.2 PSDM 5.2.3.3 Treatment of road-bed

ADD THE FOLLOWING PARAGRAPH:

"(c) Three-pass roller compaction

Any portion of the roadbed that is shown on the Drawings or is specified or is directed by the Engineer to be given three-pass roller compaction because of its inadequate natural density, shall be prepared by shaping where necessary and compacting with a roller, complying with the requirements specified below.

Compaction shall comprise three complete coverages by the wheels of the specified roller over every portion of the area that is being compacted. While it is not the intention that the Contractor should apply water to the roadbed for this type of compaction, and while no rigid moisture control will be exercised during compaction, the Contractor shall nevertheless satisfy the Engineer that everything is being done to take full advantage of favourable soil moisture conditions during the rainy season, and that such compaction is as far as possible carried out when the roadbed is neither excessively dry nor excessively wet.

The Engineer has the authority to decide when conditions are favourable for compaction and where such compaction is to be carried out at any particular time, and he has the right to instruct the Contractor to water the roadbed at the Contractor's expense when, in the opinion of the Engineer, the Contractor failed, neglected or refused to comply with these requirements.

The rollers to be used for roller-pass compaction shall conform to the following requirements:

Grid roller: The grid roller shall have a mass of not less than 13.5t when ballasted, shall be loaded to this mass if required, and shall be moved at a speed of not less than 12km/h.

Vibratory roller: The vibratory roller shall be capable of exerting a combined static and dynamic force of not less than 120kN/m width for every metre of loose-layer thickness at an operating frequency not exceeding 25Hz and shall move at a speed not exceeding 4km/h."

C3.2.2.7.2.1.3 PSDM 5.2.4 Fill

C3.2.2.7.2.1.3.1 PSDM 5.2.4.3 Finishing

(e) Topsoiling

REPLACE THE SECOND SENTENCE WITH THE FOLLOWING:

"The thickness of the topsoil shall be as directed by the Engineer."

C3.2.2.7.2.1.4 PSDM 5.2.5 Selected layer

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Except with regard to density, the requirements of subclause 5.2.4 shall apply. The degree of compaction shall be:

Selected : 93% of modified AASHTO density

C3.2.2.7.2.1.5 PSDM 5.2.6 Gravel surfacing

REPLACE THE THIRD SENTENCE OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The relevant requirements in subclause 5.2.4.2 shall apply, except that the material shall be compacted to 93% of modified AASHTO density."

C3.2.2.7.2.1.6 PSDM 5.2.8 Transport

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The provisions of subclause PSD 5.2.5 of SANS 1200 D, as amended, shall apply."

C3.2.2.7.3 PSDM 7 TESTING

C3.2.2.7.3.1 PSDM 7.3 ROUTINE INSPECTION AND TESTING

REPLACE TABLE 2 AND THE CONTENTS OF SUBCLAUSE 7.3.2 WITH THE FOLLOWING:

"PSDM 7.3.2 The dry density requirements for a particular lot of selected layer or wearing course shall be deemed to be satisfied if the average density and the results of individual tests meet the requirements specified in table 2 below. Refer to subclause PSD 7.2 for the requirements for fill.

TABLE 2: DENSITIES

1	2	3	4	5
Layer	Specified density (% of modified AASHTO density)	Number of tests per lot	Average density, %	Minimum density for any single test, %
Selected layer	93	3 and 4 5 6	93,1 93,4 93,6	89,4 89,2 89,0

"

C3.2.2.7.4 PSDM 8 MEASUREMENT AND PAYMENT

C3.2.2.7.4.1 PSDM 8.2 COMPUTATION OF QUANTITIES

REPLACE SUBCLAUSES 8.2.1 TO 8.2.3 (INCLUSIVE) WITH THE FOLLOWING:

C3.2.2.7.4.1.1 "PSDM 8.2.1 The provisions of subclause 8.2.1 of SANS 1200 D shall apply.

C3.2.2.7.4.1.2 PSDM 8.2.2 The provisions of subclause 8.2.2 of SANS 1200 D shall apply.

C3.2.2.7.4.1.3 PSDM 8.2.3 The provisions of subclause 8.2.2 of SANS 1200 D shall apply."

C3.2.2.7.4.1.4 PSDM 8.2.5 Verifying quantities

REPLACE THE FIRST SENTENCE WITH THE FOLLOWING:

"Before any earthworks are commenced but after completion of any site preparation, the Engineer will, upon a written request from the Contractor, provide cross-sections for the purpose of measurement of earthworks quantities."

C3.2.2.7.4.2 PSDM 8.3 SCHEDULED ITEMS

C3.2.2.7.4.2.1 PSDM 8.3.3 Treatment of roadbed

(a) Roadbed preparation and compaction of material to

ADD THE FOLLOWING:

"The unit of measurement shall be the cubic metre of material recompacted as specified and the volume shall be determined from levelled cross-sections on which are superimposed the levels to which the roadbed is to be constructed. When material is imported to make up the required volume, such material will be paid for as cut or borrow to fill as relevant."
ADD THE FOLLOWING:

"(c) Three-pass roller compaction:

(i) Grid roller……Unit: square metre (m²)

(ii) Vibratory roller……Unit: square metre (m²)

The units of measurement shall be the square metre of roadbed compacted as specified in subclause PSDM 5.2.3.3(c) for the areas designated by the Engineer.

The tendered rates shall include full compensation for shaping the areas, providing the rollers and compacting the roadbed by means of three roller passes over the entire area."

C3.2.2.7.4.2.2 PSDM 8.3.4 Cut to fill, borrow to fill

REPLACE THE LAST SENTENCE OF THIS ITEM WITH THE FOLLOWING:

"The unit of measurement shall be the cubic metre of fill and the volume will be calculated in accordance with the authorised dimensions of the embankment and levelled cross-sections.

The tendered rates shall include full compensation for excavating the material as if in soft material, for selecting, loading, transporting for the free-haul distance, off-loading, watering, mixing and compacting the material as specified. Borrow to fill in this item relates to material from designated borrow areas (provided by the Employer).

Where it is required that material be obtained from commercial sources, payment for procuring the material will be made under item PSDM 8.3.17."

C3.2.2.7.4.2.3 PSDM 8.3.5 Selected layer compacted to 93% of modified AASHTO maximum density

REPLACE THE HEADING AND THE CONTENTS OF THIS ITEM WITH THE FOLLOWING:

"PSDM 8.3.5 Selected layer using material from designated borrow pits or excavation:

(a) Compacted to 90% of modified AASHTO density……...Unit: cubic metre (m³)

(b) Compacted to 93% of modified AASHTO density……..Unit: cubic metre (m³)
The unit of measurement shall be the cubic metre and the quantity will be calculated from the authorised dimensions of the compacted layer.

The tendered rates shall include full compensation for excavating the material as if in soft material for loading, transporting for the free-haul distance, off-loading, spreading, watering, mixing, breaking down and compacting the layer."

C3.2.2.7.4.2.4 PSDM 8.3.6 Extra over items 8.3.4 and 8.3.5 for excavating and breaking down material in

REPLACE THE HEADING OF THIS ITEM WITH THE FOLLOWING:

"PSDM 8.3.6 Extra over items 8.3.4, 8.3.5 and 8.3.16 for excavating and breaking down material in"

REPLACE THE WORDS "items 8.3.4 and 8.3.5" WITH THE WORDS "items 8.3.4, 8.3.5 and 8.3.16".

C3.2.2.7.4.2.5 PSDM 8.3.7 Cut to spoil or stockpile from

REPLACE THE HEADING WITH THE FOLLOWING:

"PSDM 8.3.7 Cut to spoil from"

C3.2.2.7.4.2.6 PSDM 8.3.12 Overhaul

REPLACE THIS ITEM WITH THE FOLLOWING:

"PSDM 8.3.12 Overhaul

(a) Limited overhaul……Unit: cubic metre (m^3)

(b) Long overhaul……Unit: cubic metre-kilometre (m^3-km)

Overhaul will be paid in accordance with item 8.3.6 of SABS 1200 D."

C3.2.2.7.4.2.7 PSDM 8.3.14 Borrow pits

REPLACE THE CONTENTS OF THIS ITEM AS FOLLOWS:

"(a) Opening up and closing down of borrow pit……..Unit: sum

(b) Dealing with overburden……Unit: cubic metre (m^3)

The provisions of subclauses 8.3.4(b) and 8.3.4(c) of SANS 1200 D shall apply respectively to items (a) and (b) above."

C3.2.2.7.4.2.8 PSDM 8.3.16 Gravel surface layer

REPLACE THE CONTENTS OF THIS ITEM WITH THE FOLLOWING:

"The unit of measurement shall be the cubic metre of gravel surface layer and the quantity will be determined from the authorised dimensions of the compacted layer.

The tendered rate shall include full compensation for excavating the material as if in soft material, for loading and transporting the material for the free-haul distance, off-loading, spreading, breaking down, watering, mixing and compacting the material."

ADD THE FOLLOWING ITEMS:

"PSDM 8.3.17 Extra over items 8.3.4, 8.3.5 and 8.3.16 for obtaining material from commercial sources……..……..Unit: cubic metre (m^3)

The tendered rate shall include full compensation for the additional cost of finding a suitable source of material, for procuring the material and paying all royalties or other charges to the owner of the source, for transporting the material to the point of use regardless of the distance hauled and for excavating in intermediate, hard or boulder material as required.

Items PSDM 8.3.6, PSDM 8.3.12 and PSDM 8.3.14 do not apply to material obtained from commercial sources.

C3.2.2.7.4.2.9 PSDM 8.3.18 Final finishing and cleaning up of the site of the works……Unit: sum

The tendered sum shall include full compensation for the clearing, disposal of material, finishing, tidying and all other work required to finish and clean up the Site of the works and affected areas by removing excess earth, stones, boulders, debris and other waste material, by clearing stormwater inlets and outlets and pipe barrels, by clearing the surfacing of all dirt, mud and foreign material, and by neatly finishing off all junctions, intersections and kerbing.

All material resulting from the finishing operations shall be disposed of to a spoil site furnished by the Contractor.

The tendered rate shall make provision for the reinstatement of existing driveways to their original condition where these have been affected by the works, as these items will not be measured and paid for separately.

C3.2.2.7.4.2.10 PSDM 8.3.19 Sidewalks:

(a) Fill compacted to 90% of modified AASHTO density and obtained from:

(i) Designated borrow pits……...Unit: cubic metre (m³)

(ii) Commercial sources……..Unit: cubic metre (m³)

(iii) Excavations……Unit: cubic metre (m³)

(b) In-situ material scarified to a depth of 150 mm and compacted to 90% of modified AASHTO density……..Unit: cubic metre (m³)

(c) Excavated material removed to spoil……..Unit: cubic metre (m³)

The tendered rates shall include full compensation for constructing the sidewalks to the profiles indicated either on the Drawings or by the Engineer, for working in restricted areas, for using material classified as soft material with a maximum particle size of 60mm, and for carrying out the work in accordance with the Specifications.

Additional payment will be made under item PSDM 8.3.12 if overhaul is applicable to subitems (a)(i), (a)(iii) and (c) above.

C3.2.2.7.4.2.11 PSDM 8.3.20 Variations in the number of roller passes (applicable to subitem 8.3.3(c)):

(a) Vibratory rollers……Unit: m²-pass

(b) Oscillatory rollers……..Unit: m²-pass

(c) Grid rollers……Unit: m²-pass

(d) Tamping rollers……..Unit: m²-pass

(e) Impact rollers……Unit: m²-pass

(f) Pneumatic-tyred rollers……Unit: m²-pass

The unit of measurement shall be the square-metre coverage and shall be computed by multiplying the number of square metres to which the changed pass efforts apply by the increased or decreased number of roller passes.

Where a change in the compaction effort is requested, the Contractor will be compensated at the tendered rates for the above items in respect of the increased number of square-metre roller passes of each type of roller required over and above that specified in the relevant standard effort. His compensation will be decreased simultaneously, at the applicable rates, by the number of square-metre roller passes of each type of roller which is either decreased or completely left out.

The tendered rate for each additional square metre-pass ordered by the Engineer over and above the specified number of passes, shall include full compensation for all supervision, labour, plant, equipment, fuel, materials, work and incidentals necessary for completing the work. The same rates shall be accepted by the Contractor during computation of a decrease in his compensation where the number of roller passes for each specific type of roller is decreased."

C3.2.2.8 PSHA STRUCTURAL STEELWORK (SUNDRY ITEMS)

C3.2.2.8.1 PSHA 3 MATERIALS

C3.2.2.8.1.1 PSHA 3.1 STRUCTURAL STEEL

ADD THE FOLLOWING:

"Where stainless steel is to be used, the grade of stainless steel shall be grade 304L."

C3.2.2.8.2 PSHA 5 CONSTRUCTION

C3.2.2.8.2.1 PSHA 5.2 FABRICATION AND ASSEMBLY

C3.2.2.8.2.1.1 PSHA 5.2.4 Welding

The Contractor shall submit with his shop drawings full details of welding procedures. All welds shall be continuous. Unless otherwise approved no longitudinal or overhead welding shall be carried out on site. Under no circumstances will cutting and welding of grid covers and frames be permitted on site.

Welders undertaking manual welding of permanent steelwork shall be experienced and competent artisans.

C3.2.2.8.2.1.2 PSHA 5.2.6 Handrails

ADD THE FOLLOWING:

"Handrail stanchions shall be spaced at 1,300mm centres unless otherwise indicated on the drawings or approved by the Engineer in writing. Handrails and stanchions shall be of the material as scheduled and all stanchion anchors shall be 12mm diameter unless otherwise indicated on the Drawings."

C3.2.2.8.2.1.3 PSHA 5.2.7 Ladder and step irons

ADD THE FOLLOWING:

"Ladders shall be stainless steel and step irons shall be galvanised mild steel with corrosion protection coatings as specified."

C3.2.2.8.2.1.4 PSHA 5.2.8 Open grid floors

ADD THE FOLLOWING SUBITEM:

C3.2.2.8.2.1.4.1 "PSHA 5.2.8.3 All open grid floors and frames shall be galvanised mild steel with corrosion protection coatings as specified.

All open grid floor panels shall be open-ended as specified, except where bonding is specified on the Drawings. Cut outs shall be provided where indicated on the Drawings"

C3.2.2.8.3 PSHA 8 MEASUREMENT AND PAYMENT

C3.2.2.8.3.1 PSHA 8.3 SCHEDULED ITEMS

C3.2.2.8.3.1.1 PSHA 8.3.1 Structural steel (type of structure indicated)

Change "Unit : t" to " Unit : t or No".

ADD THE FOLLOWING AFTER THE LAST SENTENCE:
"Alterations to existing structural steelwork will be described in the schedule and measured in number. Rates for these items shall include full compensation for all labour tools, storing, additional steelwork, reinstallation, cleaning up, grinding, etc as described in the schedule and shown on the drawings."

C3.2.2.8.3.1.2 PSHA 8.3.2 Handrails

REPLACE SUBITEM (c)(3) WITH THE FOLLOWING:

"(c)(3) Extra over rails for bends, end closures and accessories:

(i) (Description of item stated)…….Unit: No.

(ii) Etc for other descriptions"

C3.2.2.8.3.1.3 PSHA 8.3.3 Ladders, complete and installed (Drawing number or type and length stated)

REPLACE THIS ITEM WITH THE FOLLOWING:

"PSHA 8.3.3 Ladders, complete and installed (Drawing number or type and length stated)

Separate items will be scheduled for ladders of different materials, dimensions and height
…….Unit: No.

The tendered rates shall include full compensation for the cost of supplying the specified or scheduled ladders complete, including welding where applicable."

C3.2.2.8.3.1.4 PSHA 8.3.4 Flooring, complete and installed with frames (Drawing number stated)

REPLACE THIS ITEM WITH THE FOLLOWING:

PSHA 8.3.4 Flooring, complete and installed with frames:

(a) Open grid floors…….Unit : m²

(b) Floor-plate floors……Unit : m² or t

(c) Frames and kerbs for flooring……...Unit : m

Separate items will be scheduled for grid floors, floor-plate floors, frames and kerbs of different materials, dimensions, weight and different methods of fixing.

The tendered rates shall include full compensation for the cost of supplying the specified or scheduled types of flooring, frames or kerbing complete, including welding where applicable."

C3.2.2.8.3.1.5 PSHA 8.3.6 Corrosion protection

REPLACE THIS ITEM WITH THE FOLLOWING:

"PSHA 8.3.6 Corrosion protection……Unit: Sum

Separate items will be scheduled for different systems of corrosion protection. Separate subitems will also be scheduled for different elements to be coated/protected.

The tendered sums shall include full compensation for all material, preparation, etc, related to the specified corrosion protection system in accordance with the Particular Specification for corrosion protection".

C3.2.2.9 PSL MEDIUM-PRESSURE PIPELINES

C3.2.2.9.1 PSL 2 INTERPRETATIONS

C3.2.2.9.1.1 PSL 2.4 ABREVIATIONS

ADD THE FOLLOWING:

HDPE: High density polyethylene

mPVC: Modified Polyvinyl chloride

C3.2.2.9.2 PSL 3 MATERIAL

C3.2.2.9.2.1 PSL 3.1 GENERAL

ADD THE FOLLOWING PARAGRAPHS:

"The contract specifications for materials and construction activities will conform to SANS 1200, SANS 1914-5 and Johannesburg Water requirements. The project specifications will include specific items to ensure proper implementation, control reporting on labour based construction and methods as included in the specifications.

Materials for this Contract must be obtained from manufacturers who operate an effective quality management system such as that described in SANS 9001 or ISO 9000.

Each type of pipe delivered to the Site shall be of a standard length corresponding to the standard lengths offered by the pipe manufacturer in his catalogue, with a maximum permissible variation in length of ± 2%.

A pipe that is shorter or longer than the defined standard will be rejected by the Engineer, except when such non-standard lengths are required in terms of the Contract and have been specifically manufactured or cut as such by the pipe manufacturer or supplier."

C3.2.2.9.2.2 PSL 3.4 STEEL PIPES, FITTINGS AND SPECIALS

C3.2.2.9.2.2.1 PSL 3.4.3 Pipes of nominal bore over 150mm

OMIT PARAGRAPH (C) AND INSERT THE FOLLOWING:

“Steel pipes and fittings shall be manufactured in accordance with API 5L X42 with a wall thickness of 12mm; 10mm, 8mm or 6mm, depending on the section of pipe in question. External coating to be Rigid Polyurethane (or other as specified by the Employer) at 2000 microns, with a minimum dry film (DFT) permitted of 1800 microns and internal lining to be Solvent Free Epoxy with a target thickness of 600 microns, with a minimum dry film thickness (DFT) of 500 microns permissible. Pipe lengths to be 12.192 m.

Straight joints and bends to be fillet welded on site. The pipe manufacturer shall submit to the Engineer the steel maker's certificates covering all steel used. These certificates shall indicate the process of manufacture, the chemical analysis and the physical properties of the steel except that, at the option of the pipe manufacturer, the physical properties of the steel may be determined from specimens taken from finished pipe.”

C3.2.2.9.2.3 PSL 3.7 OTHER TYPES OF PIPES

C3.2.2.9.2.3.1 PSL 3.7.1 uPVC Pipes

ADD THE FOLLOWING TO THE SUB CLAUSE

"uPVC Pipe's systems shall conform to SANS 966-1998 Part1 or II as applicable and have integral pipe end sockets of the rubber ring joint type. All uPVC - pipes shall be in 6m lengths. Fittings and specials for uPVC pipes shall be manufactured in Grade 14 cast iron, rated to at least 1600kPa working pressure. Unless otherwise specified fittings and specials shall be bitumen dipped.

C3.2.2.9.2.3.2 PSL 3.7.2 Polyethylene pipes

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Polyethylene pipes shall be HDPE type IV pipes with compression fittings and shall comply with SANS ISO 4427 PE 100, PN 20 or as scheduled.

HDPE pipes of diameter up to and including 63 mm shall conform with SANS 4427 Part 2 for Type IV pipes. HDPE pipes greater than 63 mm shall conform with SANS 4427 Part 3 for Type V pipes. Unless otherwise specified, pipes shall be Class 16 and plain ended for butt welding".

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.9.2.3.3 PSL 3.7.3 High Impact uPVC Pipes

Class 16 uPVC pipes shall conform to SANS 1283 (alternatively ISO 4422) shall be used unless otherwise indicated. Jointing shall be effected by means of approved "press-on" shouldered ends and cast iron and steel victaulic clamps. Unless otherwise specified, pipes shall be Class 16.

Where the cutting of any pipe is necessary, shouldered ends shall be fixed to the pipe by means of an approved machine capable of clamping the pipe without causing any damage to the pipe and pressing on the shouldered end by means of a hydraulic operated jack applying a uniform axial force to locate the shouldered end truly in position. The use of impact force to either the pipe or shouldered end will not be permitted. No on-site fixing of shouldered ends shall be permitted."

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.9.2.3.4 PSL 3.7.4 mPVC Pipes

High Impact mPVC Class 16 and shall conform to SANS 1283 for diameter up to and including 315mm with a fully end load restraint coupling system approved by Johannesburg Water.

C3.2.2.9.2.4 PSL 3.8 JOINTING MATERIALS

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.9.2.4.1 PSL 3.8.2 Flexible couplings

OMIT THE EXISTING CLAUSE AND INSERT THE FOLLOWING:

"All flexible couplings shall be "Viking Johnson" couplings without centre register, or approved similar.

Rubber rings shall be of the wedge-type and shall be manufactured from natural or synthetic rubber only. Reclaimed rubber shall not be used in the manufacture of the rubber rings."

C3.2.2.9.2.4.2 PSL 3.8.3 Flanges and Accessories

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

The dimensions and drilling of standard flanges shall comply with the requirements of SANS 1123 and SANS 1476 for a working pressure as specified. Flanges shall be machined flat, i.e. without a raised joint face. Puddle flanges shall have the same dimensions as standard flanges but shall be undrilled.
Faces of flanges which will be in contact with jointing gaskets shall receive a protective coating of such thickness and consistence as will not impair the air/gas/water tightness of the joint."

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.9.2.4.3 PSL 3.8.8 Victaulic joints

Joints for uPVC and medium steel pipelines shall conform to SANS 815: Standard specifications for shouldered end pipes, fittings and couplings.

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.9.2.4.4 PSL 3.8.9 HDPE Pipe joints

Joints for HDPE pipe shall be by means of welding or electro fusion, welded flanges or approved external compression type fittings (Plasson or similar approved)."

C3.2.2.9.2.5 PSL 3.9 CORROSION PROTECTION

C3.2.2.9.2.5.1 PSL 3.9.2 Steel Pipe

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

"All coating and linings shall be completed strictly to the publication "Corrosion Protection for Civil, Mechanical and Electrical Engineer" 2000 Edition.

Pipes shall be externally coated with Rigid Polyurethane (or other as specified by the Employer). The internal lining should be factory applied Solvent Free Epoxy with field joints coated in-situ by hand with the manufactures recommended product in suitably sized squish packs.

The target thickness of the lining material shall be 600 microns, and not less than 500 micron and test certificates of the lining thickness must be furnished to the Engineer for his approval."

The external coating Rigid Polyurethane is to be applied at 2000 microns, with a minimum dry film thickness (DFT) permitted of 1800 microns.

Pipe specials, bends and fittings shall be coated with Rigid Polyurethane or Polyisobutene with PVC outer mechanical tape. The final decision will be subject to costs versus practical time to complete whilst being cognizant of the project timelines regarding the works programme.

C3.2.2.9.2.5.1.1 PSL 3.9.2.3 Repairs to epoxy coatings

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

C3.2.2.9.2.5.1.1.1 PSL 3.9.2.3.1 General

(a) Where the damage is extensive the remedial procedures shall be agreed in writing with the Engineer.

(b) All repairs shall comply with the requirements of the repair-product manufacturer's data sheet. The Engineer may at his discretion request that repaired coating areas undergo adhesion tests.

(c) The Contractor shall repair any damage occurring during transport, on site during handling, assembly, storage, and erection.

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(d) The repaired area shall be tested in accordance with Sub-Clauses 8.4 and 8.12 of SANS 1217 for compliance with the relevant requirements for thickness and electrical insulation defects respectively.

(e) Any item showing electrical insulation defects exceeding an average of five per square metre (a cluster of pinholes within a radius of 25 mm being regarded as a single defective area), or flaking or other signs of loss of adhesion, shall not be repaired. The item shall be blast cleaned and re-coated in accordance with the relevant requirements of the Clause PSL 3.9.2.3.3.

C3.2.2.9.2.5.1.1.2 PSL 3.9.2.3.2 Repair Methods for Minor Defects

The repair of areas showing electrical insulation defects or low film thickness shall, if approved by the Engineer, be carried out as follows:

(a) Degrease in accordance with Clause PSL 3.9.2.3.4.

(b) Thoroughly abrade the damaged area, including an adjacent surrounding area of at least 25 mm wide, with a medium grade 220 abrasive paper;

(c) Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769.

(d) Wipe the abraded paint surface with methyl ethyl ketone and allow to dry, and

(e) Apply as many coats of the following repair material as necessary to achieve the specified thickness and finish.

i) Solvent free epoxy; or
ii) Fusion-bonded epoxy powder repair kit.

NOTE: Apply a final topcoat over the repaired area to achieve a pleasing, uniform finish of the item.

C3.2.2.9.2.5.1.1.3 PSL 3.9.2.3.3 Repair Methods for Major Defects

The total un-coated areas for renovation by the applicator shall not exceed 0.5% of the total surface area of a component. Each un-coated area for renovation shall not exceed 2 500mm². If damaged areas are larger, the items containing such areas shall be re-coated.

The repair of areas showing damage down to the steel surface shall, if approved by the Engineer, be carried out as follows:

(a) (a) Degrease in accordance with Clause PSL 3.9.2.3.4.

(b) Blast-clean all damaged areas to Sa 3 (ISO 8501-1).

(c) Feather the surrounding paint for a distance of 25 mm beyond the damaged areas with a medium grade 220 abrasive paper.

(d) Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769.

(e) Wipe only the abraded paint surface with methyl ethyl ketone and allow drying.

(f) Apply as many coats of the following repair material as necessary to achieve the specified thickness and finish.

i) Solvent free epoxy or
ii) Fusion-bonded epoxy powder repair kit.

NOTE: Apply a final topcoat over the repaired area to achieve a pleasing, uniform finish of the item.

C3.2.2.9.2.5.1.1.3 PSL 3.9.2.3.4 Degreasing

(a) All surfaces to be coated shall be tested for oil and grease contamination by the water break free test.

(b) Oil and grease contamination shall be removed by:

- Steam-cleaning;
- An emulsifiable or aqueous detergent applied in accordance with SANS 1344, and;
- An alkaline cleaning solution.

(c) Allow to react, and then rinse off with clean, potable water to remove all residues prior to surface preparation, all in accordance with Clause 4 of SANS 10064.

(d) The surfaces shall be tested after degreasing and show no oil, grease and chemical contamination after degreasing.

(e) Care shall be taken to avoid entrapment of cleaning agents in recesses or other retention areas.

ADD THE FOLLOWING NEW SUBCLAUSE:

C3.2.2.9.2.5.1.2 PSL 3.9.2.4 Repair of Damaged Rigid Polyurethane

C3.2.2.9.2.5.1.2.1 PSL 3.9.2.4.1 General

Damaged Rigid Polyurethane shall be repaired in accordance with the procedures detailed in the manufacturer's specifications for the repair of Rigid Polyurethane.

C3.2.2.9.2.5.2 PSL 3.9.3 Protection against Electrolytic Corrosion

OMIT THE EXISTING CLAUSE AND INSERT THE FOLLOWING:

"All joints and fittings shall be fully wrapped with approved protective tapes. Protective tape shall comply with Specifications as ordered by the Engineer.

C3.2.2.9.2.5.3 PSL 3.9.5 Joints, nuts, bolts and washers

DELETE AND REPLACE WITH THE FOLLOWING:

"All bolts and nuts shall comply with the requirements of the relevant sections of SANS 1700 and shall be of Grade 4.6 steel. Washers shall be provided at each nut and shall be of the same material (or coating where applicable to match the bolt and nut. Nuts and bolts subject to vibration shall be machined finished fitted with plain washers and treated with "Loctite" or equivalent.

Bolts other than jacking bolts shall project not less than 3mm and not more than 10mm from the heads of the nuts after tightening.

All bolts to be built into concrete work as well as bolts to be installed above ground level (outside buildings), directly above and under water shall all be of stainless steel grade 304. Bolts for flexible couplings and flanges for underground installation shall be hot dip galvanized. Bolts to be installed inside buildings shall be hot dip galvanized. Galvanizing shall be in accordance with the Standard Corrosion Protection Specification (Heavy coating).

Suitable plastic sleeves and/or washers shall be used for protection against corrosion by bimetallic action".

C3.2.2.9.2.5.2 PSL 3.9.6 Corrosive soil

ADD THE FOLLOWING:

"Steel pipes, pipe fittings and steel flanges in contact with soil shall over and above the protection as described above be protected as specified in Clause 3.9.2 with Rigid Polyurethane (or similar approved, or other as specified by the Employer). Application shall be strictly in accordance with the manufacturer's instructions.

C3.2.2.9.2.6 PSL 3.10 VALVES

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Valves shall comply with the following requirements:

(a) They shall close anti-clockwise and shall have a non-rising spindle and handwheel.

(b) They shall be class 16 valves complying with SANS 664.

(c) They shall comply with the requirements of SANS 1123 table 1000 and 1600."

C3.2.2.9.3 PSL 5 CONSTRUCTION

C3.2.2.9.3.1 PSL 5.1 LAYING

C3.2.2.9.3.1.1 PSL 5.1.4 Depth and Cover

C3.2.2.9.3.1.1.1 PSL 5.1.4.2 Cover

ADD THE FOLLOWING TO THIS SUBCLAUSE:

"The minimum cover to finished surface over water mains shall be at least 1000 mm in trafficked areas and at least 800 mm elsewhere. At valves the depth of the pipeline shall be increased if necessary to ensure a minimum cover of 100mm over the valve cap. The cover shall be maintained as close as possible to the minimum without local sags or humps and shall not be increased above the minimum by more than 200mm without the approval of the Engineer."

C3.2.2.9.2.1 PSL 5.2 JOINTING METHODS

C3.2.2.9.2.1.1 PSL 5.2.2 Flanges (steel pipelines)

DELETE THE EXISTING CLAUSE AND REPLACE WITH THE FOLLOWING:

"Insertion pieces (flange packing) and sets of bolts for connection of valves to pipes or specials shall be included in the scope of work for this Contract. All insertion pieces and sets of bolts as

specified in Subclause 3.8.3 of SANS 1200 L Specification, shall be supplied and installed by the Contractor."

C3.2.2.9.2.1.2 PSL 5.2.3 Welding (steel pipelines of diameter 450mm or greater)

DELETE THE EXISTING CLAUSE AND REPLACE WITH THE FOLLOWING:

(a) General

"Field welding of pipes which have been lined will be permitted only for pipes of DN600 and larger where a man is able to enter the pipe to make good the lining after welding and testing in accordance with Clause 7.2 of SANS 1200L has been completed. Pipes of lesser diameter may be field welded where concrete linings will be made after the pipeline has been laid and all welds have been tested and approved.

At the discretion of the Engineer, roll welding will be permitted, provided pipe alignment is maintained by use of skids or of structural framework to accommodate two or more lengths of pipe with an adequate number of roller dollies to prevent sag in the pipe. The entire root bead, however, shall be made with the pipe in a stationary position.

All pipes welded in the trench shall be properly laid and aligned before welding commences. Bell holes shall be excavated at all field welds. The Contractor shall not lift the pipe to provide adequate access for the welders to enable them to stovepipe weld the joint.

The alignment of abutting ends shall be such that the offset will not exceed 1.7 mm. Line up clamps shall be used for joint "fit-ups". The use of "bridges and wedges" or any method that may induce unnecessary stresses is forbidden.

Both ends of coated and lined pipes shall be wrapped for a distance of at least 800 mm on either side of the weld by means of an asbestos mat or other approved material to ensure that weld spatter or other damage is not caused to the coating and lining during the welding process. The pipe trench shall be kept free of all dirt and water in the vicinity of the weld until after all corrosion protection measures have been completed and approved. "

(b) Welding procedure and qualification of welders

Welding shall be done by only qualified welders who satisfy the requirements of API 1104, Clause 3.0. Before any welding of pipeline materials commences, the qualification of welders shall have been approved, all detailed welding procedure specifications with weld diagrams required for their completion shall have been submitted for approval in a neat form and the welding procedure qualification tests shall have been successfully concluded all in accordance with the relevant standard specifications. Each welder shall mark the pipe adjacent to the weld with the figure assigned to him.

Sufficient records shall be kept by the Contractor to ensure that all field welds can be subsequently identified with the welder concerned.

As far as practicable all out of trench welding shall preferably be done by an automatic submerged process and the Contractor shall provide all necessary plant to carry out this process. MSEAP welding may be used where in-trench welding is done.

Heat treatment for welding shall be in accordance with API 1104 if required by same and the Contractor shall provide an approved shield to protect the pipe joint from wind and weather during heat treatment and welding.

(c) Line up

Pipes shall be lined up in such a manner as to prevent damage thereto. If the pipe to be used has a longitudinal seam, these seams shall be staggered by not less than twenty degrees and welded sections, or single lengths, shall be assembled in such a manner that this seam shall remain in the top quadrant of the pipe during coating operations and after lowering into the trench.

(d) Cleaning of pipe ends

Before welding, all foreign matter shall be removed from the bevelled ends. If any of the ends of the pipe joints are damaged to the extent that satisfactory welding contact cannot be obtained, the damaged pipe ends shall be cut and bevelled with an approved bevelling machine. These field bevels of pipe ends shall be made to the satisfaction of the Engineer. Should laminations, split ends, or other defects in the pipe be discovered, the joints of pipes containing such defects shall be cropped, repaired, or removed from the line as designated by the Engineer.

(e) Inclement Weather

No welding shall be carried out during rain or high wind unless the welder and joint are adequately protected and sheltered, to ensure that the welding is not impaired.

(f) Protection of coatings and linings

Before welding commences, a suitable apron at least 800 mm wide shall be wrapped around both sides of the area to be welded to ensure that weld spatter does not damage the coating and lining.

(g) Butt-welding

Pipes and specials to be joined by field welding shall be supplied with ends bevelled for welding. All welding of joints shall comply with API 1104 and only approved type welding rods shall be used. If backing rings are permitted, they shall be placed in position and wedged up or adjusted so that the pipe ends are completely circular and properly mated. The space between abutting pipe ends, when aligned for welding, shall be such as to ensure complete penetration without burn-through. For pipes having the same dimensions, the spacing shall be approximately 1.5 mm. The alignment of the abutting pipe ends shall be such as to minimize the offset between pipe surfaces. For pipes of the same nominal wall thickness, the offset shall not exceed 1.5 mm. Internal line-up clamps shall be used wherever practicable and may be removed after the root bead is 50% completed, provided that the completed part of the root bead is in segments of approximately equal lengths, spaced about the circumference of the pipe. If conditions make it difficult to prevent movement of the pipe, or if the weld will be unduly stressed, the root bead shall be completed before releasing clamp tension.

External line-up clamps shall be used where it is impracticable to use internal line-up clamps. Partial root beads made when using external clamps shall be uniformly spaced about the circumference of the pipe, and shall have an accumulative length of not less than 50% of the pipe circumference before the clamps are removed.

Tack welding shall be carried out to maintain the root gap and position of the pipe ends during the welding proper. The number of tack-welds shall be kept to a minimum but shall not be less than four around the circumference of the pipe.

After proper preparation and tack welding, the root bead shall be carried out followed by successive filler passes, and capper pass in accordance with the approved welding procedure.

The filler and finish beads shall be deposited by an acceptable method and each filler bead shall be approximately 3 mm in thickness. Completed welds shall have a reinforcing of not less than 0.8 mm and not more than 1.5 mm above the pipe surface around the entire perimeter of the weld, and the width of the finish or cover shall be not more than 3 mm greater than the original

groove. The number of beads required shall be governed by the wall thickness of the pipe, so that the completed weld will have the reinforcement previously specified; provided, however, that each weld shall consist of at least three beads. No two beads shall be started at the same point. No mitre welds will be permitted, and all welds are to be at ninety degrees (± 5o) to the axis of the pipe. All slag and scale shall be removed from each bead for visual inspection immediately after each bead is run.

In all field butt-welds where it is possible to work inside the pipe, the inside weld shall be done first.

The chemical composition of weld metal and parent metal shall be similar and the inner weld metal or reinforcement shall not extend more than 1 mm above the inside metal surface of a pipe or special, and any excess shall be removed by grinding.

Defects caused by stray welding arc flashes shall be removed by grinding, provided that the pipe wall thickness is not reduced to less than the specified minimum thickness, otherwise the portion shall be cut out and repaired.

(h) Fillet welding

Welding shall be as for butt-welding as applicable. All pipes of 600 mm ND and over shall be welded on both the outside and the inside.

(i) Repair of welds

Rectification of defective welds shall be in accordance with API 1104 and to the satisfaction of the Engineer. All costs related to the repair of defective welds shall be borne by the Contractor. Defective welds shall be repaired immediately they are found to be so. The Engineer has the right to stop the Contractor proceeding with further pipe laying in the event of the Contractor delaying the rectification of defective welds. Furthermore, no consideration will be given to any claims arising from delays in construction resulting from such action.

All welded joints which have been repaired shall be 100% radiographed or otherwise tested to the Engineer's satisfaction at the Contractor's own expense.

C3.2.2.9.2.2 PSL 5.6 VALVE AND HYDRANT CHAMBERS

C3.2.2.9.2.2.1 PSL 5.6.1 General

REPLACE THE WORDS "drawing L-1" *IN THE SECOND LINE WITH* "the Drawings".

C3.2.2.9.2.2.2 PSL 5.6.2 Construction of chambers

REPLACE THE WORDS "drawing L-1, L-2 and L-3" *IN THE FOURTH LINE WITH* "the Drawings".

C3.2.2.9.2.3 PSL 5.8 BRICKWORK IN CHAMBERS AND MANHOLES

ADD THE FOLLOWING TO THIS SUBCLAUSE:

“The joints of exposed faces shall be flush-trowelled, hard and smooth and shall be rubbed for the full width of the joint as the work proceeds to give a hard polished finish.”

ADD THE FOLLOWING SUBCLAUSES:

C3.2.2.9.2.4 "PSL 5.11 STANDPIPES

Standpipes shall be erected in the positions and to the details shown on the Drawings.

C3.2.2.9.2.5 PSL 5.12 MARKER BLOCKS

Type 1 and Type 2 marker blocks shall be manufactured and positioned as shown on the Drawings.

C3.2.2.9.2.6 PSL 5.13 PIPELINE ROUTE MARKERS

Route markers for the various water pipelines shall be erected in the positions and shall be manufactured according to the details shown on the Drawings

C3.2.2.9.2.7 PSL 5.14 WORK ON EXISTING MAINS

Where connections are to be made to existing mains, the Contractor shall excavate back along the existing main only as far as is necessary to complete the connection satisfactorily and shall ensure that the existing mains are disturbed as little as possible. Backfilling shall be carefully placed and properly compacted beneath existing and new work to ensure that the mains, specials, etc. are properly bedded.

Work on existing mains and components of the reticulation system shall be carefully planned in consultation with the Engineer. The work shall be carried out expeditiously to ensure that the disruption of services and inconvenience to the local residents is kept to a minimum. All tie-ins shall be completed within a maximum of 10 hours.

The Contractor under strict supervision by the Engineer or The Employer will do all these connections.

Hand excavation must be used to expose the existing mains and erf connections where required. While every effort has been made to ensure that the information relating to these connections is correct the Engineer or The Employer takes no responsibility for the accuracy, or for the completeness of the information."

C3.2.2.9.2.9 PSL 5.15 CONNECTION TO THE EXISTING MAINS

The Contractor shall supply all necessary fittings / materials for under pressure connections suitable for all pipe sizes.

The Contractor shall confirm all measurement on site prior to ordering any pipe fittings."

C3.2.2.9.2.10 PSL 5.16 PIPELINE RENEWAL WORK

All material recovered as a result of the repairs or replacement of the components shall be returned to the Contractors store where they shall be cleaned, sorted and listed. A list of the recovered material shall be handed to the Engineer on a monthly basis. All recovered material shall be delivered to the Midrand Depot on a regular basis or at the end of the Contract.

C3.2.2.9.2.11 PSL 5.17 STERILISING OF WATER MAINS

All new water mains shall be sterilised at 10mg/l free chlorine for 12 hours and will then be thoroughly flushed.

C3.2.2.9.3 PSL 7 TESTING

C3.2.2.9.3.1 PSL 7.2 INITIAL TESTS ON WELDED STEEL PIPES

C3.2.2.9.3.1.1 PSL 7.2.2 Radiographic Examination

Fifteen percent of all welded joints, or when ordered by the Engineer, shall be examined

radiographically.

ADD THE FOLLOWING NEW CLAUSE:

C3.2.2.9.3.1.2 PSL 7.2.3 Hydrostatic Test

(a) All pipes and fittings shall be subject to an approved hydrostatic test and to a test pressure determined as follows:

$$P = \frac{2000\ t\ f}{D}$$

Where

P = test pressure in kPa
F = 85 percent of the guaranteed minimum yield strength in MPa for steel plate
D = outside diameter of the pipe in mm
T = wall thickness in mm.

(b) Hydrostatic testing shall not be carried out until all aspects of fabrication have been completed.

(c) The pressure shall be applied steadily by approved means and maintained without variation sufficiently long for proof and inspection.

(d) Should water sweat or ooze from any part or any defects of any nature be discovered the pipe shall be emptied and the defects made good. The pipe shall then be tested again. Should a pipe, after repair, fail to pass the second hydraulic test the Engineer may order its rejection.

(e) The fact that any pipe may have passed the hydraulic test at the works shall not exempt the Contractor from his liability under Clause 7 of the General Conditions of Contract.

(f) If a pipe fails to pass any of the above tests in Clauses PSL 7.2.1, PSL 7.2.2 or PSL 7.2.3, it shall be rejected, but the Engineer may permit repairs or alterations to be made to enable the pipe to pass the test.

(g) The Engineer may require one or more pipes to be tested to destruction. If practicable the Engineer may require the Contractor to repair the pipes and retest them. The cost of repairs will be paid by the Employer as an extra to the Contract."

C3.2.2.9.3.2 PSL 7.3 STANDARD HYDRAULIC PIPE TEST

C3.2.2.9.3.2.1 PSL 7.3.1 Test pressure and time of test

C3.2.2.9.3.2.1.1 PSL 7.3.1.2 The maximum working pressure for the different pipes is indicated by the class of the pipe.

C3.2.2.9.4 PSL 8 MEASUREMENT AND PAYMENT

C3.2.2.9.4.1 PSL 8.2 SCHEDULED ITEMS

C3.2.2.9.4.1.1 PSL 8.2.11 Anchor blocks/Thrust blocks and pedestals

INSERT "concrete" *BEFORE* "and" *IN THE LAST LINE OF THE LAST PARAGRAPH*.

ADD THE FOLLOWING:

"The tendered rates shall also include the wrapping of uPVC pipes and fittings with Densopol 80 or a similar approved material where the pipes and fittings come into contact with concrete."

ADD THE FOLLOWING NEW SUBCLAUSES:

C3.2.2.9.4.1.2 "PSL 8.2.16 Standpipes complete:

(a) (Give description with reference to drawing)……..……..Unit: number

(b) Etc. for other descriptions

The tendered rate shall include full compensation for all excavations for the pipe, for the drain, if required; the base of the concrete pedestal (for the tap); the supply and installation of all pipework and fittings including a 1,2m long section of the supply pipe measured from the rising pipe; the supply and installation of the taps; backfilling the drain with stone, and the trench with approved backfill material; all formwork and concrete, and; all equipment, labour and diverse material required to complete the standpipe as shown on the Drawings.

C3.2.2.9.4.1.3 PSL 8.2.17 Valve support assembly (give short description and drawing number):

(a) Specify material:

i) Description…….Unit: number

The rate shall cover the cost and include full compensation for all labour, plant, equipment, material, corrosion protection, transport, etc, manufacturing or providing and installing each item complete as scheduled and shown on the drawings.

C3.2.2.9.4.1.4 PSL 8.2.18 Pipeline route markers:

(a) (Give description with reference to drawing)……..Unit: number

(b) Etc for other descriptions

The tendered rate shall include full compensation for all excavation and backfill, labour, equipment and materials to manufacture and install the markers as shown on the Drawings.

C3.2.2.9.4.1.5 PSL 8.2.19 Connection to existing main supply pipe

(a) Description of connection, types and diameters involved……...Unit: number

(b) Etc for the other items

The rate shall cover the cost of isolating, cutting, excavation (up to 2 m deep), bedding, dewatering and exposing the existing main at the connection point, supply necessary fittings for under pressure connections for the section of the mains as required, temporary support, safety precaution backfilling and the removal of surplus and unsuitable material. The supply and installation of fittings and couplings shall be measured separately. Includes arrangements for shut-down.

C3.2.2.9.4.1.6 PSL 8.2.20 Cathodic Protection.....Unit: Prov Sum

The rate shall include the cost for the supply and installation of Sacrificial Anode Cathodic Protection (SACP), in order to protect sections of pipeline located within roadways, servitudes, right-of-way which may be hard surfaced upon completion of the pipeline.

The SACP High Potential Magnesium Anodes shall be compliant with ASTM B843 Type M1C grade. The anode shall be located in 100% pure cotton bags with at least 75mm of

Gypsum/Bentonite/Sodium Sulphate (75%/20%/5%) encapsulating each anode. Each anode shall have a 10m long SANS 1507 (600V/1000V) 10mm2 PVC/PVC cable (blue). The anodes shall be connected to the pipeline via a CP Test Station, that shall be vandal resistant and approved by the client and shall permit the pipe potential and anode current and potential to be conveniently measured.

The Cathodic Protection shall be installed complete with a 30MPa concrete base and foundation of at least 500mm x 500mm x 500mm (L x W x D), which shall be located outside the road reserve to mitigate traffic and vehicular movement.

All test stations shall be compliant with SANS 52509 Annexure G Type D facilities (Coupons 1cm2).

All of the flexible couplings located within reservoir and/or water tower and/or inlet and outlet sites shall be electrically continuity bonded with two SANS 1507 (600V/1000V) 16mm2 PVC/PVC (red) cables. The cables shall be stud welded to the pipeline in accordance with ISO 14555 using the Capacitive Discharge Stud Welding technique. The pipeline coating shall be repaired utilizing an EN 12068 Class C type material, compatible with the pipeline coating, as approved by the client and engineer.
The pipeline extremities and any off takes shall be electrically isolated as per NACE SP0186, with Insulating Flange (IF) kits.

The contractor shall be responsible for following the pipeline construction schedule and ensuring that the SACP is installed with the pipeline construction due to access constraints and scheduling.

The contractor shall provide all of the required electrical, civil and mechanical resources and equipment to ensure the smooth liaison with all other contractors to permit the effective installation of the SACP system, in strict compliance with SANS ISO 15589-1. The SACP shall ensure the complete protection of the piping in line with SANS ISO 15589-1, and the potentials shall be measured in compliance with SANS 53509, and the IF kit tested and verified to SANS 53509 clause 6.2.

C3.2.2.9.4.1.6 PSL 8.2.21 Demolish Structure

The unit of measurement shall be sum for various types of structure.

The rate shall cover the cost of excavation, plant and labour required, demolishing the existing chambers, safeguarding the existing valves and specials from damage and safely disposing of the rubble material. It shall also cover the re-instatement of the structure, if applicable, to a state similar or better to pre-construction conditions. Structures to be demolished and reinstated will be identified and / or confirmed during the site visit.

C3.2.2.9.4.1.7 PSL 8.2.22 AC Mitigation…….....Unit: Prov Sum

The rate shall include for all AC predictive and mitigation works. The AC predictive and mitigation works shall be completed in compliance with NACE SP0177, EN 50443 and completed with a SANS 10142 Electrical Certificate of Compliance (COC) pertaining to the entire AC mitigation system (materials, installation and testing), by the contractor. The CP and pipeline contractor will follow the guides set out in “Guideline on the Electrical Co-ordination of Pipelines and Power Lines” document 240-66418968 as per Clause 3.8 “Safe working procedures in power line servitudes”.

The AC Mitigation system shall be comprised of Horizonal Gradient (HG) control conductors, which shall be suitably rated for both steady state and fault state conditions, of not less than 3.7KA for 100mS. The contractor shall be responsible for all temporary earthing, requirements which shall include all temporary earth mats, that shall mitigate step, touch and transfer potentials during construction, and all ground mats shall meet the requirements of the CAN/CSA-

C22.3 NO. 6-13 “Principles and practices of electrical coordination between pipelines and electric supply lines”.

All cable connection to the pipelines shall consist of 35mm2 PVC/PVC (SANS 1507 certified cables), which shall be stud welded to the pipeline in accordance with ISO 14555, Capacitive Discharge Technique. The cables shall be wrapped around the pipeline to mitigate stress during backfilling and the coating shall be repaired in-line with the Cathodic Protection requirements, using an EN12068 Class C certified coating and repair method.

All test stations shall be dead front facilities as defined in NACE SP0177, and all Test Stations shall contain a SANS 53509 Annexure G Type D facility to measure both the AC and DC potentials and current densities from a 1cm2 coupon, manufactured from the same grade steel as the pipeline.

The DC Decoupler shall be rated as follows and installed inside the vandal resistant bunkers.

- AC Fault Current Exposure -Rated 3.7kA - 60 cycles @ 50 Hz rms
- Surge / Lightning Protection -Nominal discharge current (8/20µs) 100KA
- Lightning impulse current (10/350µs) 100KA
- 100% lightning impulse spark over voltage ≤ 2KV
- Power frequency spark over voltage (50 Hz) ≤ 2.5KV
- DC Voltage Threshold - Blocking DC Voltage: adjustable from +1V to -12V
- Induced Steady State AC - Mitigation of Steady State AC: 50A @ 50 Hz rms
- Enclosure Type & Rating - Polycarbonate IP66 enclosure
- Cable Glands - IP66 rating for all glands

C3.2.2.10 PSLB BEDDING (PIPES)

C3.2.2.10.1 PSLB 3 MATERIALS

C3.2.2.10.1.1 PSLB 3.1 SELECTED GRANULAR MATERIAL

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Selected granular material shall have a PI not exceeding 6 and shall be free from sharp-edged particles exceeding 19mm."

C3.2.2.10.1.2 PSLB 3.2 SELECTED FILL MATERIAL

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

“Selected fill material shall have a PI not exceeding 15 and shall be free from sharp-ended particles or particles exceeding 19 mm in size.”

ADD THE FOLLOWING:

"Selected fill material used for bedding shall, where indicated on the Drawings be stabilized with 5% cement as specified under subclause PSDB 3.5(c)."

C3.2.2.10.1.3 PSLB 3.3 BEDDING

ADD THE FOLLOWING:

"uPVC and HDPE pipes are deemed to be flexible pipes for the purposes of this subclause."

C3.2.2.10.1.4 PSLB 3.4 SELECTION

C3.2.2.10.1.4.1 PSLB 3.4.1 Suitable material available from trench excavation

REPLACE THE WORDS "(but is not required)" IN THE FIFTH LINE WITH THE WORDS "(at his own cost)".

C3.2.2.10.2 PSLB 5 CONSTRUCTION

C3.2.2.10.2.1 PSLB 5.1 GENERAL

C3.2.2.10.2.1.1 PSLB 5.1.2 Details of bedding

ADD THE FOLLOWING PARAGRAPH:

"The dimension "X" for flexible and rigid pipes as indicated on drawing LB-1 will be 150mm (one hundred and fifty millimeters) unless otherwise indicated on the Drawing. The dimension "X" will be measured from the invert of the pipe."

C3.2.2.10.2.1.2 PLSB 5.1.4 Compacting

Replace "90% (ninety per cent)" with "90% (ninety per cent) (100% (one hundred per cent) for sand)".

C3.2.2.10.3 PSLB 7 TESTING

C3.2.2.10.3.1 PSLB 7.1 DENSITY

REPLACE THE SECOND SENTENCE IN THE FIRST PARAGRAPH WITH "The test will be carried out using the Troxler method."

ADD THE FOLLOWING SUB-CLAUSE

C3.2.2.10.3.1.1 PSLB 7.1.1 Submission of bedding compaction test results

The Contractor will be required to submit to the Engineer four (4) compaction test results of bedding for every 100metres. Bedding compaction to be 90% MOD AASTHO density. The compaction tests to be performed by the Troxler method.

C3.2.2.10.4 PSLB 8 MEASUREMENT AND PAYMENT

C3.2.2.9.10.1 PSLB 8.1 PRINCIPLES

C3.2.2.9.10.1.1 PSLB 8.1.3 Volume of bedding materials

The volume of bedding material shall be measured net i.e. the volume of the pipe is to be deducted.

C3.2.2.9.10.1.2 PSLB 8.1.5 Disposal of displaced material

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Material displaced by the pipeline and by imported material from sources other than trench excavation, shall be disposed of at an approved site furnished by the Contractor. No haulage is payable for such material."

C3.2.2.9.10.1.3 PSLB 8.1.6 Free-haul

DELETE THE WORDS "of 0.5km" *IN THE FIRST LINE OF THIS SUBCLAUSE.*

C3.2.2.9.10.2 PSLB 8.2 SCHEDULED ITEMS

C3.2.2.9.10.2.1 PSLB 8.2.1 Provision of bedding from trench excavations

DELETE THIS SUB-CLAUSE AND REPLACE WITH THE FOLLOWING:

Without the need for screening or other treatments:

(a) Selected granular material.....Unit: m^3

(b) Selected fill material.....Unit: m^3

The rates shall cover the cost of acquiring, from any point along the trench excavation as be Selected by the Engineer within 5,0 km, bedding that complies with the relevant requirements of the specification, of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, and of disposing of displaced material within a free haul distance 5,0 km.

Including for screening and/or other treatment:

(a) Selected granular material.....Unit: m^3

(b) Selected fill material.....Unit: m³

The rates shall cover the cost of screening by means of mesh sieves or otherwise treating excavated material, at any point along the trench excavation as may be selected by the Engineer, in order to produce bedding that complies with the relevant specification, delivering it to points along the trench, within 5,0 km, spaced to suit the Contractor's methods of working, of making good any backfill deficiency there may be from points where screened backfill material has been acquired, and of disposing of displace material within a free haul distance of 5,0 km.

C3.2.2.10.4.2.1 PSLB 8.2.2 Supply only of bedding by importation

C3.2.2.10.4.2.1.1 PSLB 8.2.2.2 From borrow pits

DELETE THE WORDS IN BRACKETS IN THE FIRST FOUR LINES.

ADD THE FOLLOWING:

"The opening up of borrow pits and the removal of overburden are paid for under item 8.3.4 of SANS 1200 D."

C3.2.2.10.4.2.1.2 PSLB 8.2.2.3 From commercial sources (Provisional)

ADD THE FOLLOWING SUB-SUBITEM TO THIS CLAUSE:

(c) "Special bedding material

1) Description of material…… Unit: m²

2) Etc for other items

The unit of measurement shall be the square metre or cubic metre of material as specified.

The rate shall cover the cost as specified for (a) and (b)." The rate shall include the cost of acquiring from commercial sources, transporting regardless of distance, off loading and placing in the trench bottom clean where ordered by the Engineer.

ADD THE FOLLOWING ITEM:

C3.2.2.10.4.2.2 "PSLB 8.2.6 Extra over items 8.2.1 and 8.2.2 for bedding stabilized with 5% cement
……..Unit: m³

The tendered rate shall include full compensation for selecting, providing stabilization agent, mixing, backfilling and compacting the stabilized material to 93% of modified AASHTO density."

C3.2.2.10.4.2.3 PSLB 8.2.7 Compaction Test

Compaction testing using the troxler method……..Unit: number

C3.2.2.11 PSLE STORMWATER DRAINAGE

C3.2.2.11.1 PSLE 3 MATERIALS

C3.2.2.11.1.1 PSLE 3.1 CULVERT UNITS AND PIPES

(a) Precast concrete pipes

ADD THE FOLLOWING:

"spigot-and-socket joints with rubber rings shall be used as indicated on the Drawings. Rubber rings shall comply with the requirements of SANS 974-1."

(d) Skewed ends

ADD THE FOLLOWING:

"Skewed ends for pipe culverts may be cut on Site."

C3.2.2.11.1.2 PSLE 3.4 MANHOLES, CATCHPITS, AND ACCESSORIES

C3.2.2.11.1.2.1 PSLE 3.4.1 Bricks

ADD THE FOLLOWING:

"Bricks shall be engineering bricks complying with the requirements of SANS 227."

ADD THE FOLLOWING SUBCLAUSE:

C3.2.2.11.1.3 "PSLE 3.6 MATERIALS FOR SUBSURFACE DRAINS

(a) Pipes and fittings

Pipes for subsurface drains shall be normal duty, perforated or slotted uPVC pipes complying with SANS 791. Fittings shall be heavy duty and shall also comply with SANS 791.

The size of the perforations in perforated pipes shall in all cases be 8 mm in diameter ± 1.5mm, and the number of perforations per metre shall not be less than 26 for 100mm pipes and 52 for 150mm pipes. Perforations shall be spaced in two rows for 100mm pipes and in four rows for 150mm pipes, as shown on the Drawings.

Slotted pipes shall have a slot width of 8mm with a tolerance of 1.5mm in width. The arrangement of the slots is subject to the Engineer's approval, but the total slot area shall not be smaller than that specified for perforations.

(b) Crushed stone

Crushed stone shall be 19mm single-sized and shall comply with the requirements of SANS 1083.

(c) Geotextiles

Geotextiles shall be a non-woven, spun or thermic-bonded continuous filament fabric consisting of at least 85% by mass of polypropylene, polyester or other approved material and manufactured for civil-engineering applications by a recognised manufacturer.

(d) Selected granular material

Selected granular material shall comply with the requirements of SANS 1200 LB, subclause 3.1."

C3.2.2.11.2 PSLE 5 CONSTRUCTION

C3.2.2.11.2.1 PSLE 5.2 BEDDING AND LAYING

C3.2.2.11.2.1.1 PSLE 5.2.2 Pipe culverts

ADD THE FOLLOWING:

"The class of bedding required for the various pipe culverts is shown on the Drawings."

ADD THE FOLLOWING SUBCLAUSE:

C3.2.2.11.2.2 "PSLE 5.8 CONSTRUCTION OF SUBSURFACE DRAINS

After the completion of the excavations, the bottom portion of the trench shall be lined with geotextile sheeting as shown on the Drawings. The top edges of the vertical portions of the geotextile sheeting shall be tacked to the sides of the excavations with nails or by another suitable approved means. An overlap of at least 200mm shall be provided at each joint. Geotextile sheeting damaged during the installation or construction shall be replaced at the Contractor's cost.

A layer of crushed stone of the thickness shown on the Drawings shall be placed on the geotextile sheeting and lightly tamped and finished to the required gradient.

Pipes of the required size shall be firmly bedded on the permeable material, true to level and grade, and coupled where required. The trench shall then be backfilled with crushed stone to the height above the pipes shown on the Drawings or as directed by the Engineer.

Crushed stone shall be placed in layers of not more than 300mm at a time and shall be lightly compacted. Care shall be taken to prevent the contamination of crushed stone during construction of the subsurface drains and all material contaminated by soil or silt shall be removed and replaced by the Contractor at his own expense.

Perforated and slotted pipes shall be joined by couplers. Perforated pipes shall be laid with the perforations at the top or at the bottom, as directed. The higher end of subsurface drain pipes shall be sealed off with a loose concrete cap of class 20/19 concrete, as shown on the Drawings and at the lower end of the pipe shall be built into a concrete head wall providing a positive outlet, or it shall be connected to the stormwater pipes or culverts.

After all the crushed stone filter material and the protruding vertical filter material have been placed, the protruding vertical sections of the geotextile sheeting shall be folded back across the filter material so that the filter material will be completely enwrapped in the geotextile. An overlap of at least 200mm shall be provided between the portions folded back.

The remainder of the trench shall be immediately backfilled with approved impermeable material preferably obtained from the excavations, in layers not exceeding 150mm and compacted to 90% of modified AASHTO density, unless otherwise ordered by the Engineer. The trench shall be specially protected against the ingress of water, soil and silt until the backfilling with impermeable material has been completed.

Permeable material in subsoil drains shall not be taken to the surface but shall be discontinued at such heights as will be determined by the Engineer.

Any section of a subsurface drain constructed with pipes without perforations or slots shall be backfilled with impermeable backfill material as described above. Suitable excavated material may be used for backfilling. Payment for excavations as well as for backfilling with impermeable material will be made under SANS 1200 DB."

C3.2.2.11.3 PSLE 8 MEASUREMENT AND PAYMENT

C3.2.2.11.3.1 PSLE 8.2 SCHEDULED ITEMS

ADD THE FOLLOWING ITEMS:

C3.2.2.11.3.1.1 "PSLE 8.2.14 Pipes in subsurface drains:

(a) Normal duty uPVC pipes complete with couplings:

(i) (Diameter and whether perforated or not, indicated)……Unit: metre (m)

(ii) Etc. for other diameters

(b) Heavy-duty fittings:

(i) (Type and diameter indicated)……...Unit: number

(ii) Etc. for other types and diameters

The tendered rates per metre of pipe measured in place along its centre line including the length of fittings shall include full compensation for procuring, furnishing, laying and jointing the pipes as specified.

The tendered rates for fittings shall include full compensation for procuring, furnishing, laying and jointing the fittings as specified, irrespective of the type of fitting.

C3.2.2.11.3.1.2 PSLE 8.2.15 Geofabric (description of type, grade, etc.) ……Unit: square metre (m^2)

The filter fabric will be measured in place after installation.

The tendered rate shall include full compensation for procuring, supplying, cutting, overlapping, jointing, placing and protecting the filter fabric as specified, as well as for wastage.

C3.2.2.11.3.1.3 PSLE 8.2.16 Crushed stone in subsurface drains……Unit: cubic metre (m^3)

The tendered rate shall include full compensation for procuring, supplying, transporting and placing the material as specified. The quantity shall be calculated from the authorised dimensions.

Impermeable material will be paid under SANS 1200 DB.

C3.2.2.11.3.1.4 PSLE 8.2.17 Grade 20 MPa/19 mm concrete outlet structures for subsurface drains (including framework)…….Unit: cubic metre (m^3)

The tendered rate shall include full compensation for procuring and supplying of all materials, providing and erecting formwork, reinforcing and mixing, transporting and placing concrete.

C3.2.2.11.3.1.5 PSLE 8.2.18 Concrete caps for subsurface drain pipes…….Unit: number

The tendered rate shall include full compensation for supplying and installing the concrete caps.

C3.2.2.11.3.1.6 PSLE 8.2.19 Jointing with existing network……..…..Unit: sum

The tendered sum shall include full compensation for the cost of all labour, plant, materials, excavation, backfilling, compaction and overheads to join the subsurface drains to the existing stormwater network.

C3.2.2.11.3.1.7 PSLE 8.2.20 Breaking into existing manhole and install new pipe:

(a) (State pipe diameter and type)……Unit: sum

(b) Etc. for other diameters and types

The tendered rates shall include full compensation for the supply of all labour, plant and materials, making an opening in the existing manhole, installing the new pipe in the new opening, sealing around the pipe, breaking out the existing benching and channels where required and reconstructing them complete with rendering to suite the new pipe arrangement, disposing of all debris to the dumping site and backfilling around the manhole with selected material.

C3.2.2.11.3.1.8 PSLE 8.2.21 Breaking into existing stormwater pipe, installing new pipe and build new manhole:

(a) (State new pipe diameter and type)……..Unit: number

(b) Etc. for other new pipe diameters and types

The tendered rates shall include full compensation for the supply of all labour, plant and materials, removing a section of the existing stormwater pipe, installing the new pipe, constructing the complete, new manhole, sealing around the pipes, disposing of all debris to the dumping site and backfilling around the manhole with selected material.

C3.2.2.11.3.1.8 PSLE 8.2.22 Selected granular material…….Unit: m³

The tendered rate shall include full compensation for procuring, supplying, transporting and placing the material as specified. The quantity shall be calculated from the authorised dimensions.

Impermeable material will be paid under SANS 1200 DB."

C3.2.2.12 PSME SUBBASE

C3.2.2.12.1 PSME 3 MATERIALS

C3.2.2.12.1.1 PSME 3.2 PHYSICAL PROPERTIES

C3.2.2.12.1.1.1 PSME 3.2.1 Subbase material

REPLACE THE CONTENTS OF PARAGRAPH (a) WITH THE FOLLOWING:

"(a) The maximum particle dimension of the gravel shall not exceed 63mm."

REPLACE THE CONTENTS OF PARAGRAPH (d) WITH THE FOLLOWING:

"(d) The CBR at specified density shall be 45 for unstabilized material as well as for stabilized material prior to stabilization."

DELETE PARAGRAPH (e).

C3.2.2.12.1.1.2 PSME 3.2.2 Gravel shoulder and gravel wearing course material

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The material used for gravel shoulders and gravel wearing course shall comply with the following:

(a) The PI shall not be less than 6 and not more than (3 x GM) + 10.

(b) The maximum particle dimension of the gravel shall not exceed 40mm.

(c) The CBR shall be greater than 15 at 93% of modified AASHTO density."

C3.2.2.12.2 PSME 5 CONSTRUCTION

C3.2.2.12.2.1 PSME 5.2 EXCAVATION

C3.2.2.12.2.1.1 PSME 5.2.2 Borrow pits

*INSERT THE WORDS "*designated by the Engineer and*" BETWEEN THE WORDS* "pits" *AND* "established" *IN THE FIRST LINE.*

ADD THE FOLLOWING SUBCLAUSES:

C3.2.2.12.2.2 "PSME 5.8 WEED-KILLER

The subbase layer shall be treated before compaction by applying and mixing in granular HYVAR X or TENOC X weed-killer in accordance with the manufacturer's instructions. An approved equivalent may be used.

C3.2.2.12.2.3 PSME 5.9 INSECTICIDE

An insecticide approved by the Engineer shall be applied strictly in accordance with the manufacturer's instructions over the total area of the subbase. The instructions indicate whether the poison is to be applied before or after compaction of the layer."

C3.2.2.12.3 PSME 8 MEASUREMENT AND PAYMENT

C3.2.2.12.3.1 PSME 8.1 BASIC PRINCIPLES

INSERT A SEMICOLON IN THE FIRST LINE OF PARAGRAPH (b) AFTER THE WORDS "will be paid for once only" *AND DELETE THE REST OF THE PARAGRAPH.*

AMEND PARAGRAPH (d) AS FOLLOWS:

"(d) that, in the case of material from a commercial source or from borrow pits selected by the Contractor, no additional payment will be made for the class of excavation, method of processing (except stabilizing), or overhaul."

C3.2.2.12.3.2 PSME 8.3 SCHEDULED ITEMS

C3.2.2.12.3.2.1 PSME 8.3.2 Construct the subbase course/shoulders/gravel wearing course with material from designated excavations

REPLACE THE CONTENTS OF subitem (a) *WITH THE FOLLOWING:*

"The rate for (a) shall include full compensation for excavating and selecting subbase material, for loading and transporting the material within the free-haul distance, and for either placing the material on the road or stockpiling the material for later use. When material is stockpiled, the rate shall include compensation for shaping and grading the stockpile so that it is free-draining."

C3.2.2.12.3.2.2 PSME 8.3.3 Construct the subbase course/shoulders/gravel wearing course with material from commercial sources or designated borrow areas

REPLACE THE HEADING OF THIS ITEM WITH THE FOLLOWING:

"PSME 8.3.3 Construct the subbase course/shoulders/gravel wearing course with material from commercial sources"

ADD THE FOLLOWING PARAGRAPH:

"This item shall also apply to the construction of subbase course/shoulders/gravel wearing course with material from borrow pits selected by the Contractor."

C3.2.2.12.3.2.3 PSME 8.3.9 Overhaul (haul exceeding 2km):

REPLACE THE CONTENTS WITH THE FOLLOWING:

"(a) Limited overhaul……..……Unit: cubic metre (m^3)

(b) Long overhaul……..Unit: cubic metre-kilometre (m^3-km)

Overhaul will be paid in accordance with item 8.3.6 of SANS 1200 D."

ADD THE FOLLOWING ITEM:

C3.2.2.12.3.2.4 "PSME 8.3.11 Treatment of subbase with:

(a) Weed-killer……....Unit: square metre (m^2)

(b) Insecticide…….Unit: square metre (m²)

The tendered rates shall include full compensation for supplying, spreading and mixing-in or applying the poison.

Only areas that were treated on the written instructions of the Engineer will be measured for payment."

C3.2.2.13 PSMF BASE

C3.2.2.13.1 PSMF 3 MATERIALS

C3.2.2.13.1.1 PSMF 3.3 PHYSICAL AND CHEMICAL PROPERTIES

C3.2.2.13.1.1.1 PSMF 3.3.1 Natural gravel (stabilized or unstabilized)

Replace the contents of paragraph (a*) with the following:*

"(a) The maximum particle dimension of the gravel shall not exceed 63 mm."

C3.2.2.13.2 PSMF 5.9 TRANSPORT

Replace the contents of this subclause with the following:

"All movement of material will be considered as free-haul. No haulage cost will be paid."

C3.2.2.13.3 PSMF 8 MEASUREMENT AND PAYMENT

C3.2.2.13.3.1 PSMF 8.3 SCHEDULED ITEMS

C3.2.2.13.3.1.1 PSMF 8.3.3 Construct base with material from commercial sources or designated borrow areas

Replace the title of item 8.3.3 *with the following:*

C3.2.2.13.3.1.2 "PSMF 8.3.3 Construct base course with material from commercial sources and compact to 86% of apparent density"

C3.2.2.13.3.1.3 PSMF 8.3.9 Overhaul:

Replace the contents with the following:

"(a) Limited overhaul .....Unit: m³

(b) Long overhaul .....Unit: m³-km

Overhaul will be paid in accordance with item 8.3.6 of SANS 1200 D."

Johannesburg Water (SOC) Ltd

Johannesburg Water

CONTRACT JW14463

IMPLEMENTATION OF THE HALFWAY HOUSE WATER UPGRADE PROJECT

VOLUME 2A

PART 4: SITE INFORMATION

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C4 SITE INFORMATION

C4.1 GENERAL

This section describes the site at the time of tender to enable the tenderer to price his tender and to decide upon his method of working and programming and risks.

C4.2 SITE LOCATION

The site is situated in Halfway House, Midrand.

C4.3 ACCESS TO SITE AND RESTRICTIONS

Any permission as may become necessary shall be the responsibility of the Contractor to obtain.

Having been granted access to works areas by the Employer, other service authorities and private owners, the Contractor shall adhere to any agreed conditions of access and ensure the works area is left in a condition similar to when it was first accessed. It must be kept in mind that part of the site is located within a private business development and care must be taken not to compromise the safety / security of the workers or property of the development or those of adjacent developments / properties.

C4.4 EXISTING SERVICES, SERVITUDES AND WAYLEAVES

For detailed specification the Contractor shall refer to clauses C3.1.1.4 (Temporary Works), C3.1.4.5 (Existing services), and C3.1.4.2.4 (Permits and wayleaves).

C4.5 SECURITY

The Contractor shall be responsible for the security of his personnel, materials, equipment and construction plant on and around the site of the Works and for the security of his camp (if applicable). The Employer in this regard will consider no claims.

Refer to clause PSA 8.4.6.2 (Security)

C4.6 NATURE OF GROUND AND SUBSOIL CONDITIONS

It shall be the Contractor's responsibility to acquaint himself with the conditions of the site. A geotechnical report is available upon request.

C4.7 GEOTECHNICAL REPORT AND BOREHOLE CORES

A geotechnical report is available upon request. It shall be the Contractor's responsibility to acquaint himself with the conditions of the site when submitting his or her rates.

C4.8 HYDROLOGICAL REPORT AND FLOODLINES

There are no supporting documents available with regard hydrological and floodline aspects.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Implementation Of The Halfway House Water Upgrade Project

ANNEXURE 1:

BASELINE RISK ASSESSMENT

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Implementation Of The Halfway House Water Upgrade Project

ANNEXURE 2:

MEDICAL SCREENING POLICY

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Implementation Of The Halfway House Water Upgrade Project

ANNEXURE 3:

SIGN OFF FORM

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Implementation Of The Halfway House Water Upgrade Project

ANNEXURE 4:

ENVIRONMENTAL MANAGEMENT PLAN

FINAL

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED CONSTRUCTION OF THE HALFWAY HOUSE BULK WATER PIPELINE WITHIN THE JURISDICTION OF THE CITY OF JOHANNESBURG METROPOLITAN MUNICIPALITY IN THE GAUTENG PROVINCE

GDARD REF:

GAUT: 002/23-24/E3656

DATE

OCTOBER 2023

PREPARED FOR

Johannesburg Water

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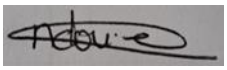
"From the world we live to the world we seek "

DOCUMENT CONTROL

PROJECT TITLE:
ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED CONSTRUCTION OF THE HALFWAY HOUSE BULK WATER PIPELINE WITHIN THE JURISDICTION OF THE CITY OF JOHANNESBURG METROPOLITAN MUNICIPALITY IN THE GAUTENG PROVINCE

QUALITY CONTROL:		
Report:	**Compiled By:**	**Peer Reviewed By:**
Draft Environmental Management Programme	Mahlatse Letsoalo Candidate EAP EAPASA: Registration No. 2020/2301	Esther Ndou  Candidate EAP EAPASA: Registration No. 2020/2319

REPORT AUTHORISATION		
Report	**Authorised By:**	**Signature**
Final Environmental Management Programme	Rejoice Aphane	 EAP (EAPASA): Reg 2019/1277

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ACRONYMS

BAR	Basic Assessment Report
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CEO	Contractor Environmental Officer
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment

EMPR	Environmental Management Programme
GDARD	Gauteng Department of Agriculture and Rural Development
HIA	Heritage Impact Assessment
NEMA	National Environmental Management Act (Act 107of 1998)
NEMWA	National Environmental Management Waste Act (Act 36 of 2008)
NEMAQA	National Environmental Air Quality Act (Act 39 of 2004)
NEMBA	National Environmental Management Biodiversity Act (Act 10 of 2004)
NHRA	National Heritage Resources Act (Act 25 of 1999)
NWA	National Water Act (Act 36 of 1998)
OHSA	Occupational Health and Safety Act (Act of 85 of 1993)
SACNASP	South African Council of Natural Scientists Profession
SAHRA	South African Heritage Resources Agency
WULA	Water Use Licence Application

1. INTRODUCTION

Nsovo Environmental Consulting (hereafter referred to as Nsovo) has been appointed by Johannesburg Water (SOC) Ltd (hereafter referred to as Joburg Water) to compile a Basic Assessment Report (BAR) in terms of National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and this Environmental Management Programme (EMPr) is compiled in response to the impacts idendtified in the BAR for the proposed development of the Halfway House Bulk Water Pipeline.

The proposed development is located in Halfway House, Midrand within Wards 32, 92, 110 and 132 of the City of Johannesburg Metropolitan Municipality in Gauteng Province.

1.1. PURPOSE AND SCOPE OF THE EMPR

An Environmental Management Programme (EMPr) is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation, and decommissioning of a project are prevented or mitigated and that the positive benefits of the project are enhanced. This EMPr serves as a guideline for the site's management and provides specifications and regulations that must be adhered to in all instances. It is the responsibility of all parties, including Contractors and Sub-Contractors, involved in the daily activities to commit to implementing the EMPr throughout the project.

This EMPr is prepared to provide specific environmental measures to be implemented during the life span of the Halfway House pipeline. As such, all activities to be undertaken during the project's planning, construction, operation and decommissioning phases have been considered.

Furthermore, this document gives effect to preventive measures, which are to be put in place for the monitoring of the activities that will take place on-site and ensure compliance with the national legislative and regulatory requirements, as well as Joburg Water monitoring guidelines and implementation tools associated with their operation.

The objectives of the EMPr are to:

- Ensure that the activity is undertaken in compliance with national and provincial environmental legislations as well as local by-laws and policies.
- Detail mitigation measures, timeframes, and criteria for assessing the success or failure of each measure.
- Provide detailed monitoring programs to ensure compliance.
- Provide input and strategies for environmental quality control and risk management.
- To preserve the natural environment by limiting destructive actions on-site.
- Ensure appropriate restoration of areas affected by the proposed activities.

- Prevent long term environmental degradation; and
- Ensure that activities consider the rights of other land users to enjoy a safe and healthy living environment.

1.2. LOCALITY OF THE PROPOSED PROJECT

The proposed development traverses various farms in Midrand, within the jurisdiction of the City of Johannesburg (CoJ) Metropolitan Municipality in the Gauteng Province. Figure 1 below shows a locality map that depicts the proposed study area at a scale of 1:50 000. (Map attached as Appendix B).

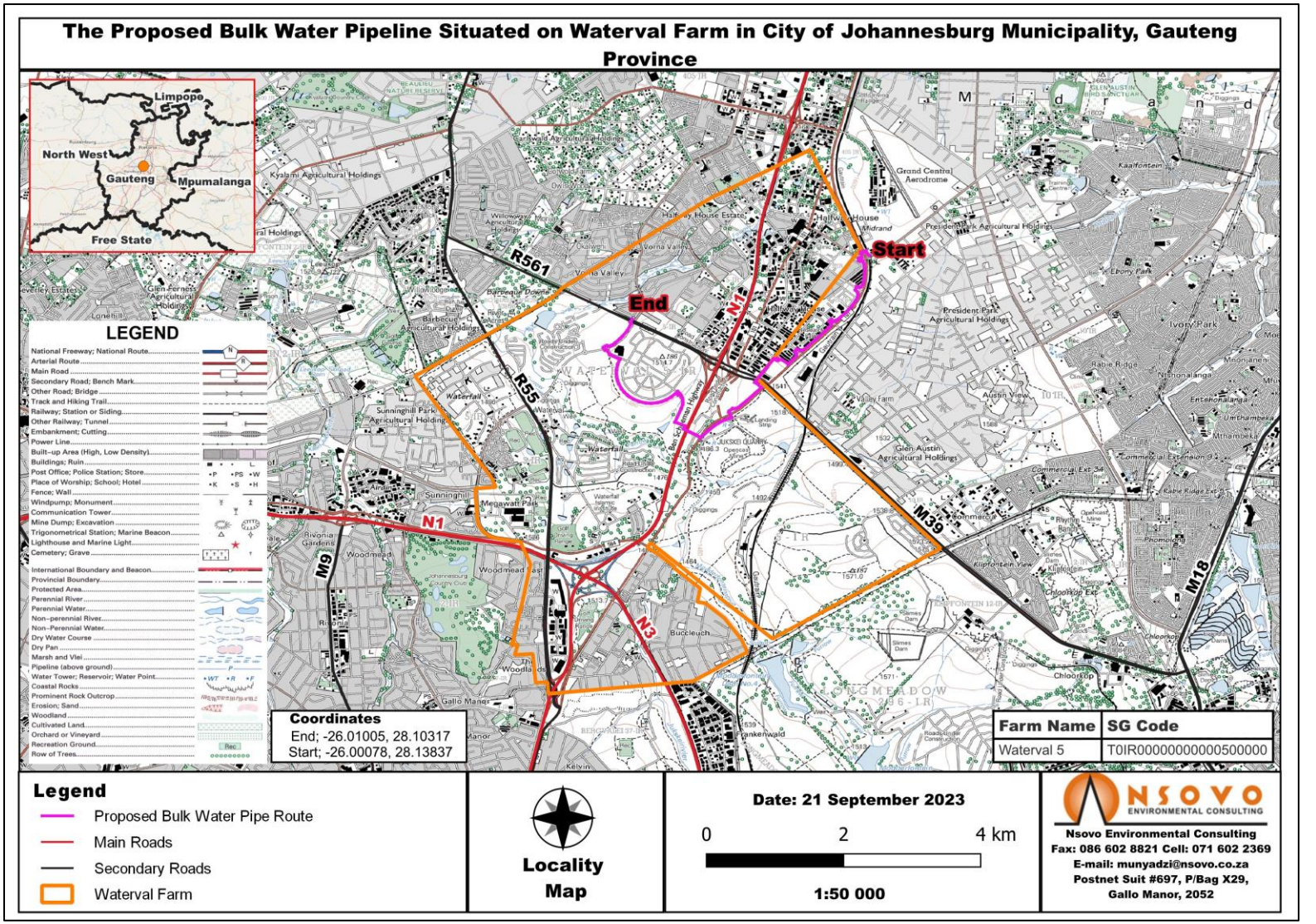

Figure 1: Locality Map

1.2.1.Description of the Locality

The proposed project traverses various farms and the details of the farm are provided in **Appendix A.**

2. THE STRUCTURE OF THE EMPR

This report has been compiled in terms of the provisions contained within Appendix 4 of GN R. 982 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA): EIA Regulations of 2014, as amended. Table 1 below provides a summary of the NEMA requirements in terms of the Environmental Impact Assessment (EIA) Regulations and an indication of which section the supporting information and documentation can be found in this document.

Table 1: 2014 NEMA EIA Regulations EMPr Report Content

No	Requirement	Reference
1(1)(a)	Details of- i) The EAP who prepared the report; and ii) The expertise of the EAP, including Curriculum Vitae;	Section 3
1(1)(b)	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 4
1(1)(c)	A map at an appropriate scale that superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Section 1
1(1)(d)	A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed, and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post-closure; and (v) where relevant, operation activities;	Section 5
1(1)(e)	A description and identification of impact management outcomes are required for the aspects contemplated in paragraph (d);	Section 5

No	Requirement	Reference
1(1)(f)	A description of proposed impact management actions, identifying the way the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions (i) avoid, modify, remedy, control, or stop any action, activity, or process that causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding the closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Section 5
1(1)(g)	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 6
1(1)(h)	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 6
1(1)(i)	An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 6
1(1)(j)	The periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 6
1(1)(k)	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 7
1(1)(l)	A program for reporting on compliance, considering the requirements as prescribed by the Regulations;	Section 7
1(1)(m)	An environmental awareness plan describing how- (i) the applicant intends to inform his or her employees of any environmental risk that may result from their work; and (ii) risks must be dealt with to avoid pollution or the degradation of the environment; and	Section 8
1(1)(n)	Any specific information that may be required by the competent authority.	Section 10

3. DETAILS AND EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER INCLUDING THE APPLICANT'S DETAILS, ORGANISATIONAL STRUCTURE, AND ROLES

3.1. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Nsovo has been appointed as the independent Environmental Assessment Practitioner (EAP) for the proposed development and meets the general requirements as stipulated in Regulations 13 (3) of the NEMA EIA 2014 Regulations as amended. Nsovo therefore is:

- Independent and Objective;
- Has expertise in conducting EIA's;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

Table 2 below provides the details of the EAP and relevant experience. A detailed CV and qualifications of the EAP are attached as **Appendix B**.

Table 2: Details of the Environmental Assessment Practitioner (EAP)

Name of Company	Nsovo Environmental Consulting
Person Responsible	Rejoice Aphane
Professional Registration	EAP (EAPASA): Reg 2019/1277
Postal Address	40 Lyncon Road, Carlswald, Midrand, 1684
Telephone Number	087 803 9294
Fax Number	086 602 8821
Email	admin@nsovo.co.za
Qualifications & Experience	B.A in Environmental Management (UNISA) **10 years of experience**
Project Related Expertise	In terms of project-related expertise, the Environmental Assessment Practitioner has undertaken projects of varying scale and complexity, including: • Integrated Environmental Impact Assessment and WULA for Exxaro discard dump expansion (2021). • Integrated Environmental Impact Assessment and WULA for Bushveld Vanchem Expansion project (2021). • Integrated Environmental Impact Assessment and WULA for Grammatikos Vogelfontein project (2021).

	• EIA for the proposed Tubatse Strengthening Phase 1 – Senakangwedi B integration within the jurisdiction of Greater Tubatse Local Municipality in Limpopo Province 2018). • EIA for the proposed Maphutha-Witkop powerline in Limpopo Province (2018). • EMPr, WULA, and EA amendment for the proposed Juno Gromis 400kV power line (2017).

3.2. DETAILS OF THE APPLICANT

This EMPr is a living document that guides the day-to-day activities throughout the project lifecycle; it may occasionally require revisions as the course of construction, operation, and rehabilitation/decommissioning activities may dictate. Therefore, preventive measures must be taken to ensure that environmental degradation is minimised while the project is undertaken. This will take a concerted effort from the project team and proper planning is of the utmost importance. This document applies to all Joburg Water employees, Contractors, and Subcontractors for the Halfway house pipeline. Table 3 below indicates details of the Applicant also referred to as the developer.

Table 3: Details of the Applicant

Name of Company	Johannesburg Water SOC Limited
Physical Address	17 Harrison Street, Marshalltown, Johannesburg 2107
Postal Address	Same as above.
Contact Person	Joyce Ngobele
Responsible position	Project Manager
Telephone Number	011 688 1443
Cell	071 609 7328
Email address	Joyce.ngobele@jwater.co.za

3.3. ORGANISATIONAL STRUCTURE AND RESPONSIBILITIES

To operate with utmost care of the environment effectively and efficiently for the duration of the project, all parties must understand their duties and responsibilities throughout all phases of the project lifecycle. Joburg Water and their duly appointed Contractors and Subcontractors are fully responsible for all activities taking place and ensuring that they are undertaken in compliance with the project's EA and EMPr as well as world best practices. The following sections describe the roles and responsibilities of the key team members.

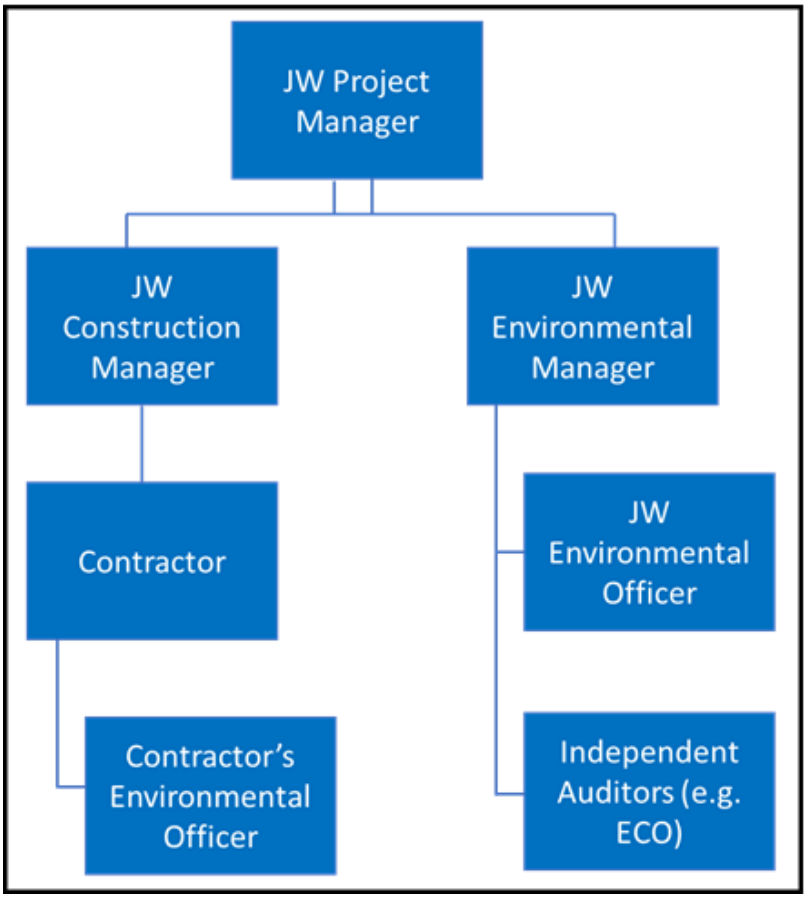

Figure 2: Typical Project Organogram

3.4. JOHANNESBURG WATER SOC LIMITED

Joburg Water must ensure the implementation and compliance of all environmental authorisations and permits and obligations emanating from other relevant environmental legislation throughout the project lifecycle. Formal responsibilities are necessary to ensure that key procedures are executed, and this would include the following:

- Ensuring that all team members are aware of their specific roles and responsibilities.
- Taking overall responsibility for all activities that occur in the proposed construction and associated infrastructure.
- Ensuring that all commitments/conditions contained in the EA and EMPr are communicated and adhered to by all Joburg Water employees, principal contractors, and Subcontractors.

Specific responsibilities of Management, Environmental Control Officer, and Contractor during the construction, operation, and decommissioning phases are detailed below:

Joburg Water Management will:

- Appoint a Project Management Team to oversee the Contractor and all activities.
- Appoint an independent Environmental Control Officer (ECO).
- Ensure that the Contractor is aware of and adheres to the provisions of this EMPr.
- Ensure that the Contractor remedies problems or non-compliances timeously.
- Appoint a suitably qualified ECO to ensure that the Contractor abides by the EMPr; and
- Ensure that an independent ECO monitors and audits the site to ensure compliance with the respective authorisation, permits, and licenses.

3.4.1. Johannesburg Environmental Officer (JEO)

The Joburg Water Environmental Officer will report to the Joburg Water Project Environmental Manager and will:

- Be fully knowledgeable of the contents of this EMPr and the conditions of the environmental authorization, and other permits.
- Be fully knowledgeable of the contents of all relevant environmental legislation and ensure effective compliance.
- Ensuring that Joburg Water and its contractors are made aware of all stipulations in the EMPr;
- Ensure compliance with the EMPr and EA commitments and any other legislative requirements applicable to their operations.
- Ensure there is effective communication with the Project Manager, the environmental control officer, and relevant project staff on matters concerning the environment; and
- Adhering to any instructions issued by the Project Manager on the advice of the ECO.

3.4.2. Environmental Control Officer (ECO)

A suitably qualified independent ECO must be appointed before the commencement of the construction activities. The ECO shall be responsible for monitoring, reviewing, and verifying compliance by the Contractor with the environmental specifications. In addition, the ECO shall be responsible for the planning and management of all environmental activities to ensure the effective implementation of EA, EMPr, landowner conditions, applicable permits, and licences. More specifically, the ECO will undertake the following responsibilities:

Communication Services

- To liaise closely with Joburg Water and the Contractor's Environmental Officer (EO).
- To assist in conflict resolution.

- To ensure that the Contractor rehabilitates any damage caused during construction.

Environmental Management (EM)

- Monitoring site environmental progress regarding time, deliverables, and quality.
- Liaison between Authorities, Joburg Water, and Contractors on environmental matters.
- Communicating changes in the EMPr to all relevant parties.
- Issuing Contractors Communications and site instructions.
- Monitoring the performance of Contractor and sub-contractors to ensure compliance with environmental and statutory requirements.
- Checking the Contractor EO's record of environmental incidents (spills, impacts, legal transgressions, etc.) as well as corrective and preventive actions taken.
- Checking the Contractor EO's complaints register in which all complaints are recorded and actions taken.
- Compiling and completing the environmental management-related component of the handing-over documentation and any other related documents.
- Timeously identifying any sensitive site issues which may affect environmental aspects. This must be reported to Joburg Water.
- Monitoring that good housekeeping practices are followed and maintained by the Contractor.
- Monitoring that the ground rehabilitation is initiated on time, complying with the EA, EMPr, and to the satisfaction of the landowner.
- Assisting the Contractor and Joburg Water EO with the environmental awareness training course for all site staff, targeted at the level of the workers so that they have a basic understanding of the environment that they are working in.
- Ensuring that sensitive areas are demarcated within or alongside the construction areas i.e., sites identified in the EMPr, EA.

Monitoring

- Validating the site environmental monitoring plan.
- Carrying out environmental surveillance.
- Validating and recording of certificates proving the legal disposal of waste streams.

Reporting

- To complete a daily diary and monthly reporting.
- To prepare monthly monitoring reports for submission to Joburg Water and the GDARD Environmental Compliance Section as and when required.

- Manage the compliance of the Contractor according to the EA, and EMPr. The reports are to include photographic images of compliances, non-compliances, and special occurrences taking place during the reporting period.
- To attend site meetings as required.
- To inform Joburg Water of any activity that is not in accordance with the EA and respective conditions, the EMPr, and special conditions or detrimental to the environment.

Administration

- To ensure a proper site ECO administration function to cater to all environmental site-related correspondence.
- To execute environmental responsibilities as per Joburg Water Risk Management System.
- To promote and maintain sound relationships with the landowners, community, Contractors, and suppliers.

3.4.3.Contractor (including Sub-Contractors)

The Contractor (including Sub-Contractors) will report to the Project Management Team and be responsible for:

- The appointment of an Environmental Officer who will ensure that all construction activities on site are undertaken in accordance with the EMPr.
- To fulfill all obligations as per the agreed contract.
- To implement the project as per the approved project plan.
- Drafting Environmental Method Statements for all activities to mitigate environmental impacts.
- Informing the workforce regarding their roles and responsibilities in terms of the EMPr.
- Ensuring that the workforce and Subcontractors comply with this EMPr.
- Ensuring compliance with the EMPr and EA commitments and any other legislative requirements applicable to their activities.
- Adhering to any instructions issued by the Project Manager on the advice of the ECO.
- Preparation and timeous submission of environmental compliance reports that include updated incident and complaints registers.
- Induction and training of their employees as well as Subcontractors before the commencement of construction, taking cognisance of this EMPr and EA.
- To inform and educate all employees about the environmental risks associated with the different construction activities through toolbox talks, environmental notices, and other methods with a specific focus on environmental topics throughout the project.
- To provide all necessary supervision during the execution of the project and must always be available on site.
- To ensure that implementation is conducted in line with the EA and EMPr.

- To comply with special conditions as stipulated by Landowners during the negotiation process.
- Ensure compliance with pertinent environmental legislation and other legally binding documents.

3.5. COMPETENT AUTHORITY

The authorising department is the Gauteng Department of Agriculture and Rural Development (GDARD) and their role is to enforce compliance with the EA and EMPr conditions.

4. A DETAILED DESCRIPTION OF THE ASPECTS OF THE ACTIVITIES THAT ARE COVERED BY THE EMPR AS IDENTIFIED BY THE PROJECT DESCRIPTION

This EMPr is part of the Basic Assessment process for the proposed upgrade of the Joburg Water bulk water pipeline. Subsequently, the EMPr incorporates measures for the construction, operation, and decommissioning activities associated with the proposed project, which includes the following aspects in Table 4 below.

Table 4: Details of the proposed activities

Pipe diameter(mm)	Approximate pipe length (km)	Supply/Feeder Pipe	Pipe battery limits
600 mm	3 km	Feeder	Start from the existing water meter chamber to the proposed 25ML Halfway House Reservoir.
700 mm	1.4 km	Supply	From the proposed 25ML Halfway House Reservoir to the connection point at the start of the existing 800mm diameter steel pipeline.
700 mm	2.8 km	Supply	From the connection point at the end of the existing 800mm diameter steel pipeline and connecting to the new 600mm diameter pipeline.
600 mm	0.6 km	Supply	From connection to the new 700mm diameter pipeline and connecting to new 500mm diameter pipeline.
500 mm	68m	Supply	From connection to the new 600mm diameter pipeline and connecting to existing reticulation at Allendale and Harry Galaun Dr.

4.1. DESCRIPTION OF STRUCTURES AND INFRASTRUCTURE

4.1.1. Proposed Activities

As detailed above, Joburg Water proposes upgrading and installing an approximately 7 km bulk water pipeline from Dale Road and K101 Old Pretoria Main Road intersection in Halfway House, to Allandale Road and Harry Galaun Drive intersection in Waterfall. Refer to **Error! Reference source not found.** below.

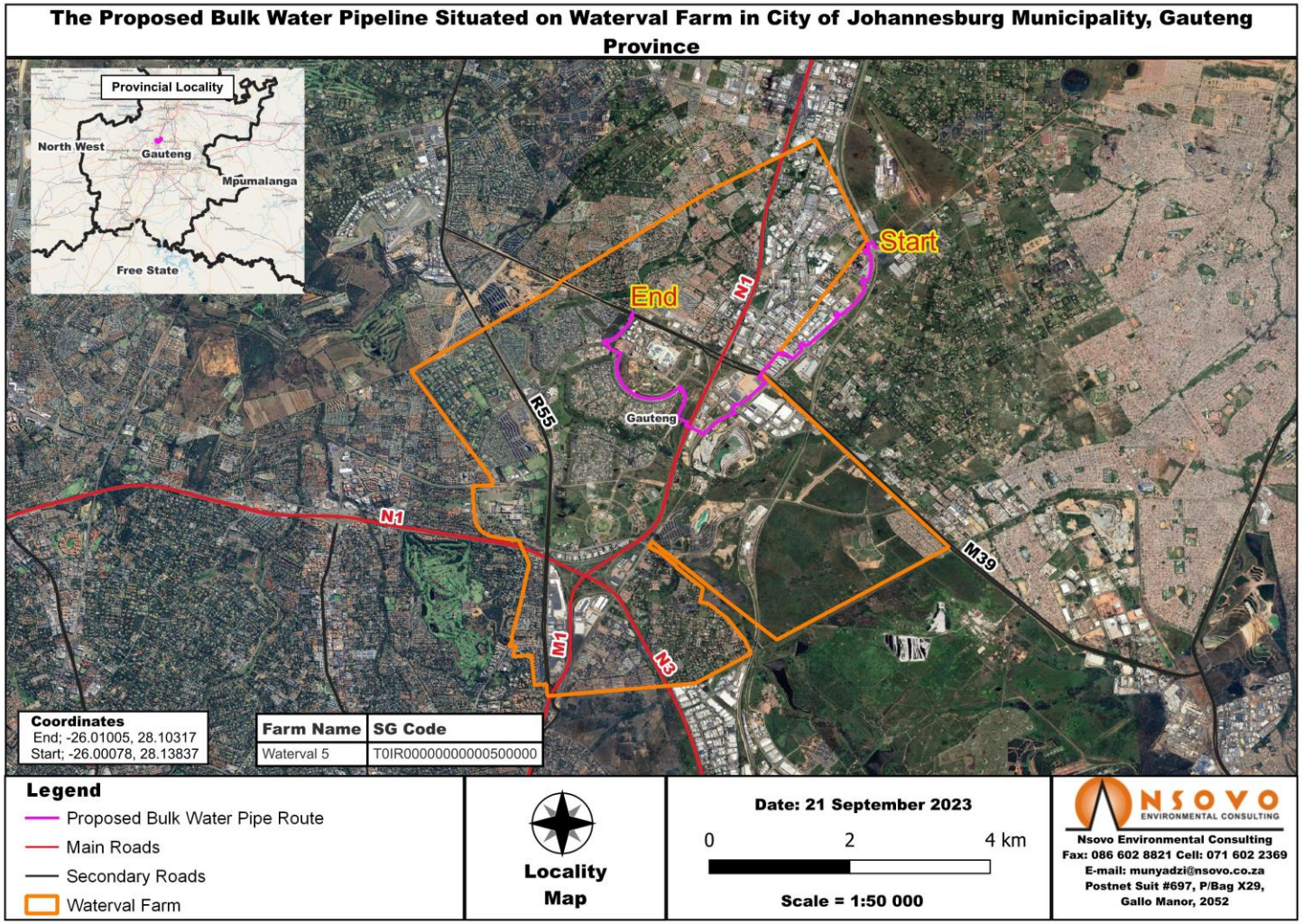

Figure 3: Map depicting the pipeline

The proposed development triggers the NEMA EIA listed activities; as such, Joburg Water must undertake the Basic Assessment (BA) process to obtain an environmental authorisation before the construction of the above-mentioned activities in accordance with the EIA Regulations, 2014 (promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended. The listed activities applicable are listed and briefly described in Table 5 below:

Table 5: Listed activities under the National Environmental Management Act (Act 107 of 1998) triggered by the proposed development.

Regulation	*Activity*	Description
GN R 983		
Activity 19, Listing 1	*(a)The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal, or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic meters from (i) a watercourse.*	The proposed 7 km pipeline will include excavations of more than 10m^3
Activity 12	*The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *(c)Gauteng* *(ii) Within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans;*	The proposed pipeline will include the clearance of vegetation during construction of the pipeline and majority of the alignment is within ESA.
GN R 985		
Activity 14, Listing 3	*The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square meters or more;* *where such development occurs—* *(a) within a watercourse;*	The proposed 7 km pipeline will have a physical footprint of more than 10m^2 and will traverse a wetland as well as areas classified as CBA. The pipeline will span 55m across a watercourse which is equivalent to 82.5m^2.

	c. Gauteng *iv Sites identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans;*	This Span will be along a gabion and no excavations will be required.

5. A MAP AT AN APPROPRIATE SCALE THAT SUPERIMPOSES THE PROPOSED ACTIVITY, ITS ASSOCIATED STRUCTURES, AND INFRASTRUCTURE ON THE ENVIRONMENTAL SENSITIVITIES OF THE PREFERRED SITE, INDICATING ANY AREAS THAT SHOULD BE AVOIDED, INCLUDING BUFFERS

Based on the baseline environment of the proposed upgrade, a sensitivity mapping has been developed to identify areas of sensitivity and create both regulated and non-regulated buffers to protect and preserve such areas. The sensitivity map below (Figure 4) and attached as Appendix A indicates the proposed project's servitude in relation to the sensitive areas. Gauteng C-Plan indicates that the site is within an Ecological Support Area (ESA); however, the site assessment showed that the industrial and residential buildings have transformed the area.

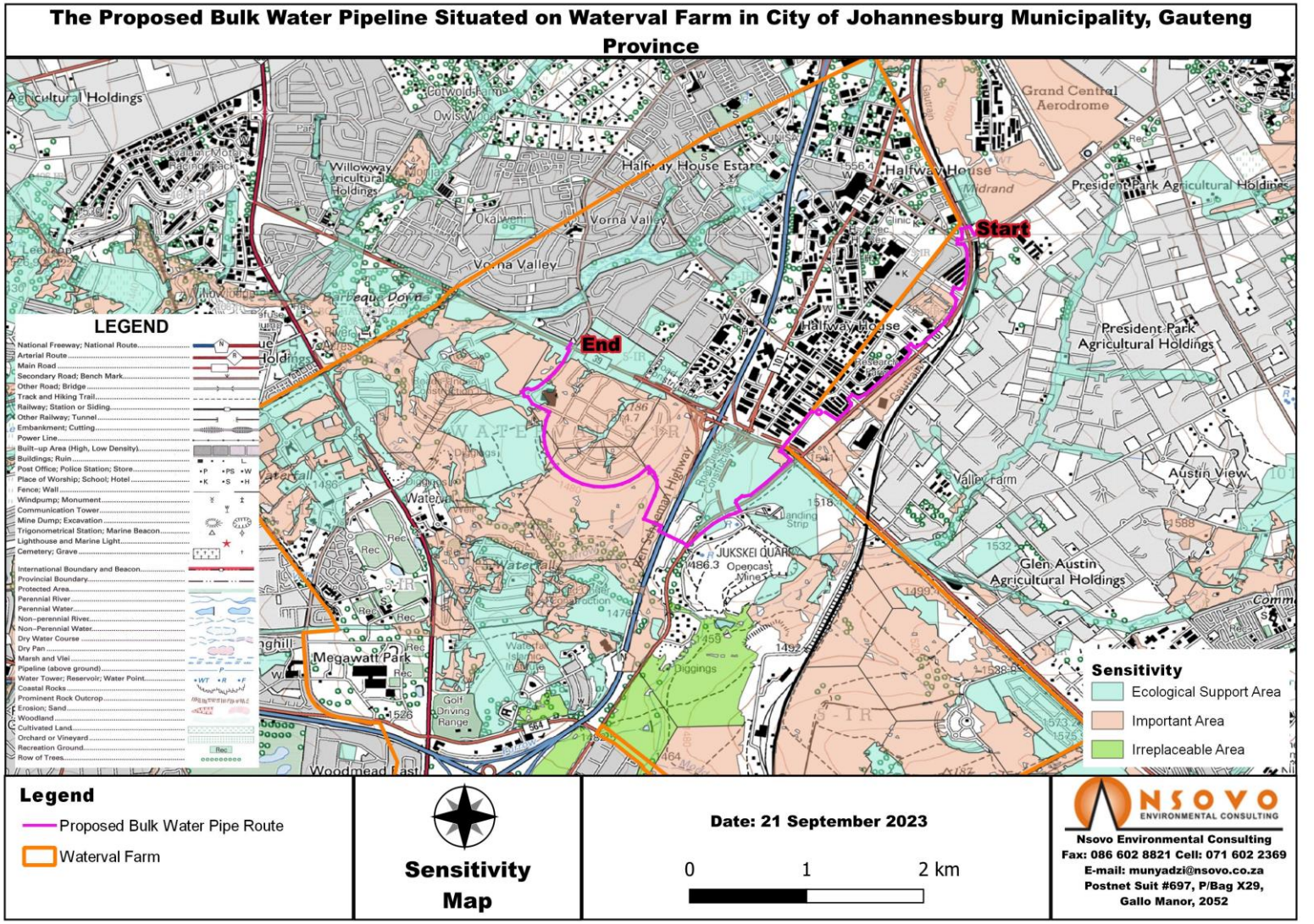

Figure 4: Sensitivity Map for the proposed pipeline

6. A DESCRIPTION OF THE IMPACT MANAGEMENT OUTCOMES, INCLUDING MANAGEMENT STATEMENTS, IDENTIFYING THE IMPACTS AND RISKS THAT NEED TO BE AVOIDED, MANAGED, AND MITIGATED AS IDENTIFIED THROUGH THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR ALL PHASES OF IMPACT MANAGEMENT OUTCOMES

6.1. IDENTIFIED RISKS THAT NEED TO BE AVOIDED

The tables below provide the impacts identified for the project's construction, operational, and decommissioning phases. The risk identification was guided by the findings of specialist studies undertaken as part of this plan and are summarized according to the project phases, as follows:

6.1.1. Construction Phase

Table 6: Impacts identified for construction.

Aspect	Impact
Construction Activities	
Movement of construction personnel	• Impact on sensitive environments • Trespassing • Safety and security
Site preparation and excavations	• Loss of topsoil • Increase in soil erosion • Contamination of soil • Disturbance of fauna • Damage to flora • Contamination of ground and surface water • Generation of dust • Generation of waste
Vehicle movement and refuelling activities	• Damage to sensitive areas. • Erosion and loss of topsoil. • Generation of dust. • Contamination of soil. • Fuel spillages could potentially contaminate ground and surface water resources.

6.2. IMPACT MANAGEMENT OUTCOMES

Table 7 below outlines the range of approaches to be implemented to manage the potential environmental impacts/risks of the project activities throughout the project cycle.

Table 7: Approach to Impact Management

Impact Management	Description
Avoidance	Avoiding activities that could result in adverse impacts and/or resources or areas considered sensitive.
Prevention	Preventing the occurrence of negative environmental impacts and/or preventing such an occurrence from having negative impacts.
Preservation	Preventing any future actions that might adversely affect an environmental resource.
Minimisation	Limiting or reducing the degree, extent, magnitude, or duration of adverse impacts
Mitigation	Measures are taken to minimise adverse impacts on the environment.
Enhancement	Magnifying and/or improving the positive effects or benefits of a project.
Rehabilitation	Repairing affected resources, such as natural habitats or water resources.
Restoration	Restoring affected resources to an earlier (more stable and productive) state, typically 'background' or 'pristine' condition. These resources may include soils and biodiversity.
Compensation	Compensating for lost resources, and where possible, the creation, enhancement, or protection of the same type of resource at another suitable and acceptable location.

Following a detailed description of the impact management approaches, this section describes the impact management outcomes, including management statements, identifying the impacts and risks that must be avoided, managed, and mitigated throughout all phases.

6.2.1. Pre-Construction Phase

Table 8: Pre-construction Objectives

Aspect	Objective
Social	• To increase local employment. • To reduce the impacts on local cultural sense of place. • To minimise social pathogens and unhealthy behaviour. • Protection of archaeological, historical, and any other site or land considered of cultural value.

Soil	• To prevent erosion, sedimentation, surface water contamination, and reduction in water quality. • To minimise land use alternation and soil erosion.
Biodiversity	• To ensure adequate planning to prevent habitat destruction. • To prevent a significant increase in alien invasive species abundance and spread and to prevent habitat fragmentation with specific reference to the proposed activities. • To conserve species of conservation concern.
Sensitive Environments	To prevent the destruction of the aquatic ecosystem at the river crossing.

6.3. CONSTRUCTION PHASE

Table 9: Construction Objectives

Aspect	Objective
Social	• To protect the social-economic environment of local land users. • To support the local economy through the utilisation of local resources. • To conserve heritage artefacts and buildings. • To minimise impacts on infrastructure and land occupiers during excavation and piling activities.
Water	• To prevent groundwater contamination. • To protect surface water flow, water quality, and associated pollution. • To conserve water usage during construction.
Air Quality	• To minimise emissions to the atmosphere affecting employees, local land users, and climate change. • To reduce greenhouse gas emissions.
Soil	• To prevent soil contamination and ensure rehabilitation of contamination.
Biodiversity	• To prevent a significant increase in alien invasive species abundance and spread. • To minimise the loss of floral habitat. • To minimise loss of floral biodiversity. • To protect floral habitats and diversity. • To reduce the impacts on faunal ecological integrity by curbing erosion. • To minimise cumulative loss of natural vegetation in the region.
Sensitive Environments	• To protect the river's integrity and function. • To protect the identified avifaunal-sensitive area (ESA).

7. LEGISLATIVE FRAMEWORK

This section lists and describes the acts and legislation relevant to the proposed project. In addition to the national legislative requirements, the EMPr must take equal cognisance of Joburg Water's internal policies and best practices. Table 10 below provides a list of policies and guidelines that must be applied to ensure effective management of the environment.

Table 10: Legislation pertaining to the proposed project.

Aspect	Relevant Legislation	Brief Description
Environment	National Environmental Management: Act 1998, (Act No. 107 of 1998)	The overarching principles of sound environmental responsibility as reflected in the National Environmental Management Act, 1998 (Act No. 107 of 1998) apply to all projects triggering listed activities. Construction and operation of activities must be conducted in line with the generally accepted principles of sustainable development, integrating social, economic, and environmental factors. The BA process followed the NEMA, and the EIA Regulations of December 2014 as amended. The proposed development triggers "listed activities", as defined by NEMA. Listed activities are an activity that may potentially have detrimental impacts on the environment and therefore require an EA from the relevant Competent Authority, in this case, GDARD.
	Regulations GN. R. 982, 983, 984, and 985 promulgated under Chapter 5 of the National Environmental Management Act (NEMA, Act 107 of 1998) in Government Gazette 38282 on 4 December 2014 as amended	GDARD is the provincial authority mandated to implement the Regulations for Environmental Impact Assessment in Gauteng as such this application for an Environmental Authorisation is being lodged with GDARD. Th proposed pipeline upgrade entails activities that trigger listed activities under Listing Notice 1 (GN.R 983 of 2014, as amended) and Listing Notice 3 (GN.R 985 of 2014, as amended) of the Environmental Impact Assessment Regulations of 2014 (Government Notice No R982 of December 2014, as amended), hence the requirement for a Basic Assessment process to be followed.
	Gauteng Provincial Environmental	The purpose of the Framework is to guide protection and enhancement of environmental assets, natural resources along with development patterns to ensure sustainable

Aspect	Relevant Legislation	Brief Description
	Management Framework (GPEMF)	environmental management and development patterns within and around the Gauteng Province. Its objectives include efficiency in urban development, optimal use of land, to protect Critical Biodiversity Areas (CBAs as defined in the revised C-Plan 3.3) within urban and rural environments and to use ESA's as defined in municipal bioregional plans in spatial planning of urban open space corridors and links within urban areas. The proposed development falls within: **Zone 1 (urban development zone):** The intention with Zone 1 is to streamline urban development activities in it and to promote development infill, densification, and concentration of urban development within the urban development zones as defined in the Gauteng Spatial Development Framework (GSDF), in order to establish a more effective and efficient city region that will minimise urban sprawl into rural areas. Certain currently listed activities may be exempted from environmental assessment requirements at the discretion of the competent authority. • Development in this area must be sustainable in respect to the capacity of the environment and specifically the hydrological system to absorb additional sewage and stormwater loads as a result of increased densities; • Existing open spaces and urban parks should be retained as open space to cater for the open space needs of the foreseen increased densities; and • Stormwater drainage must be in accordance with the Water Research Commission Report, 2012 and the South African Guidelines for Sustainable Drainage Systems.

Aspect	Relevant Legislation	Brief Description
		Zone 5 (industrial and large commercial focus zone). The intention with Zone 5 is to streamline non-polluting industrial and large-scale commercial (warehouses etc.) activities in areas that are already used for such purposes and areas that are severely degraded but near required infrastructure (such as old and even current mining areas). Certain currently listed activities, in addition to those intended for Zone 1 may be excluded from environmental assessment requirements in this zone in future. • Development in this area must be sustainable in respect to the capacity of the environment and specifically the hydrological system to absorb additional sewage and stormwater loads of increased densities; and • Development in this area must identify any unmapped wetlands, especially seep areas that may occur on any site and when necessary, apply for the required water use licence. • Non-polluting Industrial promotion areas where selected activities are to be excluded from EIA processes in addition to those excluded in Zone 1.
Biodiversity	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. The study area falls within the Grassland Biome. The vegetation type found on the study site is Egoli Granite Grassland. According to the 2021 National List of threatened terrestrial ecosystems this vegetation type is Critically Endangered. An assessment summary conducted on site suggests that Egoli Granite Grassland is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), placing the ecosystem type at risk of collapse.

Aspect	Relevant Legislation	Brief Description
Protected Areas	National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)	The purpose of this Act is to provide for the protection, conservation, and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes.
	Gauteng Conservation Plan 3.3	According to the Gauteng C-Plan the site is partially located in an Ecological Support Area (ESA), as well as an Important Area. Sensitive and Important areas within the proposed area should be conserved and where linear development (roads etc.) cannot avoid these areas, a proper assessment and implementation of alternatives should be undertaken. The C-Plan was considered in the compilation of this Basic Assessment Report (BAR).
	Red List Plant Species Guidelines	The purpose of these guidelines is the promotion and conservation of the Red List Plant Species in Gauteng, these are species of flora that face risk of extinction in the wild. By protecting Red List Plant Species, conservation of diverse landscapes is promoted which forms part of the overall environmental preservation of diverse ecosystems, habitats, communities, populations, species, and genes in Gauteng. There are no Red Listed plant species found on the area proposed for the development.
Heritage Resources	National Heritage Resources Act, 1999 (Act No. 25 of 1999)	The National Heritage Resources Act, 1999 (Act No. 25 of 1999) legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act provides for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. No obvious sites/artefacts of heritage significance were noted during the site assessment.

Aspect	Relevant Legislation	Brief Description
Air quality management and control	National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)	The objective of the Act is to protect the environment by providing reasonable measures for the protection and enhancement of air quality and to prevent air pollution. The Act makes provision for measures to control dust, noise, and offensive odours. Section 32 of the National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004) deals with dust control measures in respect of dust control. The Minister or MEC may prescribe measures for the control and management of dust in specified places or areas, either in general or by specified machinery or in specified instances, the steps to be taken to prevent nuisance or other measures aimed at the control of dust. The National Dust Control Regulations (2013) provide for the management and monitoring of dust. The proposed project may create minimal dust during excavations and is expected to be short term and site specific.
Noise Management and Control	Noise Control Regulations in terms of the Environmental Conservation, 1989 (Act 73 of 1989)	The assessment of impacts relating to noise pollution management and control, where appropriate, must form part of the EMPr. Applicable laws regarding noise management and control refer to the National Noise Control Regulations issued in terms of the Environment Conservation, 1989 (Act 73 of 1989).
	Gauteng Noise Control Regulations	Practical mitigation measures for noise pollution are low, but certain measures can be implemented to mitigate the severity. These measures have been provided for in the EMPr.
Water	National Water Act, 1998 (Act 36 of 1998)	This Act provides for fundamental reform of the law relating to water resources and use. The preamble to the Act recognises that the ultimate aim of water resource management is to achieve sustainable use of water for the

Aspect	Relevant Legislation	Brief Description
		benefit of all users and that the protection of the quality of water resources is necessary to ensure sustainability of the nation's water resources in the interests of all water users. The proposed 7km pipeline will span 55m across a wetland and thus triggers Section 21 water use activities. In line with the requirements of the NWA a Water Use Licence/ General Authorisation must be obtained prior to commencement of any activities; this requirement has been duly fulfilled.
Waste Management	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008	No waste management license would be required for the construction or operational phases of the proposed activity. Only a limited amount of solid construction waste will be stored and handled on the site, before being hauled away and dumped at the nearest registered landfill site.
Agricultural Resources	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	The Act aims to provide for control over the utilization of natural agricultural resources to promote the conservation of the soil, water resources, and vegetation and to combat weeds and invader plants. Section 6 of the Act makes provision for control measures to be applied to achieve the objectives of the Act.
Health and Safety	Occupational Health and Safety Act (No 85 of 1993)	The Act provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of machinery; the protection of persons other than persons at work, against hazards to health and safety arising out of or in connection with the activities of persons at work. The EMPr provides for measures to ensure that objectives of the Act are met on this site.
Human	The Constitution of South Africa, 1996 (Act No. 108 of 1996	The Constitution provides for an environmental right (section 24). The State is obliged "to respect, protect, promote and fulfil the social, economic and environmental rights of everyone…" The environmental right states that: "Everyone has the right -

Aspect	Relevant Legislation	Brief Description
		a) To an environment that is not harmful to their health or well-being; and b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that - • Prevent pollution and ecological degradation; • Promote conservation; and • Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." The undertaking of the BA process is in line with the state's obligations as outlined in the constitution in its effort to ensure sustainability.

7.1. METHOD STATEMENTS FOR THE ACTIVITIES TO BE CONDUCTED

The environmental specifications are required to be underpinned by a series of Method Statements (MS), within which the Contractors and Service Providers are required to outline how any identified environmental risks will be mitigated and managed for the duration of the contract and how specifications within this EMPr will be met. The Contractor will be required to describe how specified requirements will be achieved by submitting written Method Statements to Joburg Water before the commencement of activities on site. In addition, the Method Statements must cover relevant details regarding:

- Vegetation clearing;
- Fauna and flora management;
- Excavations for pipe laying
- Chemical/hazardous substance storage;
- Cement/concrete use;
- Logistics of the environmental awareness training;
- Fire management;
- Emergency Response;
- Stormwater and soil erosion management;
- Waste management;
- Access road(s);
- Contaminated water management;
- Site establishment and site layout plan;
- Temporary site closure;

- Site Rehabilitation;
- Dust control protocol

The above is not an exhaustive list of the required MS; additional MS may be as the project progresses.

8. DESCRIPTION OF MITIGATION MEASURES

This section prescribes mitigation measures to prevent, reduce, eliminate, or compensate for impacts to acceptable/insignificant levels.

8.1. PRE-CONSTRUCTION MANAGEMENT PROGRAMME

The pre-construction management program is to be used as a guide during the planning, design and detailing of the development components. All involved in decision-making during the planning and design phases should reference this part programme. The responsible agents indicated in Table 11 are abbreviated as follows:

Table 11: Responsible Agent

Title	Abbreviation
Contractor Environmental Officer	CEO
Johannesburg Water SOC Limited	Joburg Water
Environmental Control Officer	ECO

Objective	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Ensure that proper environmental conditions are established prior to commencement of construction activities by informing all parties of appropriate environmental protection measures.	• The project must be designed with consideration for the environment. • The successful tendering Contractors/third parties must be made aware of the contents of this EMPr and any penalties arising from non-compliance prior to the commencement of the work. • Appoint a suitably qualified environmental manager who must be responsible for monitoring compliance with the EMPr.	• Signed Declaration by Contractor • Appointment Letter • Design Report • Proof of submission of ECO appointment of GDARD	Joburg Water	Pre-Construction

8.2. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAMME

This section relates to the construction activities at Joburg Water and may also be implemented during any other construction activities that do not trigger the listed activities.

8.2.1.Site Establishment

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Disturbance in the natural environment. Disturbance of soil and vegetation.	To ensure minimal disturbance on-site during the site establishment.	NEMA (36 of 1998). Construction Regulations.	**Site Plan**: • A layout plan for construction activities needs to be developed and approved by the Environmental Site Manager. • Documentation for the proposed camp site should be prepared by the Contractor prior to the commencement of construction activities. This documentation must include, but not be limited to the following: o Site access (including entry and exit points).	• Observation • Site Plan • Landowner agreements	• ECO • Contractor • CEO	Prior to site establishment

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			○ All material and equipment storage areas including storage areas for hazardous substances. ○ Construction offices and other structures. ○ Security requirements including temporary and permanent fencing, and lighting. ○ Solid waste management facilities. ○ Stormwater control measures. ○ Provision of potable water and mobile chemical ablution facilities. Throughout construction, the Contractor shall restrict all activities to the designated areas as per the construction layout plan. Any modification of the construction layout plan is to be approved by the ECO. **Site Camps:** • Construction camps must not be located on a sensitive site or infringe on adjacent property owners. Where applicable camps should be in an area with existing infrastructure where minimal clearing will be required. • Invite the Environmental Officer for the site inspection of the proposed site camp prior to establishment. • Submit a method statement for Site Camp establishment for approval by the JW Environmental Officer/ECO prior to commencement of works.			

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• After the completion of the construction activities, the site camp must be rehabilitated as per the Method Statement and disestablishment should be signed off by the ECO and the landowner. The following restrictions in the site camp should be communicated to all the construction staff in general: • The use of rivers and streams for washing of clothes. • The use of welding equipment, oxyacetylene torches, and other bare flames where veld fires constitute a hazard. • Indiscriminate disposal of waste or rubble littering of the site. • Spillage of potential pollutants, such as petroleum products. • Collection of firewood. • No poaching of any form is allowed. • Use of surrounding veld as toilets. • Burning of wastes and cleared vegetation. **Vegetation clearing:** • The natural vegetation encountered on site is to be conserved and left intact as much as possible. • Only trees and shrubs directly affected by the works in writing may be felled or cleared with written permission from the ECO. **Water for human consumption:**			

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• Water for human consumption should be always available at the site offices and other convenient locations. **Ablution facilities:** • Chemical toilets must be supplied (1 per 15 persons) and must be regularly cleaned and maintained by the Contractor. • Area for the placement of the ablution facilities must be determined by the Contractor. • The Contractor should arrange for regular emptying of toilets and will be entirely responsible for enforcing their use and for maintenance.			

8.2.2.Environmental Induction Training

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Destruction of the environment due to inadequate knowledge of staff	• To ensure that all employees/staff conducting work on-site understand their duty to care for the environment and are aware of the requirements of this EMPr.	NEMA (107 of 1998) and the relevant SEMAs	• All staff must undergo environmental induction training before conducting any work on-site.	• Environmental Induction Material • Environmental Induction Attendance Registers	CEO	Before construction activities commence and as and when required.

8.2.3.Terrestrial Biodiversity

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Impact on sensitive ecology. • Damage to protected/endangered vegetation. • Damage to topsoil. • Damage/loss of habitat. • Negative impact on animal life. • Negative impact on animal life.	• To ensure that the sensitive area is not disturbed. • To prevent and reduce the negative impact on the vegetation on and around the site. • To prevent the invasion by alien invasive species. • To ensure that the rehabilitation of indigenous vegetation is as close to the original state as possible. • To conserve animal life. • To ensure that impact on natural vegetation is kept to the minimum to conserve suitable habitats as much as possible.	• NEM: BA (10 of 2004).	• Demarcate the construction footprint. • Demarcate all ecologically "sensitive" areas to the contractors (e.g., red data habitats and species, rivers, streams, wetlands, sensitive soils, steep slopes, and areas susceptible to erosion); • The access barriers must be maintained in good condition throughout the construction. • Only vegetation directly affected by the works may be felled or cleared. No bush clearing is to be undertaken without the knowledge thereof by the property owner. • The natural vegetation encountered on the site is to be conserved and left intact as much as possible. • Only manual removal of weed will be permitted on site. Chemical and mechanical (TLB) control is not allowed on site. • All exotic invaders and weeds must be eradicated. • No invasive or exotic plant species should be planted in the road reserves. • No fauna species should be disturbed, trapped, hunted, or killed during the construction phase. • Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.	• Observation • ECO to monitor. • Site plan • Observation • Complaints Register • Daily inspection	• ECO • Contractor • Mine Manager • Construction workers • CEO • Project manager	Before and during the construction phase.

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
	• To prevent degradation of suitable sensitive fauna habitats. • To prevent contamination of the nearby water resources thereby preserving several amphibian/aquatic species. • To ensure that ecological linkages are maintained along the pipeline route.		• No open fires are permitted. • No hunting of fauna shall be allowed by the Contractor. Offenders shall be prosecuted. • Any animals found should be relocated to the conservation areas in the vicinity. • Wood harvesting of any trees or shrubs in the study area or adjacent areas shall not be allowed. • Any open excavations must be inspected early morning before the daily construction activities. • Any amphibians and small mammals or any other fauna species found should be removed and released in suitable habitats away from construction activities. • Records of any injuries or deaths of fauna within the construction servitude must be kept by the ECO. • Construction should be restricted to daylight hours to prevent any disturbance such as floodlights. • Ensure that landscaping specialists are appointed to undertake the rehabilitation as per the Joburg Water requirements (EMP rev 05). • Ensure that JW EO, ECO, and Site Environmental Officer is invited for the practical inspection and completion inspection after the completion of the rehabilitation on site. • The snag list is to be compiled and accepted by all parties (JW CAPEX Representatives, JW environmental section as applicable, and appointed Contractor) All responsible			

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			personnel including Environmental representatives sign both practical and final completion letters.			

8.2.4.Heritage And/or Archaeological Sites

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Destruction of sites of archaeological and heritage significance.	• To preserve any heritage, cultural, or archaeological sites that might be encountered during the construction phase.	NHRA (25 of 1999)	If any heritage or archaeological artifacts or graves are found, the following measures must be implemented: • Construction must be stopped, and a professional archaeologist be consulted. • The area should then be demarcated by a danger tape. • A professional archaeologist or SAHRA should be contacted immediately to arrange for a registered heritage specialist for inspection, and if necessary, excavate the material, subject to acquiring the necessary approval. • All work within the construction area must cease until written permission has been received from the SAHRA. • Under no circumstances may any heritage material be destroyed or removed from the site. Furthermore, until the necessary approval has been obtained from SAHRA. • Any measure to cover up the suspected archaeological material or to collect any resources is illegal and punishable	Intermittent observation.	• ECO • Contractor • CEO • Archaeologist	On-going during all excavations

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			by law under Section 35(4) and 36(3) of the NHRA, Act 25 of 1999. • The Contractor must induct field workers about archaeology, and steps that should be taken in the case of exposing archaeological materials. This induction must include information on: o Flaked stone tools, bone tools, and loose pieces of flaked stone; o Ash and charcoal; o Bones and shell fragments; o Artefacts (e.g., beads or hearths)			

8.2.5.Surface and Groundwater Management

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Pollution of ground and surface water.	• To prevent the pollution of the ground and surface water resources. • To prevent the siltation of stormwater infrastructure. • To ensure effective water management.	NWA (36 of 1998)	• Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced. • The Contractor shall ensure that excessive quantities of sand, ,silt and silted water do not enter the stormwater system. • Drainage channels should be constructed on-site to convey stormwater to sand/silt traps for the removal of soil particles.	• Observation • Design Plans	• Contractor • ECO	Continuous through the construction phase.

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
	• To ensure that the rivers and streams are protected and incur minimal negative impact from the development.		• The Contractor must take reasonable precautions to prevent the pollution of the ground and water resources on and adjacent to the site because of construction activities. • No natural watercourse is to be used for the cleaning of tools or any other apparatus. This includes for purposes of bathing, or the washing of clothes, etc. • No spills may be washed down into a stormwater drain or sewer, or the surrounding natural environment. • Abstraction of water from the nearby river must be prohibited unless approval has been given by DWS. • Erosion control on temporary access roads must be undertaken. • Any physical damage to any aspect of a watercourse must be avoided.			

8.2.6.Storm Water Management

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Contamination of the nearby river or stream that will lead to the deterioration of water quality.	• To ensure proper management of stormwater run-off that causes erosion and siltation/sedimentation. • To ensure that the quality of water is protected.	NWA (36 of 1998)	• Runoff from the cement/ concrete batching areas must be strictly controlled, and contaminated water must be collected, stored, and either treated or disposed of off-site, at a location approved by the project manager. • The Contractor must ensure that rainwater containing pollutants does not run off into natural areas and thus result in a pollution threat.	• Site Plan • Observation	• ECO • Contractor • CEO	Continuous during the construction

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Siltation in the nearby stream or river.			• Stormwater shall be diverted from the construction works. • Increased runoff due to vegetation clearance and/or soil compaction must be managed, and steps must be taken to ensure that stormwater does not lead to excessive levels of silt entering the watercourses. • Efforts shall be made to ensure that stormwater leaving the construction site is not contaminated by any substance, whether solid, liquid, or gas. • Erosion control measures must be put in place to control stormwater runoff.			

8.2.7.Top Soil Management and Erosion Control

Possible Impact	Objective	Applicable Legislation /Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Impact on soils and habitats and sensitive environs. • Compaction of soil.	To prevent erosion and sedimentation.	NWA (36 OF 1998)	To prevent any form of erosion the following must be adhered to: • During construction, the Contractor will protect areas susceptible to erosion by installing necessary temporary and/or permanent drainage works as soon as possible and by taking suitable measures to prevent surface water concentration into nearby roadways. • Before construction, all topsoil must be stripped and stockpiled separately from subsoil and rocky material. Soil must be stripped	• Observation • Complaints Register	• Contractor • ECO • CEO	On-going particularly during excavations

Possible Impact	Objective	Applicable Legislation /Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			in a phased manner to retain vegetation cover for as long as possible. • Stockpiled topsoil should not be compacted and should be replaced as the final soil layer. • Stockpiled soil must be protected by erosion-control berms if exposed for a period of greater than 14 days during the wet season. • Topsoil stockpiles must not be contaminated with hydrocarbons, waste, or any other foreign matter, which may inhibit the later growth of vegetation and micro-organisms in the soil. • Soil must not be stockpiled on drainage lines or near watercourses. • Soil must be exposed for the minimum time possible once cleared of invasive vegetation. • If the topsoil stockpile is stored for a longer period, it must be either vegetated with indigenous grasses or covered with a suitable material to prevent erosion and invasion by weeds. • To limit the introduction of alien species into the area, no soil may be imported onto the site. • Where required, cut-off trenches can be installed to divert substantial run-off and prevent erosion as and when necessary. • Sensitive areas such as watercourses (riparian areas) should be cordoned off so that vehicles and construction personnel cannot gain access to these areas.			

Possible Impact	Objective	Applicable Legislation /Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• Where access into sensitive areas cannot be avoided, the number of vehicle and personnel traffic should be kept to a minimum and make use of only one route.			

8.2.8.Waste Management

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Visual Impact • Contamination of the nearby water resources.	• Ensure the effective and efficient separation, storage, and removal of waste from the site. • To ensure the efficient management of waste on site • To ensure minimal impact on the surrounding environment	NWA (36 of 1998). NEM: WA (59 of 2008)	• A Waste Management Plan/ Method statement should be submitted before site camp establishment. • Waste management must form part of the induction process to ensure all workers on site have a full understanding of all proper waste management practices. ***Solid Waste Management*** • The Contractor must maintain 'good housekeeping' practices and ensure that all work sites and construction camps are kept tidy and litter-free. No solid waste must be disposed of on-site. • Waste shall be separated at source (e.g., Bins for glass, paper, metals, plastic, organic waste, and hazardous waste). • No waste materials shall at any stage be disposed of in the open veld, adjacent properties or in sensitive areas. • All solid waste including excess spoil (soil, rock, rubble, etc) must be removed to a permitted waste disposal site weekly.	• Intermittent Observation • Waste Disposal Records	• ECO • Contractor • CEO	Daily

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• All waste must be transported in an appropriate manner (e.g., plastic rubbish bags) and disposed of at a registered waste disposal site. Proof of safe disposal must be kept on site.			

8.2.9.Water Usage

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Overutilization of water resources	• To ensure availability of water for various uses as and when required. • To ensure that water usage is minimised. • To ensure that water resources are conserved. • To encourage a 3R (Reduce, Reuse, Recycle).	• NWA (36 of 1998)	• The ECO shall indicate to the Contractors where they can obtain water for construction, water for dust suppression as well as for drinking. • Contractors shall not make use of/collect water from any other source than those allocated to them as suitable for use. • Ensure water conservation is being practiced by all construction personnel. • Minimizing water use during the cleaning of equipment. • Undertaking regular audits of water systems. • Regular toolbox talks on water usage and conservation during environmental awareness training.	Water use records	• ECO • Contractor	On-going during the construction phase

8.2.10. Hazardous Substances, Materials Use, and Storage

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Impact on human health. • Impact on soils and water resources.	• To ensure safe handling, storage, use, and disposal of hazardous substances. • To ensure full compliance with the requirements of the applicable legislation.	• OHSA (85 of 1993) • Construction Regulations (2013).	***Safety and Training*** • The Contractor must train and educate all personnel on-site regarding the proper use, handling, and disposal of hazardous material. • All the necessary handling and safety equipment required to be used and worn by the staff or the safe use of hydrocarbons must be provided. • Suitably qualified safety officers must undertake regular safety checks and maintenance of the storage tanks. • Joburg Water must comply with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Construction Regulations (2003). ***Hazardous Material Storage:*** • The Contractor must comply with all National, Regional, and Local legislation regarding the storage, transport, use and disposal of petroleum, chemical, harmful, and hazardous substances, and materials. • Hydrocarbons and other hazardous substances must only be stored in a secured, designated area with restricted entry. • All hydrocarbons, irrespective of volumes, must be stored on a smooth, impermeable surface or containments. The impermeable containment shall be 110% of total capacity of all the storage tanks. • All hazardous containers must be marked to indicate contents, quantities, and safety requirements.	• Hazardous material data sheet • Incident report • Observation of spillages and leakages	• ECO • Contractor • CEO	Continuous throughout the construction phase

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• Storage of hazardous products must be stored in suitable containers. Safety Data Sheets (SDS) of the hazardous material stored must always be available on—site and in the safety files. • Gas welding cylinders and LPG cylinders must be stored in a secure, well-ventilated area. The Contractor must supply sufficient fire-fighting equipment in the event of an incident. • Where fuel is stored and used, smoking must be prohibited. • Hazard signs must be installed at fuel and hazardous material storage areas indicating the nature of the stored chemical. **Oil Spillage Management** • The oil spill clean-up and rehabilitation standard must be developed and implemented accordingly. • Equipped spill kits must always be made available on site. • All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site. All spills must be reported to the ECO within 24 hours. • If any chemicals spills in the nearby water resources, such incident must be immediately reported to DWS and Joburg Water. An action plan for rectification must be developed. • Exercise extreme care with the handling of diesel and other toxic solvents to ensure that spillage is avoided.			

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• The management of chemicals and hydrocarbons must form part of the emergency preparedness and response program. No activities associated with hydrocarbons and or chemicals (i.e., wash bays, etc.) may be undertaken outside of an effectively designed contained area. • In addition, the storage tanks, and any other areas where spillages and leakages could occur must be contained within a bunded area. • All construction materials liable to spillage must be stored in appropriate structures with impermeable flooring. • Drip trays must be provided under vehicles and equipment, to contain spills of hazardous materials such as fuel, oil, and cement. • Repair and storage of vehicles must be conducted only within the demarcated site area. • Fuels, oils, hydraulic fluids, etc. must be confined to specific secured areas within the site camp to minimize accidental spillage. • No leaking vehicle shall be allowed on site. **Contaminated Soil Disposal:** • The contaminated waste shall be disposed of at a hazardous waste disposal site.			

8.2.11. Movement Of Construction Personnel and Equipment

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Damage to protected/important vegetation. • Damage to sensitive areas. • Erosion and loss of topsoil.	• To prevent ecological damage. • Minimise damage to the identified watercourses. • Minimise erosion of embankments and subsequent siltation of watercourses.	• CARA (43 of 1983). • NEM: BA (10 of 2004).	***Vehicular Access*** • A physical access plan along the servitude shall be compiled by the Contractor and approved by the ECO. The Contractor shall always adhere to this plan to ensure access to the sites. • No illegal use of private roads during construction due to damage anticipated because of heavy vehicles and equipment. • Upon completion of the project all roads shall be repaired to their original state. • No roads shall be cut through river- and stream banks as this may lead to erosion causing siltation of streams. Soil stabilisation measures should be implemented especially on steep slopes. • Rehabilitation of disturbed areas immediately following construction.	• Observation • Site plan. • Regular monitoring of access road conditions • Monitoring of impacts on the surrounding areas	• ECO • Contractor • CEO •	Continuous during the construction phase
• Impact on sensitive environment • Trespassing • Safety and security.	• To ensure controlled and manageable movement of personnel and equipment.	• CARA (43 of 1983). • NEM: BA (10 of 2004). • NEMA (107 of 1998)	***Movement of Construction Plant, Equipment and Personnel*** • All structures comprising the construction camp are to be removed from the site after completion of construction. • Ensure that access to the site, including related infrastructure and machinery is restricted to authorised personnel only. • No construction staff must be permitted to trespass on private land or the adjacent properties/estates without permission.	• Observation • Security registers. • Complaints register	• ECO • Contractor	Continuous throughout the construction phase.

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• The Contractor must ensure that all construction personnel, labourers, and equipment always remain within the demarcated construction sites. • The Contractor is to ensure that no machinery, personnel, material, or equipment enters 'No-Go' areas during construction. • The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc, and these shall be cleaned up immediately. • All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area shall be topsoiled. • All the required safety labelling on the containers and trucks used shall be in place. • The Contractor shall ensure that all the necessary precautions against damage to the environment and injury to persons are taken. In the event of an accident, the Contractor shall supply a method statement to that effect.			

8.2.12. Servicing and Re-Fuelling of Construction Equipment

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Impact on soil and water resources due to accidental spillages of hazardous material i.e., oil, fuels, cement, etc.	• To conserve soils, surface, and groundwater. • To prevent spillages of hazardous substances	• NEM: WA (59 of 2008) • NWA (36 of 1998) • OHSA (85 of 193)	• A Method Statement for the servicing and re-fuelling of the construction plant should be submitted before construction commences. • Vehicles used during the construction phase must be parked in a designated area and drip trays must be placed underneath the vehicles to prevent any oil leaks from seeping into the soil. • All maintenance and repair work must be carried out within a designated area, equipped with necessary pollution containment measures. • Spills in bunded areas must be cleaned up with a spill kit, and thereafter be disposed of at a registered landfill site, such as Chloorkop Landfill. • Refuelling, greasing, or oiling of vehicle and construction machinery must be done on a drip tray or bunded surface. • Construction vehicles must be maintained in an acceptable state of repair. No vehicles or equipment with leaks must be permitted to operate at any of the construction sites. • All leaking equipment must be repaired immediately offsite and emergency repairs must be conducted on protected ground.	• Observation • On-going monitoring	• ECO • Contractor • CEO	On-going during the construction phase

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• Fuels required during construction must be stored in a central depot at the construction camp. • Appropriate run-off containment measures must be put in place.			

8.2.13. Use of Cement and Concrete

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Soil pollution.	• To conserve soils, surface, and groundwater. • To minimise waste concrete from polluting the environment	• NEMA (107 of 1998) • NEM: WA (59 of 2003) • HSA	The Contractor is advised that cement and concrete are regarded as highly hazardous to the natural environment due to their high pH and the chemicals contained therein. To avoid ground pollution the following must be adhered to: • Pre-mix concrete shall be the preferred option where possible. • The batching/mixing area must be properly designated and indicated on the site plan and be always kept neat and clean. • The no batching / mixing of cement must strictly be done on an impermeable surface. • The visible remains of the batch plant and concrete, either solid or from washings shall be physically removed immediately and disposed of appropriately at a registered landfill site, such as Chloorkop Landfill.	• Observation • Site Plan	• Contractor • ECO • CEO	Throughout the construction phase

8.2.14. Fire

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Destruction of property • Loss of life	• To prevent open fires. • To ensure that the employees are aware of emergency procedures should an incident occur.	• NEMA (107 of 1998) • OHSA 85 of 1993)	• No fires should be permitted on site. • All the necessary precautions to ensure that fires are not started because of activities on site must be put in place. • Gas and liquid fuels may not be stored in the same storage area. • All fire control mechanisms (firefighting equipment) will be routinely inspected. Such mechanisms will be always present and accessible. • No open fires for heating or cooking will be permitted on site unless otherwise agreed and then only on designated areas. • All staff on site must be made aware of general fire prevention and control methods and the name of the responsible person to report fire incidents to. • Designated smoking areas should be provided, with special bins for discarding cigarette stumps. • Fire must be reported immediately. • Emergency contact details must be available on site, where applicable.	• Fire Management Plan • Daily checks	• ECO • Contractor • CEO	On-going during the construction phase

8.2.15. Air Pollution

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Dust nuisance from construction activities.	• To ensure proper mitigation of air pollution.	• NEM: AQ (39 of 2004)	• Dust pollution could occur during the construction, more so in the dry season. Therefore, regular, and effective dust suppression	• Observation	• ECO • CEO	Monitored daily throughout the

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
	• To avoid dust nuisance from excavation activities and vehicles on dirt roads	• National Dust Control Regulations.	must be carried out to avoid dust pollution, impacting adjacent residential areas and creating dangerous driving conditions on nearby roads. • When necessary, appropriate working areas should be damped down in the mornings and afternoons, by sprinkling bare areas with water, chemical soil binders, etc. • Dust nets must be used where the construction site borders the Residential Area • Unnecessary removal of vegetation must be avoided unless permitted for pipeline construction. • No burning of vegetation from clearing operations is allowed. • Speed limit within the access roads and residential areas affected by construction of pipeline must be limited to 40km/hr .	• Complaints register		construction phase

8.2.16. Noise Impact

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Noise during excavation/drilling of foundations and associated construction activities	• To ensure minimal noise disturbance. • To avoid noise nuisance from operating construction equipment.	• Noise Control Regulations (ECA) • SANS 10103 of 2008	• Noise activities shall only take place during working hours (09:00 to 17:30). • Site workers must comply with the Municipal noise requirements as outlined. • Machinery and vehicles are to be maintained in good working order.	A register of complaints to be always kept on site and kept up to date.	• ECO • CEO	On-going during the construction phase

			• Where possible the Contractor must use equipment which falls within the allowable noise limits (45 dBA). • Any complaints pertaining to noise must be recorded and reported to the ECO and addressed accordingly. • Employees to be provided with hearing protection as and when required.			

8.2.17. Visual Impact

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Negatively impacting the visual quality because of construction machinery.	• To ensure proper mitigation measures of potential visual impacts. • To maintain the site's aesthetics.	• NEMA (107 of 1998)	• Storage facilities and other temporary structures on site must be in a manner that they have as little visual impact on residents as possible. • Screen the construction site and lay down yards by enclosing the entire area with a dark green or black shade cloth on less than 2m height. • All temporary structures placed on site for the project's construction phase must be removed upon completion of the project. • Lighting must be sufficient to ensure security but will not constitute 'light pollution' to the surrounding areas.	• A register of complaints to be always kept on site and kept up to date. • Inspection	• Contractor • ECO • CEO	On-going during the construction phase

8.2.18. Social Impact

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency

• Influx of jobseekers into the area where they see construction activities. • Inflow of Temporary workers.	• To promote local employment.		• Encourage the Contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies. • Engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods, and products from local suppliers where feasible. • Sub-contract to local construction companies particularly SMME's and BBBEE compliant and women-owned enterprises where possible. • Use local suppliers where feasible and arrange with the local SMME's to provide transport, catering, and other services to the construction crews. • Where possible, local labour should be considered for employment to increase the positive impact on the local economy. • If possible, set up a recruitment office in Midrand and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment. • Control the movement of workers between the site and areas of residence to minimise loitering around the site. This should be done through the provision of scheduled transportation services between the construction site and area of residence. • Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area.	HR Records	• Project Manager	On-going during the construction phase

			• Assign a community liaison officer to deal with complaints and concerns of affected parties. • Provide adequate signage along relevant road networks to warn the motorists of the construction activities taking place on the site. • Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers.			

8.2.19. Traffic Impact

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Accidents. • Impact on road safety, congestion, wear, and tear of the road surface.	• To maximise road safety and minimise congestion. • To ensure that traffic impacts because of the construction-related activities are minimised.	NLTA (5 of 2009)	• Effective traffic control must take place throughout the construction phase. • The Contractor must maintain access roads. Furthermore, access roads to the site must be of suitable quality to eliminate soil erosion and channel stormwater. Where possible strategic positioning of entry and exit points must be established to ensure as negligible impact/ effect as possible on the traffic flow. • Clear traffic signs and signals should be installed on-site to provide for safe traffic movement. • Monitor adherence to traffic regulations. • Monitor drivers for use of alcohol and other substances that could impair judgment and driving. • Ensure that loads on trucks are properly secured during transport.	• A register of complaints to be always kept on site and kept up to date. • Inspection	• ECO • CEO	On-going during the construction phase

			• Schedule arrival and departure of heavy vehicles to avoid morning and afternoon peak hours. • Speed limit within the construction area should be limited to <40km/hour.			

8.2.20. Excavation, Backfilling and Trenching

Possible Impact	Objective	Applicable Legislation/Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Removal of topsoil • Possible erosion • Accidents caused by excavated areas.	• To prevent erosion. • To ensure safety for both human and animals.	• OHSA (85 of 1993) • NEMA (107 OF 1998)	While working at areas prone to erosion the following must be adhered to: • Excavations must not be left open for longer than 30 days where at all possible. • Time works to reduce excavation work occurring during precipitation events/seasons. • Excavations must be always barricaded/ fenced off by a danger tape to keep people out. • Proper site staging to ensure that the maximum amount of existing vegetation is left in place during the excavation phase. • Leave a continuous buffer of vegetation around the site perimeter to intercept any sediment that might be transferred off site via surface water flow. • A qualified person should make daily inspections of excavations using the approved checklist prior to the start of the work shift. • No personnel should be permitted in the excavation or trench when power equipment is being used to perform the excavation.	• Observation • Incident report	• Contractor • ECO • CEO	On-going excavations

8.2.21. Site Clean-Up and Rehabilitation

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Erosion • Use of non-indigenous species	• Minimise damage to topsoil and environment at excavations. • Successful rehabilitation of all damaged areas • Prevention of erosion • To ensure that the site is fully rehabilitated to its original state • To ensure that the site is clean and neat. • Minimize claims and litigation from landowners	• NEM: BA (10 of 2004) • NEMA (107 of 198)	• All areas disturbed by construction activities must be subject to landscaping and rehabilitation. • Rehabilitation of areas affected by construction activities should ideally commence at the start of the rainy season. • Recommended rehabilitation is in the form of active re - vegetation of affected areas, including areas where surface disturbances resulted from construction, as well as areas that were used for alternative or other functions, such as storage areas, parking bays. • Existing access road should be left 'as is' for future use during maintenance operations. All area of incomplete construction should be completed and prepared for final rehabilitation and re-vegetation. • The Contractor must ensure that all temporary structures, materials, waste and facilities used for construction activities are removed upon completion of the project. • All replaced equipment and excess gravel, stone, concrete, bricks, temporary and fencing must be removed from the site upon completion of the work. • No discarded materials of any nature shall be buried on the site or on any other land within the site. • Stockpiled topsoil must be used for rehabilitation. • Stockpiled topsoil must be evenly spread to facilitate seeding and minimise loss of soil due to erosion.	Rehabilitation Plan Observation	• ECO • CEO • Contractor	On completion of construction Random surveys by landowner

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
			• The Contractor shall dispose of all excess material on site in an appropriate manner and at a designated place.			

8.2.22. Monitoring of EMPr Compliance

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
• Non-compliance of the EMP • Failed rehabilitation.	• To implement an on-going monitoring and performance audit programme • To ensure adequate reporting of progress with the development • To ensure compliance with the requirements of the EMP. • To ensure successful rehabilitation	NEMA (107 of 198)	• Regular monitoring reports, monthly and close out must be compiled. • Monitoring of the general implementation of/adherence to the EMPr shall be the responsibility of the ECO. • Reporting on compliance to stipulations as communicated to contractors, shall take place during scheduled site meetings.	• Observation • Monthly audit Reports	• ECO • Contractor • CEO	On-going during the site establishment and construction phase.

8.2.23. Document Control

Possible Impact	Objective	Applicable Legislation/ Policy	Mitigation / Management Action	Monitoring Criteria	Responsible Agent	Monitoring Frequency
Lose track of time and funds for the proposed projects.	• To ensure compliance with the requirements of the regulatory authority • To assign roles and responsibilities to ensure compliance • To implement and comply with the requirements of the EMPr.		• A copy of this EMPr and the EA must always made available on site. • The EMPr and the EA must be used as reference as the project progresses. These documents must be presented to the authorities at any given time that they might visit the site.	Availability of an EMPR copy on site	• ECO • Contractor • CEO	On-going during the construction phase.

9. ENVIRONMENTAL GENERIC CONDITIONS

To ensure compliance with Joburg Water's environmental policy as well as environmental legislation requirements, the following general conditions are applicable:

9.1. SITE DOCUMENTATION/MONITORING

The standard Joburg Water site documentation shall be used to keep records on-site. All documents shall be kept on site, and be available for monitoring, and auditing purposes. Site inspections by an Environmental Audit Team may require access to this documentation for auditing purposes. All parties shall sign the documentation to ensure that such documents are legitimate. Regular monitoring (At least monthly) of all work on site by the Environmental Control Officer is required to ensure that all problems encountered are solved punctually and amicably. The Joburg Water Environmental Officer must be on site daily to ensure implementation of the EMPr., the Joburg Water Construction Manager shall keep abreast of all works to ensure no problems arise. Monthly Environmental Monitoring reports shall be submitted to the appointed Joburg Water Environmental Officer by the CEO with all information relating to environmental matters.

The following Key Performance Indicators must be reported on a fortnightly basis:

- Complaints received from Landowners and actions taken.
- Environmental incidents, such as oil spills, concrete spills, etc., and actions taken (litigation excluded).
- Incidents leading to litigation and legal contraventions.
- Environmental damage that needs rehabilitation measures to be taken.
- The following documentation shall be kept on site:
- Access negotiations and physical access plan.
- Complaints register.
- Site daily dairy.
- Records of all remediation/rehabilitation activities.
- Copy of the EMPr.

The ECO shall further prepare monthly Environmental Monitoring reports which will cover the activities undertaken as well as the status of compliance on site. Copies of the monthly reports must be submitted to Joburg Water as well as GDARD. Furthermore, monthly reports must be kept on-site either as hard or soft copies.

9.2. AUDITS

Audits must be undertaken in accordance with the requirement of Appendix 7 of the EIA Regulations of December 2014 as amended. During the construction period, the ECO must conduct at least monthly Environmental Audits to determine compliance with the recommendations of the EMPr and conditions of the EA.

The appointed ECO, as well as the Contractors on site, are responsible for ensuring compliance with the EMPr. It is recommended that monthly EMPr compliance reports (audits) are compiled by the ECO and submitted to CEO for correction of non-compliances. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified to the GDARD.

9.3. ACCESS TO DOCUMENTS

Interested and Affected Parties must be allowed access to the EMPr document should they so wish. They have the right to monitor specific aspects of the EMPr in conjunction with the ECO and Contractor, reasonably and informally without unreasonably disrupting construction activities.

9.4. PROCESS FOR IDENTIFYING EMERGENCY PROCEDURES

- A plan of action must be drawn up in the case of an emergency (veld fire, vegetation problems, etc.)
- Adjacent property owners or occupiers must be always treated with respect and courtesy.
- The culture and lifestyles of the communities living nearby the proposed development must be respected.
- Environmental clauses (as referred to in this Construction and Operation EMPr) must be included in the contract documents for all contractors; and
- A register of all complaints or queries received as well as action taken must be always kept on-site.

10. FAILURE TO COMPLY WITH THE ENVIRONMENTAL CONSIDERATIONS

The ECO will, acting reasonably, have the authority to order the Contractor to suspend part or all the works if it causes unacceptable damage to the environment by not adhering to the specifications in the EMPr. The suspension will be enforced until the offending parties' actions, procedures, and/or equipment are corrected, and adequate mitigation measures implemented.

11. AMENDMENT OF EMPR

Any issue that may arise during the construction or operational phase of the pipeline and is not provided for in this EMPr may be addressed as an amendment to this EMPr. An amendment must be submitted to Joburg Water for approval before the implementation of the provisions contained.

ENVIRONMENTAL MANAGEMENT PLAN

JOHANNESBURG WATER SOC LTD

ENVIRONMENTAL MANAGEMENT PLAN

REVISION:05

Prepared By:

OHSE & DM

Environmental Management Section

Johannesburg Water SOC (Ltd)

PO Box 61542

Marshalltown

2001

DISCLAIMER

1. Should there be any other Environmental related activities issued as non-compliance during construction, the contractor is liable to comply with those requirements
2. Should the contractor deviate from the conditions and requirements of the EMP and/or Environmental Authorisation (if applicable), the contractor is liable for non-compliances, rectification, and associated fines thereof
3. This EMP does not exempt the Contractor from complying with other relevant legislations related to the construction activities.

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Annexure C: Environmental Work Instruction
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LIST OF ACRONYMS Acronym	**Description**
BA	Basic Assessment
BAR	Basic Assessment Report
CA	Competent Authority

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DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EO	Environmental Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme Report
GDARD	Gauteng Department of Agriculture and Rural Development
GN	Government Notice
I&AP	Interested and Affected Party
JW	Johannesburg Water
km	Kilometre
m	meter
MSDS	Material Safety Data Sheets
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PHRAG	Provincial Heritage Resources Authority for Gauteng
RE	Resident Engineer
WUL	Water Use License
WULA	Water Use License Application
WWTW	Wastewater Treatment Works

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DEFINITIONS

Environment

The surroundings in which humans exist and which comprise of:

- Land, water, and atmosphere of the earth.
- Micro-organisms, plant, and animal life.
- Any part or combination of a) and b) and the interrelationships among and between them.
- The physical, chemical, aesthetic, and cultural properties and conditions of the foregoing that can influence human health and well-being.

Environmental Aspect

Those components of the company's activities, products and services that is likely to interact with the environment.

Environmental Authorisation

The written statement from the relevant environmental authority in terms of the National Environmental Management Act (Act 107 of 1998), with or without conditions, that records its approval of a planned activity and the implementation thereof and the mitigating measures required to prevent or reduce the effects of environmental impacts during the life of a contract.

Environmental Impact Assessment (EIA)

The decision-making process of examining the environmental impacts of a development in terms of the NEMA (107 of 1998) and the EIA Regulations (Government Notice No. R982, R983, R984, R985 and R986) as amended.

Environmental Management Programme (EMPR)

An environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

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Environmental Management System (EMS)

A set of process and practices that enable an organization to reduce its environmental impacts and increase its operational efficiency. The EMS provides a framework that helps a company achieve its environmental goals through consistent control of its operations.

Auditing

A systematic and objective assessment of an organization's activities and services conducted and documented on a periodic basis internally and externally.

Environmental Objective

An overall environmental goal, arising from the environmental policy, that an organization sets itself to achieve, and which is quantified where practicable.

Environmental Target

A detailed performance requirement quantified where practicable, applicable to the organization or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.

Floodplain

A flat expanse of land bordering a river channel, formed through sediment deposition and other alluvial processes, and often characterized by frequent flooding as a result of bank overspill from the river channel.

Groundwater

Sub-surface water in the zone in which permeable rocks, and often the overlying soil, are saturated.

Hazardous waste

Waste that are proven to be toxic, corrosive, explosive, flammable, carcinogenic, radioactive, poisonous or classified as such in legal terms.

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Heritage Resource

Any place or object of cultural significance including buildings, structures, landscapes, graves and geological, archaeological artefacts and paleontological sites.

Landscape

Land modified for human use and occupation, embracing both the natural (wilderness) environment and the urban.

Management actions

Practical actions aimed at achieving management objectives and targets.

Management objectives

Desired outcome of management measures for mitigating negative impacts and enhancing the positive impacts related to project activities and aspects (i.e. risk sources).

Monitoring

A systematic and objective observation of an organization's activities and services conducted and reported on regularly.

Natural Vegetation

All existing vegetation species, indigenous or otherwise, of trees, shrubs, groundcover, grasses and all other plants found growing on the site.

Pollution

Any change in the environment caused by substances, radioactive or other waves, or noise, odours, dust or heat, emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience

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and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future. Furthermore, pollution can also be regarded as an undesirable state of the natural environment being contaminated with harmful substances because of human activities.

Protected Plants

Plant species officially listed on the Protected Plants List (each province has one), and which may not be removed or transported without a permit to do so from the relevant provincial authority.

Reinstatement

Reinstatement is defined as the return of a disturbed area to a state, which approximates the state (where possible), which it was before disruption.

Riparian Habitat

The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Runoff

The total water yield from a catchment including surface and subsurface flow.

Sensitive environmental features

Environmental features protected by legislation (e.g., heritage resources), or identified during the EIA as sensitive through specialists' findings and input received from Interested and Affected Parties.

Subsoil

The soil horizons between the topsoil horizon and the underlying parent rock.

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Topsoil

Topsoil can be regarded as the fertile upper part or surface of the soil.

Transplanting

The removal of plant material and replanting the same plants in another designated position.

Veld

Unimproved areas of natural vegetation

Wastewater

Water contaminated by the project activities.

Watercourse

A geomorphological feature characterized by the presence of a stream flow channel, a floodplain and a transitional upland fringe seasonally or permanently conveying surface water.

Waterlogged

Soil or land saturated with water long enough for anaerobic conditions to develop.

Weeds and Alien Invasive Plants

Weeds and Alien Invasive plants are defined as undesirable plant growth that shall include, but not be limited to all declared category 1, 2 and 3 listed Alien Invasive species as set out in the Conservation of Agricultural Resources Act (No 43 of 1983) regulations. Other vegetation deemed to be invasive should be those plant species that show the potential to occupy in number, any area within the defined construction area.

Wetland

Land where a surplus of water (i.e., waterlogging) is the key factor determining the nature of the soil development as well as the types of plants and animals living at the soil surface.

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1. BACKGROUND

The purpose of this document is to provide management measures that will ensure that potential negative impacts associated with the activity are minimized whilst positive impacts are optimised, provided that the EMP is implemented by a suitably qualified Environmental Officer (EO). The development proponent, the main contractor and the sub- contractor are responsible for the implementation of the EMP throughout the stages. Therefore, it is imperative that the EMP is circulated to site managers, contractors and Depots who will perform any work on site which has the potential to cause environmental damage. Any parties responsible for transgression of the underlying management measures outlined in this document will be held liable for non- compliances.

The following is a generic EMP to mitigate against “generally occurring impacts” associated with the construction phase of Johannesburg Water’s activities. "Generally occurring impacts" refers to potential impacts typical of Johannesburg Water’s activities and are not restricted to a single or specific site. The findings of this EMP will be implemented at all sites.

This section is an essential component of the contract specification and shall be included during **planning, design, construction, and operational phases.**

PURPOSE

The purpose of this EMP is to ensure that Johannesburg Water conducts all its activities related to the construction and maintenance in accordance with the provisions of NEMA, and other applicable legislations. This EMP has considered the provisions of the Constitution and the principles of Integrated Environmental Management.

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2. APPLICABLE LEGISLATIONS

Several laws and regulations apply to the protection of the environment. These laws contain environmental principles and standards that need to be applied when applicable permits and licences that need to be obtained. This EMP will be subject to regulatory control under a range of State, Provincial and Local regulations. Such legislation largely embraces pollution prevention, sustainable resource use, conservation, and socio cultural (heritage) protection. This chapter reviews legislation pertaining to this generic EMP.

According to Section 2 (1, 2 & 3) of the National Environmental Management Act No. 107 of 1998 (NEMA), all organs of state must apply certain principles set out in NEMA when taking decisions that may significantly affect the environment. The key principles of this Act include that all "actions" that they approve must be economically, socially, and environmentally sustainable. It further states that "people and their needs" must be at the forefront of "its concern" and their interests must be served equitably. These legislative requirements include, but are not limited to, the provisions of the legislation represented as described below:

The Constitution of the Republic of South Africa Act No. 108 of 1996)

Section 24 of the Constitution of South Africa (Act 108 of 1996) states that "Everyone has the right (a) to an environment that is not harmful to their health or well-being; and

(b) To have the environment protected, for the benefit of present and future generations through reasonable legislative and other"

Measures that:

- Prevent pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".
- Section 152 of the Constitution states that the objectives of local government are to:
- Ensure that services are provided to communities in a sustainable manner.

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- Promote social and economic development; and
- Promote a safe and healthy environment.

National Environmental Management Act No. 107 of 1998 (as amended)

The National Environmental Management Act 107 of 1998 (NEMA) requires that an environmental authorization is obtained before activities, which have been listed in terms of NEMA, are commenced with. The failure to obtain such an environmental authorization, before commencing with listed activities, could result in administrative sanctions, including compliance notices or directives ordering the cessation of the operations until authorized; and fines of up to ZAR10 million for each such contravention.

The Environmental Impact Assessment Regulations (EIA Regulations) set out the process to be followed in applying for an environmental authorization, while the listing notices; list the activities that require authorization (the Listing Notices). NEMA 107 of 1998 amended in 07 of April 2017.The following are the listed activities:

- EIA Regulations GNR 326
- Listing Notice 1; Government Notice Number (GNR) 327 (Basic Assessment).
- Listing Notice 2; Government Notice Number (GNR) 325 (Full EIA/ Scoping & Environmental Impact Report).
- Listing Notice 3; GNR 324 (It applies on both Basic Assessment and full EIA).

National Environmental Management: Biodiversity Act No. 10 of 2004

Provides management and conservation of South Africa's biodiversity within the framework of NEMA 107 of 1998; the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.

The National Environmental Management Waste Act 59 of 2008

The National Environmental Management Waste Act (NEMWA) reforms the law regulating waste management in order to protect health and the environment providing reasonable measures for the

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prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

The Occupational Health and Safety Act No. 85 of 1993

The Occupational Health and Safety Act make provision in regulation

- Section 8 for the general duties of employers to their employees.
- Section 9 of the Regulations makes provision for general duties of employers and self-employed persons to persons other than their employees.

National Heritage Resources Act (NHRA) No. 25 of 1999

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act. The South African National Heritage Resources Agency (SAHRA) is the responsible authority for implementing the National Heritage Resources Act (NHRA) 1999, (Act 25 of 1999).

Section 38(1) of the NHRA lists development activities that would require authorisation by the responsible heritage resources authority. Activities considered applicable to the proposed project include the following:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length.

(b) the construction of a bridge or similar structure exceeding 50 m in length; and

(c) any development or other activity which will change the character of an area of land, or water -

i exceeding 5 000 m² in extent,

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ii involving three or more existing erven or subdivisions thereof; or

iii involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv the costs of which will exceed a sum set in terms of regulations by SAHRA or a Provincial Heritage

v Resources Authority.

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a Provincial Heritage Resources Authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development.

Water Services Act No. 108 of 1997

This Act provides for the rights of people to basic water supply amongst others basic sanitation. It acknowledges that that there is a duty on all spheres of government to ensure that sanitation services are provided in a manner which is efficient, equitable and sustainable and that it should be sufficient for subsistence and sustainable economic activity. The provision of sanitation services must be undertaken in a manner consistent with the broader goals of water resource management. This goal is in line with the Act as it aims to provide sufficient sanitation services to the region in a sustainable manner.

Conservation of Agricultural Resources (CARA) Act, Act No. 43 of 1983

The CARA aims to ensure the protection of agricultural resources such as land with agricultural potential and water and makes provision for the eradication of alien and invasive species, and protection of topsoil.

NEMA Air Quality Act (AQA), Act No. 39 of 2004

The aim of this law is to regulate air quality and protect the environment in South Africa through reasonable measures to prevent pollution and ecological degradation, while securing sustainable development. The Act also provides national norms and standards for air quality management, monitoring, and control. Under this legislation, Priority Air shed Areas can be proclaimed, where specific

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Air Quality Management Plans are applicable. Regulations are also published under this Act for the format of air quality assessments and what should be included in the assessment. Any Air Quality Management Plan which has been compiled for the area and any proposed WwTW should be in line with this Management Plan. This Act may list activities which may result in atmospheric emissions, and which may have a significant detrimental effect on the environment.

Government Gazette 32434 of 24 July 2009 listed activities, which require an atmospheric emission license before it commences. Air quality limits and thresholds are fundamental to effective air quality management, providing the indicators to safe exposure levels for most of the population. The current South African standards have been revised and National Ambient Air Quality Standards were promulgated on the 24th of December 2009 (Government Gazette No. 32816, Notice No. 1210). The newly proposed standards include particulate matter specifically PM10 (particulates with a diameter of less than 10 micrometre), sulphur dioxide (SO2), nitrogen dioxide (NO_2), ozone (O3), lead, carbon monoxide (CO) and benzene. These revised standards have been adopted as the VTAPA air quality objectives. Any emissions from the proposed WWTW should be within these standards.

National Water Act (NWA), 36 of 1998

Water use is controlled by the National Water Act (NWA) Act No. 36 of 1998. The NWA recognises that water is a scarce resource in South Africa and its provisions are aimed at achieving sustainable use of water to the benefit of all users. The provisions of the Act are thus aimed at discouraging pollution and waste of water resources. According to Section 21 of the NWA the following activities require a water use licence (WUL) prior construction:

"21.(a) taking water from a water resource;

21.(b) storing water;

21.(c) impeding or diverting the flow of water in a watercourse;

21.(d) engaging in a stream flow reduction activity contemplated in section 36;

21.(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);

21.(f) discharging waste or water containing waste into a water resource through a pipe, canal,

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sewer, sea outfall or other conduit;

21.(g) disposing of waste in a manner which may detrimentally impact on a water resource;

21.(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

21.(I) altering the bed, banks, course or characteristics of a watercourse;

21.(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

21.(k) using water for recreational purposes."

3. OBJECTIVES OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The purpose of this EMP is to provide an easily interpreted reference document that ensures that the project environmental commitments, safeguards and mitigation measures from the environmental planning documents, project approvals, and scope of work are implemented.

The objectives for the EMP are:

- To develop, implement and maintain effective management systems for the environmental aspects.
- To document details of environmental protection infrastructure and controls so that they can provide long term protection for the natural environment.
- To ensure compliance with relevant legislation (National, Provincial and Local), regulatory requirements and environmental documents.
- To maximise the value and outcomes of environmental monitoring activities so that the information can be applied to the planning and implementation of future projects.
- To ensure that all Environmental Management considerations are implemented during the planning, operational and maintenance phases of the project.

All the environmental specifications and the procedures discussed in this document were also developed in accordance with the relevant legislation applicable to the development.

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3.1 Phases of the Project

The EMP deals with the following phases as detailed below:

3.1.1 The Planning and Design Phase

Overall Goal for Planning and Design: Undertake the planning and design phase of the development in a way that:

- Ensures that the design of the proposed development responds to the identified environmental constraints and opportunities.
- Ensures that the best environmental options are selected for all components of the project.
- **Ensures that there is sufficient financial provision for environmental assessment, monitoring, rehabilitation, and maintenance. The JW rehabilitation calculation template must be used (See Annexure D).**
- The qualified landscaping specialist must be appointed to undertake rehabilitation on site. The landscaping specialist must pose the following qualifications and work experience:

  - Landscaping Specialist should at least have BA/BSc Honours Degree or 4-year Degree in Natural Sciences/Ecological

  - The Landscaping Specialist must at least be registered with South African Council for Natural Scientific Professions (SACNASP) as a Professional Natural Scientist (Copy of SACNASP Certificate must be submitted).

  - At least three letters from their client/s must be submitted, detailing the landscaping work he/she has undertaken (letters should have the name of the client, description of the project and/or scope of work done, contact details and must be signed). Letters should be in their client's company letterhead, and it must indicate if the work has been completed satisfactorily or not. - Copy of CV must be submitted, specialist should at least have a minimum of five (5) years working experience as landscaping Specialist (See Table 1).

  The EMP offers an ideal opportunity to incorporate pro-active environmental management measures with the goal of attaining sustainable development.

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Pro-active environmental measures minimize the chance of impacts taking place during the construction and operational phase. There is still the chance of accidental impacts taking place; however, through the incorporation of contingency plans (e.g., this EMP) during the planning phase, the necessary corrective action can be taken to further limit potential impacts. In order to meet this goal, action plans for planning and design stages of the project must be identified together with monitoring requirements.

3.1.2 The Construction Phase

The bulk of the impacts during this phase will have immediate effect (e.g., noise-, dust- and water pollution etc.) If the site is monitored on a continual basis during the construction phase, it is possible to identify these impacts as they occur. These impacts will then be mitigated through the contingency plans identified in the planning phase, together with a commitment for sound environmental management from Johannesburg Water and its agents.

3.1.3 Rehabilitation and Reinstatement Phase

This phase will involve restoring the land impacted during the construction phase back to its original state (in the case of slopes, gradients, soil profiles, and hydrology) or better. This process will be mainly on rectifying the negative impacts that have been caused during construction by the removing pollution or contaminants and other dangerous substances from groundwater, sediment, or surface water and improvement of the soil.

3.1.4 The Operational Phase

By taking pro-active measures during the planning and construction phases, potential environmental impacts emanating during the operational phase will be minimised. This, in turn, will minimise the risk and reduce the monitoring effort, but it does not make monitoring obsolete.

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4. ROLES AND RESPONSIBILITY

The implementation of this EMPr requires the involvement of several stakeholders, each fulfilling a different but vital role to ensure sound environmental management during the construction and operational phases. The stakeholders are discussed below:

4.1 Johannesburg Water and its Agents shall:

Ensure that the EMP is kept on JW's Sites and construction sites.

- Remain ultimately responsible for ensuring that the development is implemented according to the requirements of the EMP.
- Ensure that the Environmental section attends all project related tender briefing sessions.
- Although Johannesburg Water appoints specific role players to perform functions on its behalf, this responsibility is delegated.
- Be liable for restoring the environment in the event of negligence leading to damage to the environment.
- Ensure that the EMP is included in the tender documentation so that the contractor who is appointed is bound to the conditions of the EMP, and there's sufficient budget for environmental assessments and/or assessment during the planning, design, construction, replacement of vegetation and restoration of habitats, decommissioning (rehabilitation) phases of the project.
- Ensure that the contractor appointed understands, acknowledges and fully accepts the content of this EMP and their responsibilities for implementation and compliance.
- Monitor compliance with the conditions of the environmental authorisation and the EMP and compliance audits are undertaken.
- Ensure that the Environmental section signs all close out reports to confirm rehabilitation.

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4.2 Appointments and competencies

- The contractor and its appointed sub-contractor must meet the relevant legislative and non-statutory appointments, which must be maintained valid for the entire contract duration.
- All appointees shall be suitably trained and certified competent for the responsibilities they are assigned for.
- Copies of all relevant appointments and the relevant competence certificates must be kept in the relevant Environmental file.

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Table 1: Environmental Officer's Appointment Index

Appointment	Project Type	Legislative Ref	Competency requirements (Min)
Contractor SHE Officer	Unauthorised Project	JW EMP/ JW Waste Management Procedure	National Diploma in Safety & ISO14001:2015 (Introduction/Awareness, implementation, and auditing ISO14001:2015) + 2 years' Experience **OR** National Diploma in Environmental Management + 2 years' Experience OR NEBOSH / SAMTRAC & Basic ISO14001:2015/ Basic Environmental Awareness (Introduction and Implementations to ISO14001:2015) + 4 years' Experience. Register with SACPCMP.
Contractor Environmental Liaison Officer/Environmental Officer	Authorised project	JW EMP and Project Specific approved EMP /Directives/Environmental Authorisation/GA/WUL	National Diploma in Environmental Management/ + 3 years' Experience. BA/BSc Environmental Management + 3 years' experience. The recommended and/or market related minimum Salary/wages for ELO/EO should be **R17 000.00.**

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Environmental Representative/Environmental Rep	Unauthorised Project	JW EMP	Must hold a Senior Certificate (Matric) and one of the following qualifications. National Diploma in Environmental Management/ BA/BSc Environmental Management or Science/ISO 14001:2015(Introduction; Implementation and Auditing/Certificate in Environmental law/National Certificate in Environmental Management. The recommended and/or market related minimum salary/wages for Environmental Representative should be **R10 000.00.**
Consultant Environmental Control Office	Authorised project (as and when required)	JW EMP and Project Specific approved EMP /Directives/Environmental Authorisation/GA/WUL	Reputable Environmental Consulting Company National Diploma or BA/BSc Environmental Science or Management + 3 years' experience as an independent ECO/Consultant
Landscaping Specialist	Unauthorised and Authorised project	JW EMP and Project Specific approved EMP /Directives/Environmental Authorisation/GA/WUL	Reputable Environmental Consulting firm /Landscaping Company.

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			Landscaping Specialist should at least have BA/BSc Honours Degree or 4-year Degree in Natural Sciences/Ecological. - The Landscaping Specialist must at least be registered with South African Council for Natural Scientific Professions (SACNASP) as a Professional Natural Scientist (Copy of SACNASP Certificate must be submitted). - Specialist should at least have a minimum of five (5) years working experience as landscaping Specialist (See Table).

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4.3 The Contractor shall:

- Be bound to conform to the EMP conditions through his/her contract with Johannesburg Water, and is responsible for ensuring that he adheres to all the conditions of the EMP.
- Thoroughly familiarise with the EMP requirements before construction begins and must request clarification on any aspect of these documents, should they be unclear.
- Be responsible for mitigation and rehabilitating all environmental damage at his/her expense.
- Ensure adherence to, and implementation of, the environmental management specifications.
- Ensure that environmental damage, whether intentional or unintentional, is prevented in the first instance, mitigated and rehabilitated, and must adopt a proactive approach followed by a reactive approach.
- Ensures identification of, and compliance with, all environmental laws, all by laws and regulations.
- Ensure that any instructions (whether verbal or written) issued by the site manager, project manager, site engineer or EO, in terms of the EMP is adhered to.
- Ensure that an environmental compliance report is tabled at each site meeting, which must document all incidents, complaints, and non-compliances, and their close out progress, which has occurred during the period before the site meeting.
- Provide a photographic report to JW upon request showing close out of identified issues.
- Provide any project or compliance information that may be requested by JW in any format as requested.
- Ensure that proposed site camp areas are approved by JW environmental section prior to establishment.
- Ensure compliance with the EMP conditions even if there will be no site camps or the project is an emergency or subject to Directives.
- Take comprehensive site photographs for before, during and after construction.
- Ensure that each individual resident/landowner/stakeholder requirement is documented, pertaining to the area to be disturbed, special features, vegetation to be disturbed, rehabilitation requirements (contractors must state to residents/stakeholders that indigenous vegetation species will be put

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back, however, should residents/stakeholder require non-indigenous species to be replaced, these are to be documented before being affected) prior to any disturbance.

- Provide a detailed, site-specific method statement for rehabilitation, which must be approved by JW Engineer and EO.
- Ensure that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
- Ensure that incidents register is kept in the site office.
- Ensure that a register of all public complaints is maintained.
- Ensure that all employees, including those of sub-contractors receive Environmental Induction before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMP (i.e., ensure their staff are appropriately trained as to the environmental obligations).
- Ensure that all disturbed areas are rehabilitated and at least 85% healthy grass/ground cover has established, that rehabilitation is maintained, the sites are free of erosion, waste and pollution of any kind including rubble and spills, and free of weeds and alien invasive species.
- Appoint an Environmental Liaison Officer (ELO) prior Construction for Environmental Authorised Projects.
- Appoint SHE Officer prior Construction for unauthorized projects i.e., the SHE Officer with Environmental Management experience or be trained on Environmental legislation.
- Provide accurate and factual information pertaining to the projects, communications, and discussions at all times.
- Is responsible for NEMA Duty of Care, and Polluter pays principle.

4.4 Environmental Liaison Officer (ELO)/ SHE Officer shall:

- Ensure that the project team is involved in all aspects of project planning that can influence environmental conditions on the site.
- Be permanently on site during the construction phase to oversee the Contractor's internal compliance with the EMP requirements and ensuring that the environmental specifications are adhered to.

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- Assist with day-to-day monitoring of the construction activities. Ensure that any issues raised by the EO will be routed to the SHE Officer for the contractors' attention.
- The ELO/ SHE Officer shall be permanently on site during the construction phase to oversee the Contractor's internal compliance with the EMP requirements and ensuring that the environmental specifications are adhered to.
- Be responsible for keeping detailed records of all site activities that may pertain to the environment and include all these aspects in an environmental register.
- Maintain site documentation and records related to environmental management (EMP, authorisations, permits, way-eaves, method statements, audit reports, monitoring results, receipts for waste removal, environmental file, etc.)
- The ELO/SHE Officer must keep a register of complaints from any community members on environmental issues.
- The ELO /SHE Officer will be required to keep a record of all on-site environmentally related incidents and how these incidents were dealt with.
- Ensure daily implementation of the EMP conditions, and monitoring of the contractor's compliance with EMP conditions, using checklists and visual inspections.
- Provide location details for possible site camp locations to JW environmental section and await approval from this section before establishing.
- Inform JW environmental section when actual work is about to commence.
- Inform JW environmental section of pending completion activities and intention to de-establish, prior.
- Ensure proper rehabilitation is undertaken before site closure.

4.5 Resident Engineer (RE)/ Site Agent shall:

- Liaise with the Contractor and Environmental Officer (EO) on environmental matters, as well as any pertinent engineering matters where these may have environmental consequences.
- Oversee the general compliance of the Contractor with the EMP and other pertinent site specifications.

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- Familiarise him/herself with the EMP specifications and further monitor the Contractor's compliance with the Environmental Specifications daily through the Site Diary and enforce compliance.
- Ensure that Monthly Audits reach the contractor before Monthly Progress Meeting.
- Ensure proper rehabilitation is undertaken before site closure.

4.6 Project Engineer /Inspectors (PE/PI) shall:

- Ensure that there is a sufficient budget for complying with all EMP conditions at the tender stage.
- Ensure sufficient budget is provided for rehabilitation/ Reinstatement.
- Ensure proper rehabilitation is undertaken before site closure.
- Ensure of all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
- Ensure that Contractor(s) are made aware of all stipulations within the EMP.
- Ensure that the EMP is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
- Be fully conversant with the EIA for the project, the EMP, the conditions of the Environmental Authorisation (if applicable), and all relevant environmental legislation.
- Ensure compliance monitoring of contractors on a day-to-day basis.
- Ensure adherence and implementation of the tender requirements.
- Ensure reference of specific non-compliance/non-conformance issues to the responsible units and/or contractors.

4.7 Environmental Officers shall:

- Be responsible for informing the contractors of any decisions that are taken concerning environmental management during the project phase.
- This would also include informing the contractors of the necessary corrective actions to be taken, issuing stop work orders and rehabilitation and remediation instructions if necessary.
- Liaise with environmental authorities where necessary.
- Review all the environmental documents submitted by the Contractor, including sign off.

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- Review all the environmental documents from the Contractor, including sign off.
- Conduct environmental monthly audits of all contractors' work on site where necessary
- Maintain site documentation of related to environmental management (EMP, Method statements, audit reports, monitoring results, receipts of waste removal etc.). Documents to be maintained on the relevant site Documents Control Systems.
- Inspect and report on environmental incidents and check corrective actions.
- Conduct environmental incidents enquiries.
- Review and sign off method statements prepared by Contractors.
- Ensure that an environmental compliance monitoring strategy/framework is implemented.

4.8 Environmental Control Officer (ECO)

The role of the ECO shall be to:

- Act as site 'custodian' for the implementation, integration, and maintenance of the EMPr in accordance with the contractual requirements.
- Ensure successful implementation of the EMPr; and
- Ensure that the Contractor, his employees and/or Subcontractors receive the appropriate environmental awareness training prior to commencing activities.

The responsibilities of the ECO will be to:

- Liaise with the JW Environmental Section and Project Engineer on the level of compliance with the EMPr achieved by the Contractor on a regular basis for the duration of the contract.
- Advise the Project Engineer on the interpretation and enforcement of the Environmental Specifications (ES), including evaluation of non-compliances.
- Enforce compliance with the EA and EMP through audit report and checklist
- Supply environmental information as and when required.
- Review and approve Method Statements produced by the Contractor, in conjunction with the PM and EO.
- Monitor any basic physical changes to the environment because of the construction works according to an audit schedule.

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- Attend regular site meetings and project steering committee meetings.
- Undertake regular monthly audits of the construction works and to generate monthly audit reports. These reports are to be forwarded to the JW EO who will communicate the results and conclusions with the principal Contractor.
- Submit audit reports to the authority as per the requirement of issued Environmental Authorisation.
- Communicate frequently and openly with the Contractor and the Project Engineer to ensure effective, proactive environmental management, with the overall objective of preventing or reducing negative environmental impacts and/or enhancing positive environmental impacts.
- Advise the Project Engineer on remedial actions for the protection of the environment in the event of any accidents or emergencies during construction, and to advise on appropriate clean-up activities.
- Review complaints received and made instructions as necessary; and
- Identify and make recommendations for minor amendments to the EMPr as and when required.

4.9 Environmental Representative (Environmental Rep) shall:

- Review the effectiveness of environmental measures in the workspace/construction environment for which he/she was appointed.
- Identify potential impacts in the workplace.
- Investigate environmental incidents and identify root causes.
- Investigate Environmental Complaints.
- Conduct Awareness training.
- Participate in Environmental inspections.
- Ensure compliance with JW EMP and other environmental management related legislations.
- Ensure Proper Rehabilitation is conducted.
- Attend site SHE meetings where Environmental issues are addressed.
- Guide Construction crew/team on environmental requirements as per JW EMP.
- Assist in day-to-day monitoring of construction activities.

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- Assist in implementation of ISO 14001:2015 standard.
- Assist the SHE Officer/EO with preparation of audits /inspections.

5. CONTENTS FOR CONTRACTOR'S ENVIRONMENTAL FILE

The following documents must be submitted by the contractor in the Environmental file before Construction commences on site. The file must be submitted to the Environmental Section prior construction for approval. The Contractor should achieve a minimum score of 80% for the file to be approved (**Refer to Annexure B: Environmental File Specification).**

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6. ENVIRONMENTAL SPECIFICATIONS

Table 2: Environmental Management and Mitigation Measures that must be implemented during the Design Phase and Construction Phase

Design Phase Measures						
Aspects	**ID**	**Mitigation Measure/Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance indicators**
Project Planning/Design	**1**	• Proposed project is submitted to Environmental Section for screening (Project scope/layout/Maps), • CAPEX and Ops must ensure that there is budget allocated for environmental management throughout the project life cycle i.e., planned project and Directives.	Johannesburg Water (CAPEX/Ops)	Before project commences	• Screening report • Tender document	Keep the records of the project screening report and scope of work as per Directives
Authorisation	**2**	• Appoint Consulting Company • Ensure that all required licences and permits have been obtained before the start of construction. • Ensure that ECO and/or ELO is appointed as per the authorisation and EMP requirement during project execution (as when and required).	Johannesburg Water (CAPEX/ Environmental Section)	Before construction commences	Keep record of all permits, licences and authorisations	Keep record of all permits, licences and authorisations
Project Handover	**3**	• The scope of a project is outlined by CAPEX Engineer during the handover meeting. • Environmental Management Requirements are outlined during the handover meeting.	Johannesburg Water (CAPEX/ Environmental Section)	Before construction commences	Meeting invite EA/GA/WUL/ Screening report	Keep record of all permits, licences and authorisations
Environmental Awareness Training/Inductions	**4**	• Environmental awareness training is given to the Project Team Leaders • Environmental File Specification provided to the Contractor.	Johannesburg Water (CAPEX/ Environmental Section)	Before construction commences	Meeting invite	Meeting records

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		• JW Environmental Management Plan and other procedures are provided to the Contractor.				
Environmental File & Evaluation	**5**	• Contractor submits environmental file for approval prior work commences on site. • Construction activities/work (including site establishment) should ONLY commence when file is approved.	Appointed Contractor/Environmental Section	Before construction commences	Environmental evaluation report.	Approval/ rejection letter records
Construction Phase Measures						
Aspects	**ID**	**Mitigation Measure/Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance indicators**
Site camp establishment	**1**	• Invite the Environmental Officer for the site inspection of proposed site camp prior establishment. • Submit a method statement for Site Camp establishment for approval by JW Environmental Officer/ECO prior commencement of works. • Establish a suitably fenced Site Camp at the start of the contract, which will allow for site offices, vehicle, equipment, material, and waste storage areas to be consolidated as much as possible. Locate the Site Camp at a position approved by the JW EO, at least 100m from watercourses and in an area which is not ecologically sensitive. • Provide water and/or washing facilities at the Site Camp for personnel. • Lim it construction and lay down areas to areas within the development footprint. • Ensure that environmentally friendly on-site sanitation options are selected, and these facilities are properly managed and maintained. • Designated eating areas shall be provided on site. • These eating areas shall be clearly demarcated and shall be provided with bins with lids.	All Contractors	Before commencement of Project	• Visual inspection • Site establishment checklist/Method statement	Method statements approved by CAPEX and the Environmental Officer • Position of Site Camp approved by ECO • Security and access to Site Camp controlled • Clear demarcation of no-go areas as agreed with JW EO. • Detailed site layout plan

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		• Staff will be prohibited from consuming meals anywhere other than at these eating areas and that noise is limited. • All eating areas shall include provision for a water and smoking area.				• Environmental file approval letter.
Environmental Awareness Training	**2**	• Provide environmental awareness training to all personnel on site at the start of their employment. Training should include discussion of: • Potential impact of construction waste and activities on the environment. • Suitable disposal of construction waste and litter. • Key measures in the EMPr relevant to worker's activities. • How incidences and suggestions for improvement can be reported. • Ensure that all attendees remain for the duration of the training and on completion sign an attendance register that clearly indicates participants' names.	All Contractors	• Before workers start working onsite • Before new activities are undertaken	• Check training attendance register • Observe whether activities are executed in line with EMPr requirements	• Proportion of workers that completed. • Environmental training Compliance of workers with EMP
Plant Search and Rescue/Vegetation clearing	**3**	• From information gathered during the plant marking exercise, establish the size. • Requirements for the plant rescue team workforce, and the methodology to be employed during the rescue to maximise the likelihood of success; Document and motivate which species found on site are considered to be conservation worthy. • Follow a multi-pronged approach to maximise the likelihood of success wherever feasible. In addition to transplanting of whole plants, seed can be collected and sown in situ in suitable habitats and/or in an off-site nursery. • Any plants not suitable for transplantation must be considered for transplanting to existing conservation	All Contractors	Before commencement of activities	Visual Inspection/ inspection by Botanist/Ecologist	• Incidents of harm coming to fauna/ flora. • Number of incidents of disturbance of vegetation outside construction site boundary; and

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		areas nearby. This could involve growing these plants on in an off-site nursery for a period of time. • Depending on the conservation worthy species found, the location of suitable existing conservation areas nearby and the location of the off-site nursery, the most appropriate plant rescue options must be detailed in the search and rescue plan, and could be a combination of the following options: • All required permits must be obtained from the appropriate authority covering plants to be affected by the plant rescue operation prior to the removal of the plants. • Demarcate the area for construction prior to each phase and prevent access by construction personnel outside of this area. • Appoint a suitably qualified botanist to undertake search and rescue of key plant species in the development footprint where necessary (Where is applicable. Clearly demarcate sensitive areas, including buffers, with appropriate signage. • Do not allow personnel to enter calcrete vegetation areas. • Do not allow personnel to pick or destroy plants outside of the construction footprint. • Limit clearing to those areas within the footprint of construction for each phase. • Restrict construction vehicles to designated roadways. • Do not allow the temporary storage of building material within sensitive areas. **Aftercare and monitoring**				• Size of area cleared relative to development footprint • Size of area disturbed outside of construction site boundary. • Areas of development footprint must be clearly demarcated

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		• Record numbers and diversity of propagated plants and the health of the same, until they can be planted out. • Aftercare of transplanted plants to be done in accordance with the plant search and rescue plan by an appropriate agent (e.g., staff from the commercial nursery or an appropriately trained onsite Contractor), including watering and alien plant control requirements. If done correctly, the frequency of input will decrease with time. • Record numbers and diversity of transplanted plants and the health of the same. • Monitoring must be undertaken as per requirements of the plant search and rescue plan approved by GDARD, including monitoring of alien plants and maintenance of a photographic record; and • Provide a detailed record (including photographic record) that indicates the success of the plant rescue operation. Records of corrective action taken to improve management of transplanted plants, where relevant, must also be completed. **Applicable Legislation** • National Environmental Management Act: Biodiversity Act (Act 10 of 2004) including Threatened or Protected Species Regulations. • National Environmental Management Act (Act 107 of 1998). • Gauteng Nature Conservation Bill, 2014/Transvaal Nature Conservation Ordinance 12 of 1983; and • National Forests Act (Act 30 of 1998).				

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Excavation	**4**	• The process of excavation and back filling must be carried out as a sequential process following one another as quickly as possible. • Excavations must only remain open for a minimum period of time and during this time they must be clearly demarcated. If excavations place the public at risk these sites must be fenced. • Where possible, close excavations immediately after pipe is laid. • The residents directly affected by open trenches must be notified of the dangers. This will be done during the site-specific phase. • Danger tape shall not be utilised to prevent personnel from open excavations, orange nets should be used for all open excavations on site. Construction vehicles should avoid creating new roads, use existing roads. • Wet exposed surfaces using a water cart, bowser or use a biodegradable and environmentally friendly soil binder to prevent dust emissions. • Dewater excavations regularly and channel water to areas of grass cover. If dewatering is near/within a watercourse and is to be discharged to a watercourse, ensure a silt fence/net and sandbags are used to reduce silt loads. • Topsoil must be cleared (considered to be the upper 150mm of soil surface) and retained as it contains most inorganic matter and nutrients. Topsoil must be kept separate from subsoil and stored in windrows parallel to excavations. • Harvested grass should be retained and used as a mulch to combat erosion.	All Contractors	Throughout construction	Visual inspection	• Daily site inspection. • Damage to the environment (sensitive environment)

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		• Soil should be exposed for the minimum time possible once cleared of indigenous or invasive vegetation. • Avoid prolonged exposure of soils to wind and water erosion when clearing and grubbing. • The stockpiled topsoil (which will be left standing for more than 1 month) must be covered with suitable fabric, and / seeded, to prevent erosion and weed invasion. • Stockpiled topsoil must be covered with suitable fabric to prevent erosion and weed invasion. • No vehicles are allowed to access onto the stockpiles after they have been placed. • Topsoil and subsoil must be kept separate throughout construction and rehabilitation. • A marsh wire or snow netting shall be erected around the exposed excavations to warn the public. • The contractor must rip and rehabilitate temporal roads after project completion. • The Contractor shall be in possession of an emergency oil and chemical spill kit, drip trays and bioremediation substances/enzymes that must be always complete and available on site.				
Topsoil and subsoil	**5**	• The contractor should remove 150mm of topsoil and stockpile at a height of not more than 1m. • Topsoil should be temporarily stockpiled, separately from (clay) subsoil and rocky material, when areas are cleared. If mixed with clay sub-soil the usefulness of the topsoil for rehabilitation of the site will be lost. • Stockpiled topsoil should not be compacted and should be replaced as the final soil layer. No	All Contractors	During Vegetation clearance	Visual inspection	• Incident of incorrect storage and harvesting. • Manifestation of alien invasive plants. • Incident of erosions.

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		vehicles are allowed access onto the stockpiles after they have been placed. • Stockpiled soil should be protected by erosion-control berms if exposed for a period of greater than 14 days during the wet season and seeded. • Topsoil must be hydro seeded during shut down in December. • Topsoil stripped from different sites must be stockpiled separately and clearly identified as such. • Topsoil obtained from sites with different soil types must not be mixed. • Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and micro-organisms in the soil. • Soil must not be stockpiled on drainage lines or near watercourses without prior consent from the Project Manager. • Soil should be exposed for the minimum time possible once cleared of invasive vegetation, that is the timing of clearing and grubbing should be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. • Stockpiled topsoil must be either vegetated with indigenous grasses or covered with a suitable fabric to prevent erosion and invasion by weeds. • Limited vehicular access is allowed across rocky outcrops and ridges. • All cut and fill surfaces need to be stabilized with appropriate material or measures when major civil works are complete. • Erosion and donga crossings must be dealt with as river crossings. Appropriate soil erosion and control				

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		procedures must be applied to all embankments that are disturbed and destabilized as per the Authorisation • All equipment must be inspected regularly for oil or fuel leaks before it is operated. Leakages must be repaired on mobile equipment or containment trays placed underneath immobile equipment until such leakage has been repaired. • Soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site or the soil can be regenerated using bio-remediation methods. • Runoff must be reduced by channelling water into existing surface drainage system.				
Protection of archaeological and heritage resources	**6**	• Alert the construction workforce of the potential existence of artefacts at the site. • Empower staff to stop works on (chance) discovery of artefacts at the site. • Cease construction on (chance) discovery of archaeological sites of heritage importance or redirect machinery away from finds until an archaeologist is able to make a site inspection and establish the importance of the find and make recommendations for preservation and/or record keeping. • Report the presence of graves or human remains, fragments of fossil bone, ostrich egg and stone fragments to HWC. • Obtain a permit for the removal of artefacts from the site if any are discovered during construction.	All Contractors/Johannesburg Water	• Before Construction commences • During earthworks	Visual inspection	• Discovery of possible archaeological material • Rescue and reporting of identified material when discovered
Protection of paleontological resources	**7**	• Identify a stand-by palaeontologist to inspect fossils if they are discovered during construction activities.	Johannesburg Water	Prior commencement	Visual inspection	• Discovery of possible

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		• Empower staff to stop works on (chance) discovery of fossils at the site. • Alert the construction workforce of the potential existence of fossils at the site. • Cease construction on (chance) discovery of fossils and artefacts of paleontological importance or direct machinery away from finds until the identified palaeontologist can make a site inspection and establish the importance of the find and make recommendations for preservation, collection or record keeping.	All Contractors	During earthworks		archaeological material. • Rescue and reporting of identified material when discovered.
Concrete / cement Work/Batching plant	**8**	• Use Ready-Mix concrete rather than batching where possible. • Ensure that no cement truck delivery chutes are cleaned on site. Cleaning operations are to take place off site at a location where wastewater can be disposed of in the correct manner. If this is not possible a suitable washing facility is to be developed on site in consultation with the ECO. • Concrete must be mixed only in an area demarcated for this purpose, ideally on an impervious surface (e.g., cement mixing pit). • Batching operations to take place in a designated area, which will be kept clean at all times. • All concrete spilled outside this area, must be promptly removed by the Contractor and taken to a permitted waste disposal site. • After all concrete mixing is complete; all waste concrete must be removed from the batching area and disposed of at an approved dumpsite. • Ensure separation of clean and dirty water from batching plant.	All Contractors	Throughout construction	Visual inspection and JW EO/ECO approval.	• Number of incidents of batching outside works footprint. • Contamination of water and soil; and • Visible litter / waste on site.

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		• Storm water must not be allowed to flow through the batching area. Water laden with cement must be collected in a retention area for evaporation and not allowed to escape the batching area. • Operators must wear suitable safety clothing. • Wastewater from batching operations to be suitably disposed of. • Waste concrete and cement sludge to be removed on a regular basis (to prevent overflowing) and to be disposed of at a suitable facility. • Unused cement bags will be stored in an area not exposed to the weather and packed neatly to prevent hardening or leakage of cement. • Used cement bags will be stored to prevent windblown dust and potential water contamination. Used bags will be disposed of adequately at a licenced waste disposal facility. • Limit concrete batching to single sites where possible. • Concrete transportation will not result in spillage. • Cleaning of equipment and flushing of mixers will not result in pollution, with all contaminated wash water entering the wastewater collection system. • To prevent spillage onto roads, ready mix trucks will rinse off the delivery shoot into a suitable sump prior to leaving the site. The Contractor shall ensure such designated concrete wash bay area's/ sumps are created and that all concrete trucks delivering concrete to site first empty and clean their shoots at this point before leaving the site. The dried waste product shall be handled as construction rubble.				

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		• Suitable screening and containment will be in place to prevent windblown contamination from cement storage, mixing, loading and batching operations. • All contaminated water and fines from exposed aggregate finishes will be collected and stored in sumps and will be adequately disposed of. • All visible remains of excess concrete will be physically removed on completion of the plastering or concrete pouring and disposed of in an acceptable manner. • Any spilled concrete to be cleaned up immediately. • In practice all wastes arising from construction activities are to be handled; transported and disposed of in accordance with the relevant regulations. All efforts should be made to minimise, reclaim or recycle waste, and failing that, dispose of it in a manner licensed by the government for that purpose.				
Water Management	**9**	• Con serve water wherever possible (e.g., ensure that areas are not watered excessively, and all leaking pipes are replaced and repaired immediately). • Adequate erosion, runoff and sedimentation prevention, control and mitigation measures must be instituted at all sensitive areas, such as embankments, slopes, river crossings/watercourses/drainage lines, wetlands, when excavations or disturbance occurs within these areas, within the buffers, beds, and banks. • These control measures must include use of silt fences/traps, sandbags, retention of vegetation, berms, immediate replacement of vegetation. Additionally, reno mattresses, riprap, stone pitching,	All Contractors	Throughout construction/post construction	Visual inspection	• Incidence of storm water contamination. • Visible leaks/ water wastage. • And Visible surface erosion.

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		gabions, use of geotextiles) e.g., biojute must be used at the direction of the JW Engineer. • Adequate sedimentation control measures must be instituted at any river crossings when excavations or disturbance of a riverbanks or riverbeds takes place. • Adequate sedimentation control measures must be implemented where excavations or disturbance of drainage lines of a wetland may take place. • All fuel, chemical, oil, etc. spills must be confined to areas where the drainage of water can be controlled. Use appropriate structures and methods to confine spillages such as the construction of berms and pans, or through the application of surface treatments that neutralise the toxic effects prior to the entry into a water course. • The drip trays and spill kits must be used to contain oil from spilling into the water. Ensure adequate drip trays are available. • During construction through a wetland or watercourse, most of the flow of the wetland should be allowed to pass downstream. • Vehicular traffic across wetland and watercourse areas must be avoided. • No dumping of foreign material in streams, rivers and/or wetland areas is allowed. • The wetland area and/or river must not be drained, filled or altered in any way including alteration of a bed and/or, banks, without prior consent from the DWS. The necessary licenses must be obtained in terms of Section 21 and 22 of the National Water Act, 36 of 1998 from DWS. • No fires or open flames are allowed in the vicinity of the wetland, especially during the dry season.				

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		• No swimming, washing (including vehicles and equipment), fishing or related activity is permitted in a wetland or river. • Disturbances to nesting, breeding and roaming sites of animals in or adjacent to wetland areas must be minimized. • Portable Water shall be the last resort info dust suppression on site.				
Air Pollution	**10**	• Speed limits must be implemented in all areas, including public roads and private property to limit the levels of dust pollution. • Dust must be suppressed on access roads and construction sites during dry periods by the regular application of water or a biodegradable soil stabilisation agent. Water used for this purpose must be used in quantities that must not result in the generation of run-off. • Where possible the use of potable water should be minimised for dust suppression purposes, preferably recycled or reused water. • The site-specific investigation will quantify the impact of dust on nearby wetlands, rivers and dams in terms of sedimentation. Mitigation measures identified during the site-specific study must be implemented. • The Contractor must notify the principal of all schools within 50m of the site of proposed activities. The principal must in turn ensure that children with allergies and respiratory ailments take the necessary precautionary measures during the construction period. The Contractor must ensure that construction activities do not disturb school	All Contractors	Throughout construction	Visual inspection	• Visible air pollution.

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		activities e.g., dust clouds may reduce visibility affecting sports activities. • Waste must be disposed of, as soon as possible at a municipal transfer station, skip or on a permitted landfill site. Waste must not be allowed to stand on site to decay, resulting in malodours. • Noise control measures must be implemented. All noise levels must be controlled at the source. All employees must be given the necessary ear protection gear. IAP's must be informed of the excessive noise factors. • The Contractor must inform all adjacent landowners of any after-hour construction activities and any other activity that could cause a nuisance e.g., the application of chemicals to the work surface. Normal working hours must be clearly indicated to adjacent landowners. • No loud music is allowed on site and in construction camps. • No fires are allowed if smoke from such fires will cause a nuisance to IAPs.				
Social and cultural	**11**	• Access by non-construction people onto any construction sites must be restricted. The Contractors activities and movement of staff must be restricted to designated construction areas only. • The Contractors crew must be easily identifiable due to clothing, identification cards or other methods. • Rapid migration of job seekers could lead to squatting and social conflict with resident communities and increase in social pathologies if not properly addressed. The Contractor must ensure that signs indicating the availability of jobs are installed.	All Contractors	Throughout construction	Visual inspection	• Community complaints. • Complaints register. • Daily environmental inspection

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		• Criteria for selection and appointment (by the Contractor) of construction labour must be established to allow for preferential employment of local communities. The Local Authority must be actively involved in the process of appointing temporary labourers. • Sub-Contractors and their employees must comply with all the requirements of this document and supporting documents e.g., the Contract document that applies to the Contractor. Absence of specific reference to the sub-contractor in any specification does not imply that the sub-contractor is not bound by this document. • No member of the construction workforce is allowed to wander around private property, except within the immediate surroundings of the site. • The Contractor must provide suitable sanitation facilities for site staff. Sanitation provided during the construction phase should be managed so that it does not cause environmental health problems. The use of the surrounding veld for toilet purposes is not permitted under any circumstance. • The Contractor must arrange for all his employees and those of his sub-contractors to be informed of the findings of the environmental report before the commencement of construction to ensure: • A basic understanding of the key environmental features of the work site and environments, and • Familiarity with the requirements of this document and the site-specific report. • Supervisory staff of the Contractor or his sub-contractors must not direct any person to undertake any activities which would place such person in				

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		contravention of the specifications of this document endanger his/her life or cause him/her to damage the environment. • The demand for construction materials and supplies will have an effect on the local economy. This impact can be optimised by sourcing and purchasing materials locally and regionally wherever possible, insofar as the material complies with the design specification. • The Contractor must maintain a detailed complaints register. This must be forwarded, together with solutions, to the authorities when requested.				
Aesthetics	**12**	• Scenic Quality • Damage to the natural environment must be minimized. • The contractor may not remove any trees. If trees are in the way of the pipe route or with the development sites, the contractor must inform the environmental section who will then liaise with city parks for permission or recommendation. • Trees and tall woody shrubs must be protected from damage to provide a natural visual shield. Excavated material must not be placed on such plants and movement across them must not be allowed, as far as practical. • The clearing of all sites must be kept to a minimum and surrounding vegetation must, as far as possible, be left intact as a natural shield. • No painting or marking of natural features must be allowed. • Above-ground Structures (reservoirs, water hammer tanks, valve chambers, pump stations etc.)	All Contractors	Throughout construction	• Visual inspection. • Wayleaves	• Daily inspection • Environmental incident.

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		• All above ground structures should be located in areas where the visual impact from roads, houses etc. is minimised. • All above ground structures could be treated or painted to blend in with the natural environment. • Cut and fill areas, river and stream crossings and other soil stabilisation works must be constructed to blend in with the natural environment. • Natural outcrops, rocky ridges and other natural linear features must not be bisected. Vegetation on such features must, as far as possible, not be cut unless necessary for construction. • Excavated material must be flattened (not compacted) or removed from site. No heaps of spoil material must be left on site once the Contractor has moved to a new construction site. • Any complaints from IAP's regarding the appearance of the construction site must be recorded and addressed promptly by the Contractor.				
Fauna and Flora	**13**	**Flora** • All suitable and rare flora and seeds must be rescued and removed from the site. They must be suitably stored, for future use in rehabilitation. • The felling and/or cutting of trees and clearing of bush must be minimised. • Bush must only be cleared to provide essential access for construction purposes. • The spread of alien vegetation must be minimized. • Any incident of unauthorised removal of plant material, as well as accidental damage to priority plants, must be documented by the Contractor. • Woody vegetative matter stripped during construction must either be spread randomly	All Contractors	Throughout construction	• Visual inspection • Wayleave from City Parks. • Biodiversity permit from Gauteng Department of Rural and Development	• Environmental incident register • Daily inspection • Number of environmental incidents. • Fauna and flora removal and relocation register

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		throughout the surrounding veld to provide biomass for other micro-organisms and habitats for small mammals and birds, or it may be stockpiled for later redistribution over the reinstated top soiled surface. No vegetative matter must be burnt or removed for firewood other than those removed during the grubbing and clearing phase. Such vegetation can be made available to the local inhabitants to be used as firewood. • No tree outside the footprint of the Works area must be damaged. **Fauna** • No species of animal may be poached, snared, hunted, captured, or wilfully damaged or destroyed. • Snakes and other reptiles that may be encountered on the construction site must not be killed unless the animal endangers the life of an employee. • Anthills and/or termite nests that occur must not be disturbed unless it is unavoidable for construction purposes. • Disturbances to nesting sites of birds must be minimized. • The Contractor must ensure that the work site is kept clean and free from rubbish, which could attract pests.				
Infrastructure	**14**	• The relevant authorities must be notified of any interruptions of services, especially the Local Municipality, National Road Agency, Transnet, TELKOM, and ESKOM. In addition, care must be taken to avoid damaging major and minor pipelines and other services. • The integrity of property fences must be maintained.	All Contractors	Throughout construction	• Visual inspection • Wayleaves from different entities.	• Incident register. • Permit/ Way-leave register • Complaints register.

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		• No telephone lines must be dropped during the construction operations, except where prior agreement by relevant parties is obtained. All crossings must be protected, raised, or relocated as necessary. • All complaints and/or problems related to impacts on man-made facilities and activities must be promptly addressed by the Contractor and documented. • Proper storage facilities should be provided for the storage of oils, grease, fuels, chemicals, and hazardous materials. • The Contractor must ensure that accidental spillage does not pollute soil and water resources. • Fuel stock reconciliation must be done on all underground tanks to ensure no loss of oil, which could pollute groundwater resources. • Cement must be stored and mixed on an impermeable surface. • The Contractor shall ensure that existing services (e.g., roads, pipelines, and power lines and telephone services) are not damaged or disrupted unless required by the contract and with the permission of the RE. • The Contractor shall be responsible for the repair and reinstatement of any existing infrastructure that is damaged or services which are interrupted. • A time limit for the repairs may be stipulated by the RE in consultation with the Contractor.				
Blasting	**15**	• Blasting must not endanger public or private property. • Noise mufflers and/or soft explosives must be used to minimize the impact on animals.	All Contractors	Throughout construction	Visual inspection/ Engineer report	• Incident register. • Complaints register.

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		• All the provisions of the Explosives Act, 26 of 1956 and the Minerals Act, 50 of 1991 must be complied with. • The Contractor must take measures to limit fly rock. • Certificate of competence. In file • Blasting permit must be obtained from the South African police station issued in terms of section 9 of explosive Act, Act 26 of 1956) prior blasting. • Method statement for drilling and blasting (NB: Submitted for acceptance before any works) in file • Provide the MSDS's for the chemicals are to be used. • Proof of notification to the affected community. • The Appropriate PPE.				• Permit register.
Workshops, storage areas and materials handling	**16**	• These areas shall be chosen to cause the least impact on the biophysical and social elements of the area. • The siting of workshops, maintenance and refuelling sites and materials storage areas shall not be in the vicinity of sensitive sites e.g., wetlands, cultivated fields or drainage lines, or where local landowners can be disturbed. • Storm water shall be diverted around the storage area. Storm water falling on the storage area shall be discharged if it meets the required water quality standards. • Proper storage facilities, placed on an impermeable surface, shall be provided for the storage of oils, grease, fuels, chemicals, and other hazardous materials to be used during the construction phase of the project. If fuel is required on site, it shall be stored in a secure area in a steel tank supplied and	All Contractors	Throughout Construction	• Visual inspection • Method statement for handling hazardous substances. • MSDS	• Hazardous substances register. • MSDS file • Spill register • Incident register.

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		maintained by the fuel suppliers. Leakage of fuel shall be avoided. • An adequate bund wall, 110% of volume, shall be provided for fuel and diesel areas to accommodate any spillage or overflow from these substances. The area inside the bund wall shall be lined with an impervious lining to prevent infiltration of the fuel into the soil. • In addition, hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or container and Material Safety Data Sheets (MSDS's) will be made available for all hazardous chemicals. Before containers or storage facilities are erected, emergency procedures in the event of misuse or spillage that may negatively affect an individual or the environment will be in place. • The storage facilities (including any tanks) shall be surrounded by a bund wall, in order to ensure that accidental spillage does not pollute local soil or water resources. • The storage areas shall not be utilised for accommodation purposes and shall be access controlled. • The storage area shall be kept tidy, and the area shall be rehabilitated after use. • An inventory of any hazardous chemicals/substances (including that within equipment) kept on site, along with a description of possible ill effects and treatment of health-related afflictions resulting from accidents, shall be kept in the storage area as well as by the appropriate manager. These areas shall be securely fenced.				

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		• Gas welding cylinders and LPG cylinders shall be stored in a secure, well-ventilated area. • A notice board with the contact details of the responsible party shall be displayed at the gate to the storage area. • The contractor shall ensure that any delivery drivers are informed of all procedures and restrictions required to comply with the EMP. Someone with an adequate understanding of the CEMP shall supervise drivers during delivery and off-loading. • All vehicles and machinery will be inspected for any leaks or malfunctions regularly. Vehicle servicing or repairs is prohibited from site, unless in an emergency. • Drip trays shall be inspected and emptied daily and serviced when necessary. Drip trays shall be closely monitored during rain events to ensure that they do not overflow. The contents must be disposed of at a recognised site. • All repairs done on machinery using hydrocarbons as fuels or lubricants shall have a drip tray placed strategically to avoid incidental spillage. • Workers shall be made aware of the health risks associated with any hazardous substances used (e.g., smoking near refuelling depots), and shall be provided with appropriate protective clothing / equipment in case of spillages or accidents. • Cement and other potential environmental pollutants shall be stored and mixed on plastic sheeting or ready-mix trucks shall be used. There shall be no opportunity for environmental contamination.				

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		• Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediate to the satisfaction of the EO. • The Contractor shall be in possession of an emergency spill kit that must be always complete and available on site.				
Waste Management	**17**	Methods for waste management and waste minimisation shall be implemented from the outset of the contract as per the Waste Management Plan to be submitted to Client. All personnel shall be instructed to dispose of all waste in the proper manner. A waste avoidance and minimisation approach will be encouraged for the duration of the project. The following steps in order will be applied. • Prevention – avoid and minimise waste • Recycle – reuse and recover all general waste • Treat – treatment to reduce toxicity reduce waste quantities • Dispose – waste removal into a registered landfill facility **Solid waste** Waste with the potential for market re-use will be stored in separate containers, this includes, scrap metal, used tyres and paper. This waste will be recycled wherever possible. Solid waste shall be temporarily stored in tip – poof metal drums or waste skips at an approved area on site for collection and disposal. This area shall be away from drainage lines or water courses. • All general waste drums or skips will be appropriately labelled GENERAL WASTE	All Contractors	Throughout Construction	• Visual inspection/Environmental inspection checklist. • Legal Documents: Transport certificate obtained from GDARD for transporting general or hazardous waste. • Transport certificate obtained from City of Johannesburg for transporting general waste within COJ. • Waste manifest/	• Littering • Soil contamination • Water pollution.

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		• A refuse control system shall be established for the collection and removal of refuse to the satisfaction of Client and ECO. • No waste shall be burned at the site offices or anywhere else on the site. • All building rubble shall be a) removed from the site and disposed of at an appropriate dumping site, or b) temporarily stored in a clearly demarcated area on site for future use. • All waste shall be disposed at an appropriate waste disposal facility. **Litter** • No littering by construction workers shall be allowed. During the construction period, the facilities shall be maintained in a neat and tidy condition and the site shall be kept free of litter. • Measures shall be taken to reduce the potential for litter and negligent behaviour regarding the disposal of all refuse. • Littering, discarding, or burying of any materials shall not be allowed on site. **Hazardous waste** • Hazardous waste shall be temporarily stored in tip – poof metal drums or waste skips at an approved area on site for collection and disposal. This area shall be away from drainage lines or water courses. • All hazardous waste drums or skips will be appropriately labelled.			waste disposal certificate/ weighbridge slip.	

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		• Hazardous waste must not be temporary stored on site for a period exceeding 90 days as per the National Environmental Management Waste Act (Act 59 of 2008) as amended in 2014) (Schedule 19 (2)). **HAZARDOUS WASTE.** • Hazardous waste such as bitumen, tar and oil shall be disposed of at a registered waste disposal facility. Special care shall be taken to avoid spillage of tar products such as tar prime or pre-coating fluid to avoid water-soluble phenols from entering the ground or contaminating water. • All used filter materials shall be stored in a secure bin for disposal off site. Any contaminated soil shall be removed and replaced with clean soil. Soil contaminated by oils and lubricants shall be collected and disposed of at a facility designated by the local authority to accept contaminated materials. • Used oil, lubricants, and cleaning materials from the maintenance of vehicles and machinery shall be collected in a holding tank and returned to the supplier. Water and oil shall be separated in an oil trap. Oils collected in this manner shall be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at an approved hazardous waste disposal site. Oil collected by a mobile servicing unit shall be stored in the service unit's sludge tank and discharged into the safe holding tank for collection by the specialist oil recycling company. • Sludge should be managed in accordance with the Sludge Guideline 2010.				

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		• Sludge should be kept only at the drying bed and no sludge should be stored at a permeable ground or natural ground. • Hazardous waste shall be disposed of at a registered hazardous waste disposal site, disposal certificates shall be kept in the site file for record. **Medical Waste** • All medical waste will be contained in the special bins provided. All sharp needles must be separated from other medical waste, • All outdated and disused medicines will be disposed of as a hazardous medical waste or returned to the supplier for disposal. (Tablets and syrups will be crushed and/or dissolved before disposal as hazardous waste), • Medical waste used on personnel coming for treatment at the clinic are to be placed on a demarcated container storage room, • The Occupational Health Nurse (OHN) will notify a service provider for removal of the medical waste prior exceeding 90 days. • The service provider to provide Waste Manifest as well as the Safe Disposal Certificate, to the OHN who will maintain the copies of the waste manifest and safe disposal certificate. • The OHN will arrange for an approved hazardous waste disposal company to collect and dispose of this medical waste. The OHN is responsible for and authorised to keep all records in connection herewith (disposal certificates).				

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Ablution facilities	**18**	• Provide ablution facilities (i.e., chemical toilets) for all site staff at a ratio of 1 toilet per 15 workers (absolute minimum 1:25). • Secure all temporary/portable toilets to the ground within the Site Camp to the satisfaction of JW EO/ECO to prevent them toppling due to wind or any other cause. • Maintain toilets in a hygienic state (i.e., toilet dispensers to be provided, toilets to be cleaned and serviced regularly (by registered appropriate waste contractor), and toilets to be emptied before long weekends and builders' holidays). • Remove/ appoint an appropriate supplier to remove accumulations of chemicals and treated sewage from the site and dispose of at an approved waste disposal site or sewage plant. • Ensure that no spillages occur when the toilets are cleaned or emptied. Repeated incidents of spillage of chemicals and or waste (i.e., more than one incident), will require toilets to be placed on a solid base with a sump. • Ablution facilities must be located at least 50m from any watercourse. • Ablution facilities shall be provided on site. • The positioning of the ablution facilities shall be done in consultation with Client and shall be placed so that it cannot contaminate the natural streams and rivers. One toilet shall be provided per 10 staff members on site. Toilets shall be positioned within walking distance of wherever employees are employed on the site. Toilets shall be provided with locks and doors shall be secured to prevent the toilets from blowing over.	All Contractors	Throughout construction	• Visual inspection • Records of waste manifest/disposal certificates/ weighbridge slip	• Incidence of staff not using Facilities • Incidence of pollution

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		• The toilets shall be placed outside of areas susceptible to flooding. • Chemical toilets shall be serviced regularly by an authorised service provider and removed to a registered wastewater treatment works and disposal certificates shall be obtained from the waste disposal facility for each disposal and retained on site. • Polluted run-off must be discharged in the local sewerage main and not overland or into public streams. In instances where a sewerage main is not available, polluted run-off will be collected in sub-surface tanks and a reputable effluent removal contractor will be contracted to dispose of the waste in an environmentally acceptable manner. Official documentation shall be obtained from the waste disposal facility for each disposal and retained on site. • Toilets situated close to the site boundaries or within sight of residential areas shall be hidden behind screens or other cover as approved by the Engineer. • Discharge of waste from toilets into the environment and burial of waste is strictly prohibited. • Only flushable toilets should be utilised on site. • If the Ablution facilities are to be connected to the Municipal sewer line, method statement and a letter for municipal tax and rates should be submitted to JW Environmental section and responsible Depot for approval. • A letter or agreement for disposing waste must be obtained from the applicable WWTW; this must be provided by service provider. Waste manifests, disposal certificates and service certificates are				

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		required; these must be provided by service provider. • The contractor shall not appoint service providers who do not have registration certificates with GDARD and CoJ for transporting hazardous (and general waste), and copies of permits for landfills, and agreement letter from WWTW, to be used for disposals. The contractors themselves are encouraged to register as general and hazardous waste transporters, and open accounts with Pikitup, so disposal slips may be obtained.				
Access road and traffic control	**19**	**Access Roads** • The Contractor and the affected landowner must collaborate on the planning and construction of new access routes and the repair or upgrading of existing routes. • Access to the site must be controlled such that only vehicles and persons directly associated with the work gains access to the site. • Temporary access roads must not be opened until required and must be restored to its former state as soon as the road is no longer needed**.** **Traffic Control** • All reasonable precautions must be taken during construction to avoid severely interrupting the traffic flow on existing roads, especially during peak periods. • Before any work can start the Local Traffic, Department must be consulted about measures to be taken regarding pedestrian and vehicular traffic control and obtain proper road signage's	All Contractors	Throughout construction	• Method statement for access road and traffic control. • Wayleave	• Daily Inspection checklist. • Environmental incident. • Incident register.

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Electrical	**20**	• Measures must be taken during thunderstorms to protect workers and equipment from lightning strikes. • All tall structures must be properly earthed and protected against lightning strikes.	All Contractors	Throughout construction	• Permit • OHS approval letter • Wayleave	• Approval letter • Electrical certificate
Development Footprint	**21**	• The development footprints and disturbed areas surrounding the proposed project infrastructure should be kept at minimum as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum. • The extent of all development footprint areas and permanent/ temporary structures must be limited to what is essential. • As far as possible, existing roads are to be utilised, to limit cumulative impacts from roads and traffic. • The height of any temporary structures such as topsoil stockpiles should be kept as low as possible below 1m.	All Contractors	Throughout construction	• Agreement letter. • Wayleave	• Incident register. • Complaints register.
Fire Prevention	**22**	• The Contractor must take all the necessary precautions to protect the materials on site and to avoid veld fires. • No fires or open flames are allowed on site unless directly used for construction purposes, • Review all SANS standards relating to fire precautions and fire control namely, SANS 0131-3 Section 8 and SANS 089-1 or as amended. • The Contractor must have fire-fighting equipment and a first aid box available on site and on all vehicles working on site. • All waste bins must be kept away from fuel tank installations.	All Contractors	Throughout construction	• Visual inspection • Emergency Response Plan.	• Fire extinguisher inspection checklist. • Incident register • Mock drill report.

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		• All fuel tanks must be installed above ground, depending on the volume of stored fuel, for easy detection of fuel leaks. • Any welding or other sources of heating of materials must be done in a controlled environment, wherever possible and under appropriate supervision, in such a manner as to minimise the risk of veld fires and/or injury to staff. • Fires lit for comfort (warmth) must be actively discouraged by the Contractor, due to the risk of veld fires and the risk to adjacent properties. Also, no waste material must be burnt.				
Noise Pollution	**23**	• Temporary noise pollution due to construction works should be controlled by proper maintenance of equipment and vehicles and tuning of engines and mufflers. Construction works should be completed in as short a period as possible by assigning qualified engineers and foremen. • It is the responsibility of the Contractor to monitor for the mitigation of such impacts. Noise problems should be reduced to normally acceptable levels by incorporating low-noise equipment in the design and/or locating such mechanical equipment in properly acoustically lined buildings or enclosures. In the presence of adequate buffer zones between the facility and residential areas, noise control measures must be minimized.	All Contractors	Throughout Construction	Random noise measurements	• Results of random noise measurements • Number of registered complaints
Complaints	**24**	Maintain complaints register for all complaints. The register must list: • Complainant name and contact details. • Date complaint was lodged. • Person who recorded the complaint. • Nature of the complaint.	All Contractors	Throughout construction	Complaints register	• Availability of register on site • Designated person to

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		• Actions taken to investigate the complaint and • outcome of the investigation. • Action taken to remedy the situation. • Date on which feedback was provided to complainant.				maintain register • Complaints logged • Complaints followed up and Closed out.
Housekeeping	**25**	• All construction and operational areas must be always kept in a neat and orderly condition. • An efficient removal system of waste and rubble must be ensured during all development phases. • All operational facilities, including vehicles, should be actively maintained. • Any areas for material storage, waste sorting and other potentially intrusive activities must be screened from view as far as considered feasible. • Regularly inspect all construction machinery and holding tanks for leaks or damages. • Place generators on drip trays. • Repair any defects as soon as possible. In the case of leaks, ensure that the leaking water or effluent is captured and not released into the environment. • Service and refuel equipment that uses hydrocarbon fuels, oils, lubricants, and other hazardous chemicals at the designated area at the Site Camp only under conditions approved by JW EO/ECO • Ensure that absorbent pads (or equivalent) and/ or drip trays are available to collect any oil, fluid, etc. in the case of a breakdown or emergency repair outside the designated area. Keep a copy of fuels and hazardous substance inventory on site.	All Contractors	Throughout	Visual inspection of site camp/ construction site	Regular inspection reports by SHE Officer and JW EO

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		• Keep spill containment and clean-up equipment at all work sites and for all polluting materials used at the site. • Prevent discharge of any hazardous substances or pollutants, such as cements, concrete, chemicals, and other contaminated wastewater and fuels into the ground, surface, or storm water systems on site. • Control litter and keep construction areas as clean and neat as possible.				
Transportation and refuelling	**26**	• Undertake regular maintenance of vehicles and machinery to identify and repair minor leaks and prevent equipment failures. • Undertake any on-site refuelling and maintenance of vehicles/machinery in designated areas. Line these areas with an impermeable surface and install oil traps. • Ensure that oils and lubricants used for maintenance of equipment in the field are correctly contained. • Use appropriately sized drip trays for all refuelling and/or repairs done on machinery – ensure these are strategically placed to capture any spillage of fuel, oil, etc. • Use drip trays under all equipment and plants that are parked overnight or for long periods. • Store and handle fuels, oils and chemicals so as to avoid the risk of spillage, i.e., in waterproof and impervious	All Contractors	Throughout Construction	Visual inspection of vehicles, barges, machinery and refuelling / maintenance areas	• Incidence of non-compliance • Incidence of leaks and spills • Cost of cleaning up spills
Safety and Security	**27**	• Do not allow any open fires on the site. • Do not allow smoking on the site except within designated areas. Suitable fire-fighting equipment must be readily available in these areas.	All Contractors	Throughout construction	• Inspect attendance register for training sessions	• Number of fire incidents

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		• Equip all fuel stores and waste storage areas with fire extinguishers. • Ensure that all personnel on site are aware of the location of fire-fighting equipment on the site and how the equipment is operated. • Suitably maintain fire-fighting equipment. • Ensure that emergency procedures (in relation to fire, spills, contamination of the ground, accidents to employees, use of hazardous substances, etc.) are established prior to commencing construction. • Make all emergency procedures available, including responsible personnel, contact details of emergency services, etc. to all the relevant personnel. Clearly demarcate emergency procedures at the relevant locations around the site. • Secure the Site Camp, particularly to restrict • Unauthorised access to fuels and other hazardous substances. • Provide suitable emergency and safety signage on site and demarcate any areas which may pose a safety risk (including hazardous substances, deep excavations, etc.). • Advise the ECO of any emergencies on site, together with a record of action taken.	All Contractors	Before and during construction	• Inspect fire extinguishers and certificates Visual inspection	• Certified extinguishers in appropriate locations Number of safety / emergency incidents.
Response to environmental pollution	**28**	• In the event of environmental pollution, e.g., through spillages, immediately stop the activity causing the problem. • Maintain relevant Material Safety Data Sheets (MSDS) at the site for all potentially hazardous substances (as defined in the regulations for hazardous chemical substances). In the event of an emergency, procedures detailed in the MSDS shall be followed. Clean up any spills immediately,	All Contractors	Throughout construction	• Maintain register of pollution events and response • Following resumption of activities, frequently	• Number of incidents • Time activities stopped • Number of recurring Incidents

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		through containment and removal of free product and appropriate disposal of contaminated soils. • Immediately remediate and rehabilitate areas in the event of a spill of an environmentally hazardous substance. • Only resume activity once the problem has been stopped or (in the case of spillages) the pollutant can be captured without reaching the environment. Repair faulty equipment as soon as possible. • Treat hydrocarbon spills, e.g., during refuelling, with adequate absorbent material, which then needs to be disposed of at a suitable landfill. • Ensure a quantity of appropriate remedial agent, capable of containing and/or remediating a hydrocarbon spill is available on site at all times in case of an emergency spill. The material shall be capable of handling a spill of at least 200l. • Report all fuel, oil or hydraulic fluid spills to the JW EO/ECO so that appropriate clean-up measures can be implemented. • Report all incidents within 24 hours to JW environmental section. • All environmental incidents must be investigated within seven (7) working days.			inspect repaired equipment to ensure proper functioning	• Availability and 66complete ness of register
Storm Water Management	**28**	**Objective** • To minimise erosion of soil from site during construction. • To minimise deposition of soil into drainage. • Minimise loss of vegetation cover due to construction related activities.	All Contractors	Throughout Construction	• Visual inspection. • Storm water management Plan. • Wayleave from JRA	• Daily inspection checklist. • Incident register.

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		Mitigation Measures • Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations) • Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from drainage lines and wetlands. • Erosion control measures: Run-off control and attenuation on slopes (sandbags, logs), silt fences, storm water channels and catch-pits, shade nets, soil binding, geofabrics, hydro seeding or mulching over cleared areas. • Control depth of excavations and stability of cut faces/sidewalls. • Compile a comprehensive storm water management plan as part of the final design of the project and implement during construction and operation.				
Indigenous Vegetation, Re-vegetation, Rehabilitation, Reinstatement	**29**	**Objective** To ensure that suitable rehabilitation and re-vegetation of disturbed areas is undertaken the following legislations are applicable: **Legislation and Standards** • Conservation of Agricultural Resources Act (Act 43 of 1983 • Environment Conservation Act (Act 73 of 1989 • National Forestry Act (Act 84 of 1998	All Contractors	Throughout Construction	• Rehabilitation Plan • JW EMP • Visual inspection • Ecologist Specialist report • Environmental Authorisation/ GA	• Daily inspection checklist. • Rehabilitation report • Waste management collection report (Waste Disposal Certificate).

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		• National Environmental Management Act 107 of 1998 and Gauteng Nature Conservation Bill, 2014. • National Environmental Management Biodiversity Act 10,2004. **Mitigation measures** In order to meet this goal, the following objective, actions, and monitoring requirements are relevant: • Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use native/indigenous plant species removed from disturbance areas in the rehabilitation phase as per the re-vegetation and rehabilitation management plan. • Alien/non-native species must not be used. If these are requested/ required by stakeholders, then this must be documented by contractor. • Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved. • On-going alien plant monitoring and removal within the disturbed project footprint (where the initial clearing for construction took place) must be undertaken on all areas of natural vegetation on an annual basis. • All temporary facilities, equipment and waste materials must be removed from site and appropriately disposed of. • All temporary access road must be rehabilitated to their original condition			• Practical and completion certificate. • Community Happy Letters.	

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		• Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion. • On-going inspection of rehabilitated areas to determine effectiveness of rehabilitation measures implemented. • On-going alien plant monitoring and removal should be undertaken as per the approved Rehabilitation/Re-vegetation plan. **Management and Mitigation Requirement** • Conduct a detailed search of at the area. As a minimum, this should take place during the spring and summer months prior to impoundment so positive identification of flowering plants can be made. This should be done taking due cognisance of specialist studies already undertaken as part of the EIA process. • Allow time for additional searches if these are deemed necessary, based on progress and diversity of plant species found. • Identify and physically mark all conservation worthy plants found on the ground; and • Capture markers and reference in a retrievable system, so that these can be located again for transplanting (e.g., using a combination of aerial photography, GPS, and GIS, as appropriate).				
Practical and Final completion inspection	**30**	• Ensure that practical inspection is conducted before the Contractor hands over the project back to JW in order to ascertain if the reinstatement or rehabilitation has been done accordingly.	CAPEX/ OHSE& DM/ All Contractors	During the final stage of project	• Meeting invite • Visual inspection	• Meeting invite • Attendance register • Snag list

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		• The snag list is to be compiled and accepted by all parties (JW CAPEX Representatives, JW environmental section as applicable, and appointed Contractor) All responsible personnel including Environmental representative sign both practical and final completion letter.				• Signed practical and final completion inspection letter.
Final close out report	**31**	• Conduct final audit on site. • EO must ensure that audit reports are signed by RE/Engineer and Contractor. • Environmental File is returned to JW, after rehabilitation has been deemed successful.	OHSE & DM	During the final stage of project.	• Final audit report. • Signing of Audit reports.	• Final Audit report. • Signed Audit report. • Environmental file.

Table 3: Environmental Management and Mitigation Measures that must be implemented during the Operational Phase

Operational Phase Measures						
Aspects	**ID**	**Mitigation Measure/Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance indicators**
Waste Management	**1**	Sanitation Facilities • Ablution facilities shall be provided on site. • The positioning of the ablution facilities shall be done in consultation with Client and shall be placed so that it cannot contaminate the natural streams and rivers. One toilet shall be provided per 15 staff members on site. Toilets shall be positioned within walking distance of wherever employees are employed on the site. Toilets shall be provided with locks and doors shall be secured to prevent the toilets from blowing over. • The toilets shall be placed outside of areas susceptible to flooding.	Johannesburg Water	During operation and maintenance activities	• Visual inspection of Waste collection and disposal areas. • Visual inspection of site. • Check waste	• Presence of litter • Availability of waste bins and skips. • Degree to which rubbish bins and skips are filled • Total volume of general and hazardous waste storage capacity • Total volume of general and

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		• Chemical toilets shall be serviced regularly by an authorised service provider and removed to a registered wastewater treatment works and disposal certificates shall be obtained from the waste disposal facility for each disposal and retained on site. • Polluted run-off must be discharged in the local sewerage main and not overland or into public streams. In instances where a sewerage main is not available, polluted run-off will be collected in sub-surface tanks and a reputable effluent removal contractor will be contracted to dispose of the waste in an environmentally acceptable manner. Official documentation shall be obtained from the waste disposal facility for each disposal and retained on site. • Any cooking on Site shall be done on well-maintained gas cookers with fire extinguishers present. No cooking shall be permitted to occur on open fires. • Toilets situated close to the site boundaries or within sight of residential areas shall be hidden behind screens or other cover as approved by the Engineer. • No spillage shall occur when the toilets are cleaned or emptied and the contents shall be properly stored and removed from site. • Discharge of waste from toilets into the environment and burial of waste is strictly prohibited. • All building rubble and rubble from the demolished structures, solid and liquid waste must be disposed of as necessary at an appropriately licensed refuse facility. • Ensure that no refuse wastes are burnt on the premises or on surrounding premises. No fires will be allowed on site.			disposal slips. • Monitor activities against JW Waste Management Plan. • Waste Inventory Register.	hazardous waste stored on site • Degree to which different waste is separated. • Frequency of waste collection. • Total volume of recycled and reused waste.

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		Contaminated water •Workshops, refuelling depots and washing areas shall be bunded. •Any wastewater or spilled fuel collected within bunded areas around the refuelling area shall be disposed of as hazardous waste •Wastewater containing hydrocarbons, paints oil etc. shall be treated as hazardous waste				
Protection of Vegetation	**2**	• Limit the footprint of the maintenance and operational activities to the minimum to minimise environmental damage. • Designate vegetated areas outside the development footprint as "No go" areas. • Limit the off-road driving within the Johannesburg Water Sites. • Protected or endangered species of plants shall not be removed unless they are interfering with a structure. • All trees and vegetation cleared from the site shall be cut into manageable lengths. • Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root system is removed. • Stumps shall be treated with herbicide. • Protected or endangered species of plants shall not be removed unless they are interfering with a structure. • Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from	Johannesburg Water	• During operation and maintenance activities/. • When is necessary?	Visual inspection	• Incidents of vegetation damage. • Number of incidents of disturbance of vegetation outside site boundary.

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		Provincial Department of Agriculture and Rural Development. • All protected species not to be removed must be clearly marked and such areas fenced off if required. • The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. • No scalping shall be allowed on any part of Johannesburg Water Sites.				
Alien invasive/weeds control	**3**	• Some of the areas of JW area are covered with moderate to very dense invasive alien shrubs and trees. Clearing of such vegetation will be necessary to gain access. However, clearing of this vegetation from the entire project area as far as possible will reduce the re-establishment rate of this vegetation over time, and will thus not only benefit the environment also put the proposed project and potential future phases of the project in the long term. • The type of invasive, however, will require regular follow-up eradication of seedlings after clearing, as extensive seedbanks of these species are present underneath present infestations. • Wood from alien vegetation can be used. However, care must be taken not to leave any of the leaf- or seed material on the site where the vegetation was cleared. Rather, identify a particular area that no longer has any indigenous vegetation, demarcate that area and dump excess material of alien species there. • Once the material is sufficiently dry, it should be burned to destroy any regenerating capacity of stems and roots as well as seeds.	Johannesburg Water	During operation and maintenance activities	• Visual inspection. • Monitoring against Vegetation Management Plan. • PCO certificate.	• Daily inspections register. • Incident register.

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		• Only registered PCO with Certificate for competency to handle the hazardous substances (e.g., Herbicides) is allowed to use herbicide. • Only environmentally friendly herbicide is allowed within JW sites. • MSDS for the herbicides must be kept in the storage area. • Method Statement for applying and handling herbicides and Risk Assessment for applying and handling herbicides. • Appropriate PPE for handling herbicides. • Herbicides stored only in a designated storage. • Empty containers of herbicides disposed of accordingly to the registered hazardous landfill site. • Proof of disposal provided to JW Environmental Section.				
Sludge Management	**4**	• The sludge must be managed according to the sludge guideline. • All agreements or Contract must be placed in the file. • The sludge must be kept on a designated bunded and concrete lined drying bed.	Johannesburg Water/Bulk Waste	During operations activities	• Visual inspection according to Sludge SOP. • Monitoring against Sludge Guideline. • Monitoring against WUL.	• Sludge test report • Complaints register. • Sludge spill register. • Environmental Officers Internal WUL Audit Report.
Workshop and storage Area	**5**	• The siting of workshops, maintenance and refuelling sites and materials storage areas shall not be in the vicinity of sensitive sites e.g., wetlands, cultivated fields or drainage lines, or where local landowners can be disturbed.	Johannesburg Water	During operations and maintenance activities	• Visual inspection • SOP for handling hazardous	• Workshop and storage register. • MSDS register. • Incident register.

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		• Storm water shall be diverted around the storage area. Storm water falling on the storage area shall be discharged if it meets the required water quality standards. • Proper storage facilities, placed on an impermeable surface, shall be provided for the storage of oils, grease, fuels, chemicals, and other hazardous materials to be used during the construction phase of the project. If fuel is required on site, it shall be stored in a secure area in a steel tank supplied and maintained by the fuel suppliers. Leakage of fuel shall be avoided. • An adequate bund walls, 110% of volume, shall be provided for fuel and diesel areas to accommodate any spillage or overflow from these substances. The area inside the bund wall shall be lined with an impervious lining to prevent infiltration of the fuel into the soil. • In addition, hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or container and Material Safety Data Sheets (MSDS's) will be made available for all hazardous chemicals. Before containers or storage facilities are erected, emergency procedures in the event of misuse or spillage that may negatively affect an individual or the environment will be in place. • The storage facilities (including any tanks) shall be surrounded by a bund wall, in order to ensure that accidental spillage does not pollute local soil or water resources. • The storage areas shall not be utilised for accommodation purposes and shall be access controlled.			substances. • MSDS register	

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		• The storage area shall be kept tidy, and the area shall be rehabilitated after use. • An inventory of any hazardous chemicals/substances (including that within equipment) kept on site, along with a description of possible ill effects and treatment of health-related afflictions resulting from accidents, shall be kept in the storage area as well as by the appropriate manager. These areas shall be securely fenced. • Gas welding cylinders and LPG cylinders shall be stored in a secure, well-ventilated area. • A notice board with the contact details of the responsible party shall be displayed at the gate to the storage area. • All vehicles and machinery will be inspected for any leaks or malfunctions regularly. Vehicle servicing or repairs is prohibited from site, unless in an emergency. • Drip trays shall be inspected and emptied daily and serviced when necessary. In particular drip trays shall be closely monitored during rain events to ensure that they do not overflow. The contents must be disposed of at a recognised site. • All repairs done on machinery using hydrocarbons as fuels or lubricants shall have a drip tray placed strategically to avoid incidental spillage. • Workers shall be made aware of the health risks associated with any hazardous substances used (e.g., smoking near refuelling depots), and shall be provided with appropriate protective clothing / equipment in case of spillages or accidents. • Cement shall be mixed on a plank, mental plate or a plank only or ready-mix trucks shall be used, and				

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		other potential environmental pollutants shall be stored at the designated area. There shall be no opportunity for environmental contamination. • Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediate to the satisfaction of the EO. • The site shall be in possession of an emergency spill kit that must be complete and available at all times on site.				
Complaints	**6**	• Maintain complaints register for all complaints. The register must list: • Complainant name and contact details. • Date complaint was lodged. • Person who recorded the complaint. • Nature of the complaint. • Actions taken to investigate the complaint and outcome of the investigation. • Action taken to remedy the situation. • Date on which feedback was provided to complainant.	Johannesburg Water	During operations and maintenance activities	• Complaints register. • GDARD complaints reference number.	• Availability of register on site • Designated person to maintain register • Complaints logged • Complaints followed up and closed out.
Collection of water sample	**7**	• Water sampling shall be undertaken at the selected sampling points as per the WUL. • Any incident or non-compliance with the WUL parameters or DWS Water Quality Guidelines shall be reported accordingly and investigated • Unused sampling bottle shall be disposed of accordingly.	Johannesburg Water/CDYNA	During operation activities	• Visual inspection. • Online Lab reports	• Daily water sample report. • Incident register.
Environmental Incident reporting and Emergency Response and Preparedness	**8**	• NEMA Section 30 and 30A emergency incidents and situations must be reported to GDARD or DEA immediately after as an incident or situation occurs. NWA Section 20 emergency must be reported to DWS, mostly by Operations Department. This can be done via phone, fax, or email. JW must implement	Johannesburg Water Sites	During operation and maintenance activities.	• Visual inspection. • Flash report/ Incident	• Incident register • Bioremediation report. • Section 30A Directive.

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		measures to contain the incident or situation immediately. Thereafter the Emergency Incident Report (EIR) or Emergency Situation Report (ESR) must be submitted to the authorities ASAP. The reports must provide as much information as possible, if not; the reports can be updated later as the investigation progresses. Not reporting an incident could result in the authorities issuing a directive or a compliance notice to the responsible person. • Important Note: For Section 30A Emergency Situation, an oral or written directive must be obtained from GDARD or DEA before works can be undertaken in the watercourse to avoid undertaking listed activities without obtaining EA. • Johannesburg Water takes responsibility in order to effectively respond to emergency incidences such as fire, hydrocarbon and sewer spills or leakages, disturbance of wildlife and archaeological artefacts. The SHE Rep must conduct daily inspections to ensure that the required equipment needed to handle environmental incidents/ emergencies are readily available and in working condition. Quick response to an incident prevents escalation to an emergency:			investigation report. • Section 30A Annexure A. • JW Environmental Emergency Preparedness and Response Procedure.	• Corrective Action Plan
9. Water Management • Water is a scarce resource and water shall be conserved wherever possible. • Improved and protected watercourses to Class C classification which is moderately modified in terms of determined class of water resource and resource quality objectives of chapter 3 (Part 2) of National Water Act (Act 36 of 1998). • Demand reduction/ Alternative sources. • Building a water sensitive city. • Well managed and maintained water infrastructure networks**.**						

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Water Usage	**9.1**	• The site must be kept tidy and hygienic at all times with special reference to sanitation & water management. • Maintain a monthly water usage. • Reporting of water pipe burst and damaged meters	Johannesburg Water Sites	During operation	• Visual inspection • Meter readings	• Records of Monthly water Usage.
Reduce water demand	**9.2**	• Implement effective demand-side management practices while exploring investment into smart infrastructure and alternative supplies to increase levels of net water savings. • Establish Task Team with different law enforcement agencies to develop and implement solution for infrastructure abuse problem. • Promote the implementation of Sustainable Urban Drainage System practice.	Johannesburg Water (Network)	During operation	• Monthly Monitoring • Monthly water management report	• Records of percentage reduction on non-revenue water. • Records of Percentage reduction of Rand Water system input volume.
Incentivise water saving interventions across domestic and economic sector users.	**9.3**	• Implementation of command-and-control base mechanism that promote water saving (CoJ By-laws). • Implementation of incentives base mechanism • Develop partnerships beyond the City to encourage water savings. • Expand current CoJ drought policy to build greater resilience of the water system. • Integrate water conservation requirements in conditions of planning approval. • Develop an awareness and communications campaign using available technology.	Johannesburg Water	CoJ/Operations	• Monthly water management report	• Records of reduction in annual water consumption per capita • Water from alternative sources as % of total water supply
Rehabilitation/ Reinstatement	**10**	• Clean up and remove any spills and contaminated soil in the appropriate manner.	Johannesburg Water	During operation and maintenance activities	• EO compliance	• Inspection report. • Audit report by External Auditor.

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		• Ensure that no discarded materials are buried on site or on any other land not designated for this purpose. • Rehabilitate any disturbed areas as soon as maintenance or construction in the area is complete. • If disturbed areas are left to rehabilitate naturally, they must be frequently monitored and interventions put in place immediately should it become necessary. Special attention must be given to the potential for soil erosion and the associated environmental degradation. It is also essential to undertake alien vegetation control and management.			monitoring. • Visual inspection. • Compliance inspection against rehabilitation plan. • JW EMP.	• Photos before and after.

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6.1 Method Statement

The objective is to ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk. The environmental specifications are required to be underpinned by a series of Method statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMPr will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to Johannesburg Water Environmental Section and ECO.

Method Statement is defined as “a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plan, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager and Environmental Officers are able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications”. The Method Statement must cover applicable details with regard to:

- Construction procedures
- Materials and equipment to be used
- Getting the equipment to and from site
- How the equipment/material will be moved while on-site
- How and where material will be stored
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
- Timing and location of activities
- Compliance/non-compliance with the Specifications, and
- Any other information deemed necessary by the Johannesburg Water.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Site Manager, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved. The EO and ECO should monitor the

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construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

6.2 Monitoring

- Regular inspections of the site by EO/SHE and Environmental Reps
- Immediate reporting of ineffective sediment control systems.
- Public complaints register must be developed and maintained on site.

6.2.1 Monitoring Program

OBJECTIVE: Monitor the performance of the control strategies employed against environmental objectives and standards

A monitoring programme must be in place not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the environmental authorisation (once issued). Where this is not clearly dictated, Johannesburg Water will determine and stipulate the frequency of monitoring required in consultation with the relevant authority. The contractor project manager will work with the site manager of the contractor to ensure that monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

- Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
- Ensure adequate and appropriate interventions to address non-compliance.
- Ensure adequate and appropriate interventions to address environmental degradation.
- Provide a mechanism for the lodging and resolution of public complaints.
- Ensure appropriate and adequate record keeping related to environmental compliance.
- Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, to enhance the efficacy of environmental management on site.
- Aid communication and feedback to authorities and stakeholders.

6.2.2 Method of Monitoring

The Environmental Officer will ensure compliance with the EMP and will conduct monitoring activities. The EO will undertake site inspections monthly or as specified in the environmental authorisation once issued.

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6.2.3 Monitoring Reports

Environmental Monthly reports will be compiled by the EO monthly and must be submitted to Environmental Specialist. The report should include details of the activities undertaken in the reporting period, any non-conformances or incidences recorded, corrective action required and details of these non-conformances or incidents which have been closed out.

A document handling system must be established to ensure accurate updating of EMP documents, and availability of all documents required for the effective functioning of the EMP. The complied environmental file must be ISO14001:2015 conformant as per JW environmental file specification (Annexure B). Supplementary EMP documentation could include:

- Method Statements.
- Environmental Action Plan
- Environmental File Site instructions.
- Emergency preparedness and response procedures.
- Record of environmental incidents.
- Non-conformance register
- Training records.
- Site inspection reports.
- Waste Register
- Water Usage Register
- Fauna and Flora Register
- Hazardous chemical Inventory list
- Monitoring reports.
- Auditing reports; and
- Public complaints register (single register for maintained for overall site).

Table 4: Monitoring Programme

ISSUE	FREQUENCIES OF MONITORING	RESPONSIBLE PERSON
WATER		
Prevention of water pollution Prevention of stagnant water on site. Proper functioning of sanitation facilities	Weekly in rainy season Weekly in rainy season Weekly	Contractor's Representative (CR)/ Johannesburg Water

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ISSUE	FREQUENCIES OF MONITORING	RESPONSIBLE PERSON
SOIL		
Surface or gully erosion on site Soil contamination with oils If small, clean up. If large, appoint a suitable contractor for clean-up.	Weekly in rainy season Monthly Immediately	CR/JW CR/JW CR/JW
Air		
Control domestic fires. Heavy vehicle emission control. Dust control of access roads. Wetting when required.	Weekly Monthly Weekly inspection	CR/ JW CR/JW CR
WASTE		
Efficiency of domestic waste collection. Prevention of burning of solid/liquid wastes on site. Proper collection and containment of liquid wastes (petroleum, oils, paints, resins & cooking oils) The recycling and/or disposal thereof. The collection and disposal of construction waste (concrete, wood, steel) Collection of hazardous waste.	Weekly Weekly Monthly Biweekly Monthly Biweekly	CR/JW CR/JW CR/JW CR CR/JW CR/JW
WILDLIFE		
Weed Control Control of illegal hunting or snaring of game, birds, or other wild animals.	On-going On-going	CR/JW CR/JW
SOCIAL		
Inspect overall appearance of site.	Weekly	CR

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ISSUE	FREQUENCIES OF MONITORING	RESPONSIBLE PERSON
(Paint work, cleanliness & housekeeping) Resolve complaints Monitor behaviour of labourers	 Daily Daily	 CR/JW CR/JW
SAFETY		
Inspect road signs, pedestrian, and vehicle behaviour	At least once a week	CR/JW

6.3 Internal Audits and Reporting

Typically, an audit analyses the results obtained from monitoring, assesses whether objectives and targets have been met and whether there are variances from the stipulated EMP and legal requirements. In addition, the audit assesses whether EMP implementation has been undertaken according to planned arrangements and that the EMP itself is being appropriately updated. The audit should confirm that identified corrective actions have been undertaken and then assess the effectiveness of such actions. The timing of audits should be included in the implementation schedule in the EMP.

The key steps in a successful audit are:

- Establish audit procedures.
- Determine the frequency of audits.
- Ensure that the auditors are competent, in that they must be able to undertake the audit objectively and competently. Audits may be undertaken by internal or external parties, although certain I&AP requirements may define a need for external auditors.
- Maintain records of audits.

A procedure is to be developed by the project management team for conducting EMP audits, and should incorporate processes for scheduling and reporting, as well as the timing and frequency of the audits. This procedure should also address responsibilities and required resources. The EO is usually responsible for the maintenance of the environmental audit information that is required prior, during and

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after an audit. Internal audits must be undertaken by Johannesburg Water Environmental Section on monthly basis.

6.3.1 Monthly compliance rating

A monthly compliance rating will be calculated for each Principal Contractor as per a formula determined by Johannesburg Water SOC Ltd focussing on or incorporating outcomes of assurance (e.g., monthly audit), operational assessments and other requirements, as necessary. Johannesburg Water SOC Ltd reserves the right to adjust the monthly compliance calculation formula as and when required – each revision of the monthly compliance calculation formula will be communicated to the Principal Contractor before implementation (**Each Principal Contractor is required to maintain a minimum compliance rating of 93% (Ninety-Three Percent).**

Table 5: Compliance Rating Protocol

Classification	Scoring	Classification description
Good	**93 – 100%**	Substantial compliance
Average	**80-92%**	Compliance status needs to be improved
Poor	**61-79%**	Methods to ensure compliance require substantial improvement
Very poor	<60%	Methods to ensure compliance failed completely - no system in place

6.3.2 Work Stoppage

Work stoppages will be identified for 2 (two) types of work stoppages to be implemented:

- Overall work stoppage – the Principal Contractor and its Contractors are not allowed to continue with any type of construction / site work up until the work stoppage has been closed-out.
- Activity work stoppage – The Principal Contractor and its Contractors are not allowed to continue with the specific activity / task / job up until the work stoppage has been closed-out (**Overall work stoppages will be issued where non-conformances are identified against the criteria in Annexure C).**

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6.4 Environmental Awareness Plan

OBJECTIVE: Ensure all operation personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm (Environmental Awareness Plan).

To achieve effective environmental management, it is important that Contractors and site employees are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. Johannesburg Water is responsible for informing its employees and contractors (transportation contractor) of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. Johannesburg Water's obligations in this regard include the following:

- Employees must have a basic understanding of the key environmental features of the depot and its surrounding environment.
- Ensuring that a copy of the EMP is readily available on-site and that all site staff is aware of the location and has access to the document.
- Employees must be familiar with the requirements of the EMP and the environmental specifications as they apply to the operation of the facility.
- Ensuring that, prior to commencing any new site works, all employees have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Awareness of any other environmental matters, which are deemed to be necessary by the depot manager.
- Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimise of disturbance to sensitive areas (wetland), management of waste and prevention of water pollution
- Records must be kept of those that have completed the relevant training.
- Training should be done either in a written or verbal format but must be in an appropriate format

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and language for the receiving audience

- Refresher sessions must be held to ensure the operating staffs are aware of their environmental obligations.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr. This training and awareness will be achieved in the following ways:

6.4.1 Environmental Awareness and Training

Environmental Awareness and Training must be undertaken by the Environmental Officer or SHE/ELO and must take the form of an on-site talk and demonstration by the Environmental Officer before the commencement of construction activities on site. A record of attendance of this training must be maintained by the Environmental Liaison Officer/SHE Officer on site.

6.4.2 Formal Environmental Training

NB: JW must ensure that there is a budget allocated for environmental formal training in CAPEX projects for the skills development of contractor staff, development of community where project is being undertaken. The principal Contractor shall identify short courses and include them on the training matrix that can be done on site during project duration. The following are some of the trainings that can be done on site:

- ISO14001:2015 Environmental Management System Awareness
- Handling of beehives
- Snake awareness and handling
- Environmental legal Liability.
- Waste Management
- Environmental Site Representative
- Recycling
- Grass cutting training

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The principal Contractor must ensure that they are appointing a registered company that meet all the requirements and before appointment of service provider, the files shall be submitted to Environmental Section for evaluation.

6.4.3 Induction Training

Environmental induction training must be presented to all persons who are to work on the site, be it for short or long durations. Contractors or Engineers staff, site staff, sub-contractors, or visitors to site. This induction training should include discussing Johannesburg Water's environmental policy and values, the function of the EMP and the importance and reasons for compliance to these. The induction training must highlight overall dos and don'ts on site and clarify the repercussions of not complying with these. The reporting procedure must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE officer on site.

6.4.4 Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least once a month) where the foreman/site supervision manager, environmental and safety representative and all employees on site hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

6.5 Erosion Management Plan

The objective to control soil erosion from an ecological perspective is:

- To reduce the effects of raindrop splash erosion on exposed soil surfaces.
- To keep rainwater on the soil surface for as long as possible to increase the infiltration rate and reduce surface runoff.
- To reduce the speed of surface runoff to reduce the erosion effect of the soil surface.
- To provide methods to retain soil, debris, seed banks and organic matter being carried away by runoff.
- To improve water retention of the area (Coetzee, 2005).

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a) Areas with a high soil erosion potential on the site

Areas identified as being of high soil erosion potential on the site include:

- Any areas without vegetation cover
- Excavated areas
- Steep areas
- Areas which undergo overland flow of water.
- Areas close to water
- Irrigated areas
- Compacted areas
- Rivers
- Drainage lines
- Any areas where developments cause water flow to accelerate on a soil surface.

If any erosion features are present as a result of the activities mentioned above the ELO must:

Assess the situation.

- Take photographs of the soil degradation.
- Determine the cause of the soil erosion.
- Inform and show the relevant contractors the soil degradation.
- Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
- Monitor that the contractor is taking action to stop the erosion and assist them where needed.
- The progress of the rehabilitation must be monitored weekly and recorded in the site diary.
- All actions with regards to the incidents must be reported on in the monthly Audit report.
- If the erosion incident has not been addressed by the contractor within 14 days of you reporting it, the Johannesburg Water ‘s Environmental Section must be informed.

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The contractor/ developer (with the EO's consultation) must:

- Select a system to treat the erosion
- Design the treatment system
- Implement the system
- Monitor the area to see if the system functions like it should, if it the system fails adapt or adjust the system to ensure erosion is controlled.
- Monitoring must continue until the area has been stabilized

b) General Erosion

The civil works contractor may use the following instruments to combat erosion when necessary:

- Reno matrices
- Slope attenuation
- Shade catches nets
- Mulching
- Hydro-seeding or transplanting
- Re-vegetating
- Tilling (roughing the surface)

c) Erosion Management control measures

- Areas susceptible to erosion must be protected by appropriate measures and repair of any damage caused by erosion due to construction activities must be undertaken as soon as possible.
- Minimise erosion and sedimentation into water courses through effective stabilisation (gabions and reno-mattresses) and re-vegetation of disturbed riverbanks (Refer to rehabilitation specifications and erosion control measures below).
- Stabilisation of sandy, dispersive slopes or slopes steeper than 1:3 will be required. Ensure that bare soil is covered, and hydro seeded to reduce topsoil loss.

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- Ensure that all soil surfaces are protected by vegetation or a covering to avoid the surface being eroded by wind or water.
- Ensure that heavy machinery don't compact areas that are not meant to be compacted as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area.

d) Surface water control measures

- Prevent the concentration or flow of surface water or storm water down cut or fill slopes or along pipeline routes or roads and ensure measures to prevent erosion are in place prior to construction.
- Storm water and any runoff generated by hard surfaces should be discharged into retention swales or areas with rock riprap.
- These areas should be grassed with indigenous vegetation.
- These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but also supporting the maintenance of natural base flows within these systems, i.e., hydrological regime (water quantity and quality) is maintained.
- Mitigate against siltation and sedimentation using the above-mentioned structures and ensure that all structures do not cause erosion.
- Ensure that all storm water control features have soft engineered areas that attenuate flows, allowing for water to percolate into the local aquifers.
- Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation.
- Vegetation clearing should occur in parallel with the construction progress to minimize erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.
- Minimise the diversion of flows into different catchments.

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- If implementing dust control measures, prevent over-wetting, saturation and run-off that may cause erosion and sedimentation.
- Water course (stream) crossings should not trap any run-off, thereby creating inundated areas, but allow for free-flowing water courses.

e) Environmental Incident/Accident

All environmental related incidents should be reported to environmental section. The ELO should compile and keep an Incidents and Accidents Register on the file/book in which all environmental related incidents and accidents are recorded, e.g., chemical spills, fires, accidents involving workers and vehicles, etc.

The following information must be recorded in the Incidents Register:

- The name and contact details of the persons involved
- The person recording the incident
- The date and time of incident
- The nature, extent, and cause of the accident
- The name and contact details of any persons notified of the incident
- The actions taken to deal with the incident and whether the accident has been sufficiently
- Dealt with additional steps required to prevent recurrence of the incident.

7. RECORD KEEPING, COMPLIANCE AND PENALTIES

Various records will be kept on site for monitoring purposes these include but not limited to:

- Copy of Environmental Management Plan
- Approved Environmental Method Statements
- Environmental Authorisation
- Environmental induction attendance register
- Hazardous chemicals register
- Waste disposals register and disposal certificates

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- Oil/fuel spill register

Records of non-compliance shall also be kept on record and will include the nature and magnitude of the non-compliance in a register, the action taken to discontinue the non-compliance, the action taken to mitigate its effects and the results of the actions. External complaints received regarding activities on the construction site pertaining to the environment shall be recorded in public complaints register and the response noted with the date and action taken. This record shall be submitted with the monthly reports and a verbal report given at the monthly site meetings. A score of 90% is required for the Monthly Audit undertaken by the Johannesburg Water 's Environmental Officers.

8. DECOMMISSIONING

Objective

- To avoid and or minimise the potential environmental and social impacts associated with the decommissioning phase

Mitigation Measures

Mitigation measures as detailed in the construction phase on the EMP regarding impacts on flora, fauna, habitats, and wetlands would be applicable to this phase.

- Rehabilitation to be undertaken in terms of specifications outlined in the Rehabilitation section of this EMP as well as in terms of any specific requirements applicable at the time.
- Johannesburg Water EO will need to supervise and monitor all decommissioning activities as per the snag list.
- All disturbed areas should be rehabilitated closer to its original state and more.

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Retainable Annexure A (Ref: Annexure 5 of JW 6.4): Acknowledgement of EMP specification by the Contractor.

Environmental Requirement for Contractors and Suppliers working for Johannesburg Capital Expenditure (CAPEX) projects	**Unique no**	**JWEMP:122017**
	Revision no	**00**

I, the undersigned, hereby acknowledge that I have obtained copies of the following listed documentation and confirm that I fully understand the contents thereof and the consequences of non-compliance. The Contractor furthermore reiterates its commitment to compliance of the requirements contained within the following provided documentation:

Name of the Contractor	
Vendor Number	
Project Number	
Scope of Work	
Declaration by Capital Expenditure Projects Contractor	
• I undertake to adhere to the requirements as set out in: - Johannesburg Water Environmental Management Plan and Waste Management Plan - Environmental requirements for Contractors working on Capital Expenditure Projects • I undertake to comply with all applicable environmental legal and other requirements. • Undertake to comply with Johannesburg Water 's environmental standards, policies, and procedures where applicable. • I pledge to inform all staff of their role in managing environmental impacts on site. • I am fully aware that incidents must be reported within 24 hours of occurrence. • I pledge to always implement environmental best practice on site during the contract. • I pledge that all non-conformances issued to us will be addressed promptly.	

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I …… hereby acknowledge that I have obtained copies of Johannesburg Water Environmental Management Plan and Waste Management Plan and confirm that I fully understand the contents thereof and the consequences of non-compliance. The Contractor furthermore reiterates their commitments to compliance of the requirements contained within the following provided documentations and conform to all above mentioned requirements.

Signed at …… on this …….. Day of …… 20……...

Contractor Reperesentative Name:	Signature:	Date:
Designation:		
JW Project Engineer/Manger (Witness) Name:	Signature:	Date:

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Annexure B: Contractors Environmental File Evaluation Form

	CONTRACTORS ENVIRONMENTAL FILE EVALUATION FORM		
	A minimum score of 80% is required on all sections for the approval of the submitted Environmental file System. Failure to achieve the required score will result in non-approval of the Environmental file, and the project will not commence prior file approval.		
ENVIRONMENTAL SYSTEM EVALUATION OUTCOME			
AVERAGE SCORE OBTAINED			**0.00%**
		APPROVED/REJECTED	
EVALUATED BY:	**REVIEWED BY:**	**APPROVED/REJECTED BY:**	**ACKNOWLEDGED BY:**
DESIGNATION:	**DESIGNATION:**	**DESIGNATION:**	**DESIGNATION:**
SIGNATURE:	**SIGNATURE:**	**SIGNATURE:**	**SIGNATURE:**
DATE:	**DATE:**	**DATE:**	**DATE:**

PROJECT DETAILS			
Contract Number			
Project Title			
Name of Contractor			
Is the project screened?	YES/NO	IF NO	Construction activities/work (including site establishment) should ONLY commence when after the project is Screened

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Specialist Studies/Report				
Environmental Authorisation (If applicable)				
Water Use Licence /General Authorisation (If applicable)				

SCORE ANALYSIS		
	Satisfactory (Approved)	Requirements have been met
0.00%	Unsatisfactory (Not Approved)	Requires substantial improvement / partially achieved

ENVIRONMENTAL REQUIRED DOCUMENTS		
1	Copy EMP and signed acknowledgement letter for JW EMP	0
2	SHE/ELO appointment letter	0
3	Contractor Environmental Induction presentation	0
3	Environmental Toolbox talk and copy of attendance register template	0
5	Environmental Objective (Site specific)	0
6	Environmental Policy Statement	0
7	**Registers**	0
3	Legal Register (Site specific)	0
9	Environmental Aspect and Impact register (site specific)	0
10	Permit register	0
11	Non-Conformance Register	0
12	Waste register template	0
13	Complaint register	0
14	Incident register	0

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15	Method statement register	0
16	Hazardous substances register	0
17	Daily Environmental checklist/ weekly checklist and spill kit checklist	0
18	Spill kit checklist	0
19	**Method statements or procedures**	0
20	Document control procedure	0
21	Storm water management plan/ Erosion control	0
22	Alien invasive and weeds control plan	0
23	Hazardous Management Plan/ Procedure (i.e., handling of hazardous substances)	0
24	Method statement for the activities to be undertake/ (include environmental aspects on the technical MS)	0
25	Waste management plan/ Method statement for waste management	0
26	Incident report template (Flash report/Investigation report)	0
3	Emergency Response Plan	0
28	Training Matrix	0
29	Dust Management Plan or Method Statement for dust suppression	0
30	Contractor Audit procedure/template	0
31	Rehabilitation Plan or Method Statement for Rehabilitation/Reinstatement	0
TOTAL		**0**

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Annexure C: Environmental Work instruction

ENVIRONMENTAL MANAGEMENT (EM) SITE INSTRUCTION Document No: JW- EMS-HO—R014	

1. All JW rules and regulation including JW Environmental Management Plan and other applicable legislation, standard and by-laws must be adhered to at all times.
2. Copies of Environmental Authorisation, Water Use License/General Authorization, Rehabilitation plan, EMP shall be kept on site **(where applicable).**
3. All JW sites must have waste bins, drip trays, spill kit and designated hazardous storage **(where applicable).**
4. Only registered Waste Service providers who comply with National Environmental Management Waste Act and Municipal By-laws shall be appointed.
5. No burning or burying of waste is allowed on site.
6. The conservation of water and the use of energy efficiently shall be implemented in all JW sites.
7. The letter from City Parks for occupying the open space shall be received and kept in the file and if the land belongs to the private owner, the copy of an agreement letter shall be kept in the file **(where applicable).**
8. The photos are taken before and during and after the project **(where applicable).**
9. The Environmental file must be approved before the commencement of works on site **(where applicable).**
10. The Environmental file will be kept on site all the times and shall be made available to competent authority and JW environmental representative **(where applicable).**
11. Rehabilitation/ reinstatement of the site must be done as per the JW EMP, rehabilitation method statement.
12. The hazardous waste must only be stored not more than 90 days on site as per the legislation.
13. Only asbestos registered service providers shall be appointed to handle and dispose asbestos to registered landfill site.
14. No mixing of general and hazardous waste will be allowed.
15. No cutting of trees is allowed on site without permit.
16. If archaeological artefacts or anything of heritage importance are found at JW sites/ servitude Environmental Section must be informed.
17. Everyone working within JW sites shall familiarize with the EMP requirements and other applicable JW environmental procedures.

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18. All the environmental incidents shall be reported within 24 hours to JW environmental Section.
19. Ensure that all JW employees and its service providers or suppliers receive environmental induction.
20. All work must be carried out under close supervision by the competent persons.
21. Repetitive findings or non-compliances shall be avoided.
22. Topsoil stockpile shall be protected by erosions control berms if it is exposed to a period of 14 days during wet season (where applicable).
23. Only 150mm of topsoil shall be removed and stockpile at a height of not more than 1m.
24. All hazardous material must be stored on a bunded and ventilated storage, and MSDS must be available for all of them.
25. No painting or marking of natural features is allowed on site.
26. Pollution of the environment shall be prevented all the times.
27. No leaking mobile plant is allowed on site.
28. Dust control measures shall be implemented on site (where applicable).
29. No sewer spillage shall spill into the storm water or the watercourse.
30. All environmental related incidents and/or emergencies shall be investigated within 48 hours from the date of notice.
31. Killing of fauna and/or Avifauna is prohibited.
32. Alien invasive and weeds must be eradicated.
33. Fumigation shall be done by trained personnel that is registered with DAFF.
34. No smoking is allowed in restricted areas. All such areas are posted appropriately.
35. Personal protective equipment is required to be worn at all times in production areas.
36. Maintain good housekeeping in your work area.
37. Keep fire lanes, roadways, walkways, and aisles free and clear of material.
38. The use of unsafe or defective equipment or tools is not permitted.
39. A contractor or subcontractor shall leave no unused materials on site. At the completion of a project the contractor shall remove all unused material and all waste shall be properly disposed of at a registered landfill site.
40. Any contractor or subcontractor found to be in violation of any EH&S rules can be ejected or escorted off premises if deemed necessary.
41. This file shall be kept on site and will be available at all times to the JW Reps and authorities (upon request).

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ENVIRONMENTAL MANAGEMENT PLAN

ACKNOWLEDGEMENT BY MANAGER/CONTRACTOR
I, _____ the Manager/Contractor, do hereby declare that my site/company _____ _____acknowledges having read and understood the conditions contained in this document and furthermore, the employees agree to abide by these conditions.

CONTRACTORS/FACILITY REP.	SIGNATURE	DATE

ENVIRONMENTAL SITE INSTRUCTION		Document No: **JW- EMS-HO—R014**	
Name of Contractor/Facility			
Responsible Manager/ Engineer			
Project No. ***(where applicable):***	Date Issued:	Date of Inspection:	
Environmental Representative:		Designation:	

DISCLAIMER

1.Should there be any other Environmental related activities issued as non-compliance during construction, the contractor is liable to comply with those requirements

2.Should the contractor deviate from the conditions and requirements of the EMP and/or Environmental Authorisation (if applicable), the contractor is liable for non-compliances, rectification, and associated fines thereof

3.This EMP does not exempt the Contractor from complying with other relevant legislations related to the construction activities.

Should the responsible persons fail to comply with any term of this instruction, JW may demand compliance in writing from the defaulting party. Should the defaulting party fail to comply within the stipulated time frames, JW shall take the necessary steps to remedy the situation.	**PROJECT DESCRIPTION**

Reference No. of Non-Conformances	**Action Required**
EM-1.	
EM-2.	
EM-3.	
EM-4.	
EM-5.	
EM-6.	
EM-7.	
EM-8.	
EM-9.	
EM-10.	

Received & Acknowledged by	**Signature**	**Date**
Responsible Manager/Contractor		
Responsible Consultant ***(where applicable)***		

DISCLAIMER
1.Should there be any other Environmental related activities issued as non-compliance during construction, the contractor is liable to comply with those requirements
2.Should the contractor deviate from the conditions and requirements of the EMP and/or Environmental Authorisation (if applicable), the contractor is liable for non-compliances, rectification, and associated fines thereof
3.This EMP does not exempt the Contractor from complying with other relevant legislations related to the construction activities.

JW Environmental Representative			
JW Project Inspector / Engineer ***(where applicable)***			
Contractor SHE/EL Officer ***(where applicable)***			
COMMENTS BY RESPONSIBLE MANAGER/ENGINEER:		**Target date for corrections**	
		Accepted/Acknowledged by Manager/Contractor	
COMMENTS BY CONTRACTOR *(WHERE APPLICABLE)*:		**Follow up comments by JW Environmental Representative**	

DISCLAIMER
1.Should there be any other Environmental related activities issued as non-compliance during construction, the contractor is liable to comply with those requirements
2.Should the contractor deviate from the conditions and requirements of the EMP and/or Environmental Authorisation (if applicable), the contractor is liable for non-compliances, rectification, and associated fines thereof
3.This EMP does not exempt the Contractor from complying with other relevant legislations related to the construction activities.

Annexure D: Johannesburg Water General Surface Rehabilitation Specification

Johannesburg Water General Surface Rehabilitation Specification

Doc No: JW-EMS-CAPEX-T040
Effective Date:14/9/2021

No.	Description	Unit	A Quantity	B Master Rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)
1	Rehabilitation Plan	m2	0	10.05	1	1	0
2	Rehabilitation of disturbed area/s including roads (prepare the ground/level profiling, soil surfaces including	m2	0	22.05	1	1	0
2	Replacement/import of topsoil (if required)	m2	0	22.05	1	1	0
3	Planting of grass/hydroseeding (Including hydro seeding seed mix ratio).	m2	0	22.05	1	1	0
4	Maintenance for 3 months (weed removal, replanting, soil conditioner, erosion repairs etc.)	m2	0	17.4	1	1	0
5	Rehabilitation close-out report	m2	0	10.05	1	1	0
6	Bioremediation (ONLY if applicable for contaminated areas/land) Process to be determined if required.	m2	0	22.05	1	1	0
					Sub Total 1		0

7	Preliminary and General	0	weighting factor 2 1	0
8	Contingencies		0	0
			Subtotal 2	0.00
			VAT (15%)	0.00
			Grand Total	0

DISCLAIMER
1.Should there be any other Environmental related activities issued as non-compliance during construction, the contractor is liable to comply with those requirements
2.Should the contractor deviate from the conditions and requirements of the EMP and/or Environmental Authorisation (if applicable), the contractor is liable for non-compliances, rectification, and associated fines thereof
3.This EMP does not exempt the Contractor from complying with other relevant legislations related to the construction activities.

JOHANNESBURG WATER (SOC) LTD

MEDICAL SCREENING POLICY

JW 14463: HALFWAY HOUSE WATER UPGRADE

NOTICE

It is the Contractor's responsibility to ensure that medical surveillance requirements specified in the Occupational Health and Safety Act (85/1993) and Regulations and any other applicable legal and Johannesburg Water's requirements are fully complied with.

This document is meant to facilitate the Contractor's compliance to applicable requirements and does not replace the applicable legal requirements.

This document may be revised at any time to include applicable legal requirements not currently included that may come to the attention of Johannesburg Water in future. The Contractor will accordingly be responsible to comply with the revised requirements as might be necessary.

Where methods to ensure legal compliance have been specified in this document, Contractors may submit alternative detailed method statements for consideration and approval by Johannesburg Water. Johannesburg Water may, at its sole discretion, reject or accept such alternative methods.

1 PURPOSE OF THE MEDICAL SURVEILLANCE REQUIREMENTS PROCEDURE

The purpose of this Medical Surveillance Requirements Procedure is to facilitate the achievement of legal compliance relating to medical surveillance by all Consultants, Contractors, Subcontractors and suppliers that will be working on the Johannesburg Water project and to ensure that employees are fit to work in the roles that they have been employed to execute and remain so for their duration on the project site.

This document represents the minimum requirements for medical surveillance and does not replace applicable legal requirements.

2 MEDICAL SURVEILLANCE OBJECTIVES

The Johannesburg Water main objectives for medical surveillance are:

a) To ensure compliance with all applicable medical surveillance legal requirements.
b) To ensure compliance with all Johannesburg Water's requirements regarding medical surveillance.
c) To ensure that employees are fit to execute the work for which they have been employed.
d) To prevent employees from acquiring occupational diseases or illnesses.
e) To ensure early detection and treatment of occupational diseases and to prevent the aggravation of existing medical conditions.
f) To ensure that employees on departure from the project have not contracted any occupational diseases and to enable any such condition that arises to be suitably addressed.

All contractors are required to demonstrate total commitment towards the achievement of these objectives.

3 GENERAL REQUIREMENTS

3.1 The Principal Contractor shall ensure that a medical surveillance programme is implemented for all employees.

3.2 An initial health evaluation shall be carried out by an occupational health practitioner immediately after a person commences employment, where any exposure exists or may exist, which comprises:

- an evaluation of the employees medical and occupational history;
- a physical examination; and
- any other essential examination which in the opinion of the occupational health practitioner is desirable in order to enable the practitioner to do a proper evaluation.

3.3 Medical surveillance & Immunization shall be done accredited institutions or occupational health doctor, including, but not limited to:

a) Audiograms.
b) A cardio-respiratory examination, including full size chest x-rays (If lung function tests are abnormal)
c) Lung function tests.
d) Eye/ sight tests.
e) A general physical examination.
f) A review of previous medical history.
g) Blood pressure tests
h) Glucose tests

Copies of all medical certificates shall be submitted to the Johannesburg Water Safety Specialist or Appointed OHS Agent to prior to site establishment and before an employee is allowed to come onto site.

Specific attention shall be given to the physical and psychological fitness of people who will be required to work in elevated positions and operators of mobile machinery.

An exit medical certificate shall be obtained for all workers at the end of the contract and for all workers who leave the employment of the Contractor before the end of the Project. Copies of all

exit medical certificates shall be submitted to the Johannesburg Water Safety Specialist or Appointed OHS Agent.

Medical surveillance shall address all occupational health risks to which the employee is exposed, identified through the risk assessment referred to in section 4 below.

Retention monies will be withheld if the exit medical is not complete for all employees.

The cost of all medical examinations will be borne by the Contractor as provision is made on the bill of quantities.

4 OCCUPATIONAL HEALTH RISK ASSESSMENT

4.1 The Contractor shall conduct an occupational health risk assessment prior to site establishment.

4.2 The Contractor shall ensure that, as far as is reasonably practicable, ergonomic related hazards are analyzed, evaluated and addressed in the risk assessment.

4.3 The methodology used by the contractor to assess occupational health risks associated with their activities shall be submitted to Johannesburg Water for approval by the Johannesburg Water Safety Specialist or Appointed OHS Agent prior to site establishment. The methodology should take the following into consideration, among others:

a) Legal requirements.
b) Normal activities undertaken by the contractor.
c) Abnormal situations (e.g. unanticipated breakdown of equipment etc).
d) Emergency situations (e.g. fires, exposure to chemicals).
e) Changes in work procedures and methods.
f) Previous experience.

4.4 A risk register that will include the following shall be submitted to the Johannesburg Water Safety Specialist or Appointed OHS Agent before site establishment.

a) All occupational health risks identified during the occupational health risk assessment.

b) A list of the occupational health risks that have been identified as being significant.

c) Reference to the method statements, measures or procedures that will be followed to either eliminate or reduce the significant risks to tolerable levels.

4.5 The Contractor shall, in writing, clearly explain how each occupational health risk assessed to be significant will be addressed to eliminate or reduce it to a tolerable level and submit it for approval by the Johannesburg Water Safety Specialist or Appointed OHS Agent before site establishment. This may be through method statements or written operational control procedures. Associated responsibilities and authorities shall be clearly defined. All method statements shall reflect at least:

a) When the activities relating to the method statement will be conducted (timing).

b) Materials to be used.

c) Equipment and staffing requirements.

d) The proposed construction procedure designed to implement the relevant requirements.

e) The system to be implemented to ensure compliance with the method statement.

f) Any other information deemed to be necessary by the Johannesburg Water Safety Specialist or Appointed OHS Agent and/or the contractor's responsible person.

4.6 For significant occupational health risks identified after site establishment, method statements shall be submitted to the Johannesburg Water Project Specialist or Appointed OHS Agent at least 10 working days before the start of the associated activity, when possible.

4.7 All changes to approved method statements or procedures shall be approved in writing by the Johannesburg Water Safety Specialist or Appointed OHS Agent.

4.8 The contractor's Responsible Person shall retain records of any amendments and shall ensure that only the most current approved version of any method statement or procedure is used.

4.9 Every occupational health risk that is identified during the risk assessment process shall be conveyed to every employee whose work is associated with the risk. This may be done in the form of a toolbox talk but does not replace the toolbox talk entirely. Each employee shall sign to confirm an understanding of the occupational health risks in the tasks.

4.10 Occupational health risk assessments may be combined with safety and environmental risk assessments, but the consideration of occupational health issues shall be clearly reflected in the records generated and maintained.

4.11 The occupational health risk assessment process and effective implementation of measures to eliminate or reduce identified risks is the responsibility of the Contractor. Johannesburg Water will closely monitor the effectiveness of implemented measures.

Acknowledgement of JW Medical Screening Policy

Name of Contractor

I, the undersigned, hereby acknowledge that I have obtained copies of JW Medical Screening Policy and confirm that I fully understand them and the consequences of non-compliance.

Signed at …… on this …….. Day of …… 20……..

Signature of Contractor / Mandatory **Date**

---------- **----------**

Signature of 16.2 / Construction Manager **Date**

---------- **----------**

Witness 1 …… **Witness 2 ……**

OHS CONTRACTORS' MANAGEMENT SYSTEM				
TENDER DOCUMENT SHE SPECS SIGN-OFF FORM				Johannesburg Water
REQUESTED BY	**Nsuku Shibambu**	**DATE**	**30/09/2024**	**JW 14463**

JW 14463: Halfway House Water Upgrade

LIST OF OHS SYSTEM ATTACHED TO THE TENDER DOCUMENT

SHE SYSTEM ATTACHED	Y/N	VERSION	NO PAGES	REMARKS
Volume 2 SHE Specification & Acknowledgement Form	Y	V2 – 09/16	48	For info
Baseline Risk Assessment	Y	V01 – 05/15	24	For info
Medical Screening Policy	Y	V01 – 05/15	8	For info
Returnable Annexure A	Y	V02 - 02/20	1	Return with tender document

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

BASELINE RISK ASSESSMENT

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: TRANSPORTATION OF MATERIALS TO SITE

Task	Hazard	Risk	Consequence	Rating	Controls
Transportation of material to site	✓ Unsafe road conditions ✓ Un-road worthy vehicles ✓ Equipment and material not safely secured ✓ Incompetent drivers ✓ Driving under the influence of alcohol ✓ Inclement weather ✓ Speeding ✓ Slippery road	✓ Overturning vehicles ✓ Vehicle collisions ✓ Bumping pedestrians / employees	✓ Injuries ✓ Property damages ✓ Third party liability	**M**	✓ Adherence to the speed limit ✓ Only competent/ authorized drivers should operate the vehicle ✓ Inspection of vehicles ✓ Equipment and material to be properly secured ✓ Alcohol testing to be done ✓ The road to be paved to prevent accidents ✓ Traffic control to be implemented to avoid collisions
Offloading of material	✓ Faulty lifting machinery & equipment ✓ Suspended load ✓ Poor housekeeping	✓ Malfunctioning ✓ Falling on employees ✓ Obstructed walkways by materials	✓ Injuries	**M**	✓ Inspect lifting equipment prior to use. ✓ Ensure the safe working load prior to use ✓ Train the employees in manual lifting ✓ Ensure proper housekeeping ✓ The correct PPE must be worn ✓ Designate the stacking areas and put signs ✓ Stacking and storage inspector must be appointed and in charge

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: SITE ESTABLISHMENT

Task	Hazard	Risk	Consequence	Rating	Controls
Site establishment	✓ Sharp objects/ wires ✓ Uneven surface ✓ Faulty connection ✓ Poor ergonomics ✓ Falling objects ✓ Inadequate security services ✓ Not enough welfare facilities e.g. toilets, change rooms and lockers	✓ Cuts ✓ Slips and trips ✓ Damage to services ✓ Using the environment as ablution facilities	✓ Injuries ✓ Back strains and injuries ✓ Crime, theft, fights ✓ Contracting of communicable diseases ✓ Soil, water pollution	**M**	✓ Supervisors to plan during site set up and induct employees ✓ A competent electrician must be appointed to connect electrical wires to the site offices and Distribution Board. ✓ Ensure there are welfare facilities on site for health and hygiene purposes ✓ Awareness on hygiene and use of ablution facilities ✓ Detailed Risk Assessment must be drawn before any work commences on site.
Installing containers	✓ Using lifting equipment ✓ Faulty equipment ✓ Faulty slings / chains	✓ Wind ✓ Incompetent personnel ✓ Heavy load ✓ Failing of lifting equipment	✓ Serious injuries ✓ Property damage	**H**	✓ Check wind speed prior to using the crane. ✓ Inspect the crane, slings and chains before use. ✓ Load test the crane before use ✓ Only carry loads certified to be carried by the crane
Electrical installation	✓ Electricity ✓ Incompetent personnel	✓ Contact with live electricity ✓ Incompetent person	✓ Electrocution ✓ Serious injuries	**H**	✓ Follow lock out procedure ✓ Ensure that equipment are earthed to an approved earthing point

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: SITE ESTABLISHMENT

Task	Hazard	Risk	Consequence	Rating	Controls
	✓ Wrong tools ✓ Damaged cables	connecting electricity ✓ Electric shocks			✓ Ensure a zero potential test is performed for electricity is isolated ✓ Inspect all tools ✓ Use correct tools for the job ✓ Appoint a competent electrician/ technician ✓ Wear task specific PPE ✓ Ensure that there are no exposed wires on the cables
Entry and exit	✓ No access control	✓ Unauthorised entry into the construction site	✓ Injuries ✓ Theft	**M**	✓ Appoint a full time, registered security guard on site
Stacking and storage	✓ Unsafe stacks of materials or pallets	✓ Falling of pallets and material on employees ✓	✓ Injuries ✓ Property damage	**H**	✓ Supervision of all stacking of materials on site ✓ Materials of same base and heights stacked together ✓ Barricade the stacking area ✓ Unsafe stacks to be removed immediately ✓ Never stack materials during knocking off time or late at night ✓ Use task specific PPE

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: WORKING NEAR UNDERGROUND AND OVERHEAD SERVICES

Task	Hazard	Risk	Consequence	Rating	Controls
Working close to Eskom line	✓ High voltage	✓ Electrocution	✓ Fatalities ✓ Power cuts ✓ Property damages	**H**	✓ Proper scanning of services prior to starting with excavations ✓ Obtain wayleaves from Eskom prior to starting with work ✓ Do not use lifting equipment in close proximity to power lines unless authorized to do so. ✓ Appoint an OHRVS to supervise all work done in close proximity to power lines ✓ Contact Eskom if services are identified for isolation ✓ Develop a method statement and risk assessment ✓ Train employees in the method statement as well as risk assessment ✓ Develop emergency response procedures for explosions
Working close to gas lines	✓ Gas leaks	✓ Explosion ✓ Suffocation ✓ Inhalation	✓ Fatalities ✓ Property damages		✓ Proper scanning of services prior to starting with excavations ✓ Obtain wayleaves from service provider prior to starting with work ✓ Develop a method statement and risk assessment ✓ Develop emergency response procedures for leaks and explosions

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: EXCAVATION					
Task	**Hazard**	**Risk**	**Consequence**	**Rating**	**Controls**
Excavation	✓ Deep excavations ✓	✓ Collapse ✓ Falling ✓ Unsafe entry and exit	Fatalities	**H**	✓ Recommendations from the Geotech survey should be followed. ✓ Shoring of the excavation ✓ No unauthorised entry into the project site. ✓ Fencing off of the excavation and prompt supervision of the area. ✓ Full time security on site to monitor entry and exit. ✓ Safe method of entry and exit to be provided for employees ✓ Spoil material to be stored at least 2m away from the excavation ✓ Signage to be displayed indicating deep excavations ✓ Tracked excavator to be used where shallow soft rock is found
	✓ Incompetent operator ✓ Faulty excavator	✓ Overturning ✓ Bumping against people	✓ Serious injuries	**H**	✓ Only competent personnel may operate the excavator ✓ All excavators must be inspected prior to use

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: EXCAVATION

Task	Hazard	Risk	Consequence	Rating	Controls
Mechanical excavation	✓ Ignition on	✓ Accidental movement	✓ Fatalities ✓ Property damages	**H**	✓ Operators should ensure that the ignition is off prior to leaving the plant. ✓ Keys should be removed from the ignition and returned to the office for safekeeping,
Deep excavation	✓ Lack of safety signage	✓ Employees / passersby falling into excavations	✓ Fatalities	**H**	✓ Ensure that deep excavation signage is placed and visible. ✓ Deep excavations must be fenced off and access controlled.
	✓ Spoil material	✓ Collapse of excavation walls. ✓ Entrapment	✓ Fatalities	**H**	✓ Excavated soil to be placed at least 2m away from the excavation wall.
	✓ Underground service	✓ Contact with plant	✓ Injuries ✓ Property damages ✓ Electrocution	**H**	✓ All underground services to be identified and marked prior to excavation. ✓ Wayleaves from all service providers to be obtained prior to starting with excavations.
	✓ Unsafe access and exit	✓ Falling	✓ Injuries	**H**	✓ TLB / Excavator may not be used by employees to access and exit the excavation

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: EXCAVATION					
Task	**Hazard**	**Risk**	**Consequence**	**Rating**	**Controls**
	✓ High water table	✓ Water ingress	✓ Drowning		✓ Continuous dewatering should be done where groundwater is encountered. ✓ Trenches should not be opened for longer periods, except with prior written consent ✓ Excavations must be inspected periodically and results recorded in an inspection checklist. ✓ Where there is uncertainty about the safety of the excavation, the declaration shall be made by a registered Engineering Technologist on the safety of the excavation. ✓ Backfilling should be done as per the relevant SANS code. ✓ If saturation of the trench occurs, sidewalls should be either battered or supported laterally.
	✓ Open excavations	✓ Falling of employees ✓ Collapse	✓ Injuries		✓ Trenches should not be opened for more than 3 days to prevent deterioration in trench stability and to reduce the risk of persons and motorists falling inside.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: WORKING AT HEIGHTS

Task	Hazard	Risk	Consequence	Rating	Controls
Working at heights	✓ Heights ✓ Unfit employees ✓ Using hand tools ✓ Unsecured tools and equipment	✓ Falls ✓ Falling onto employees	✓ Injuries	**M**	✓ Employees to use proper PPE including safety harnesses when working at heights. ✓ Inspect all tools prior to use. ✓ Provide training for using safety harnesses correctly. ✓ Employees working at heights must be certified fit to work. ✓ Hand tools must be attached to lanyards when working at heights. ✓ Use tool bags ✓ Use netting system below each level. ✓ No work should be done on the ground when work at heights is in progress. ✓ Proper signage to be displayed.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
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	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: WORKING NEAR A STREAM / RIVER / WATERBODY

Task	Hazard	Risk	Consequence	Rating	Controls
Working near a stream / river / waterbody	✓ Water	✓ Drowning	✓ Fatality	**H**	✓ Provide employees with life jackets where activities will take place in close proximity to the stream / wetland ✓ Barricade the area ✓ Develop a method statement and a risk assessment for working near a stream
	✓ Snakes	✓ Bites ✓ Poisoning	✓ Fatalities	**H**	✓ Inspect the area before and while working ✓ Look around the surroundings for snakes ✓ Train employees in snake awareness ✓ Provide employees with lashers

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: MECHANICAL LIFTING

Task	Hazard	Risk	Consequence	Rating	Controls
Lifting using a crane	✓ Overhead lines	✓ Contact with crane	✓ Electrocution ✓ Property damages	**H**	✓ All lifting activities to be planned at least 2m away from overhead lines ✓ Obtain wayleaves from Eskom ✓ Appoint ORHVS
	✓ Wind / Unfavourable weather	✓ Deflection ✓ Loss of control	✓ Injuries ✓ Property damages	**H**	✓ Do not use during unfavourable weather conditions
	✓ Incompetent operator	✓ Loss of control ✓ Hitting structures and people	✓ Injuries ✓ Property damages	**H**	✓ Only trained and competent operators many operate the crane
	✓ Overloading	✓ Collapse of material	✓ Injuries ✓ Property damages	**H**	✓ Display safe working load on the crane
	✓ Faulty crane	✓ Malfunctioning	✓ Injuries ✓ Property damages	**H**	✓ Cranes to be inspected by competent persons prior to being used ✓ All faulty cranes to be tagged and locked out

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: PIPE JACKING

Task	Hazard	Risk	Consequence	Rating	Controls
✓ Pipe jacking	✓ Working in confined spaces	✓ Lack of oxygen ✓ Harmful gases ✓ Entrapment	✓ Asphyxiation ✓ Serious injuries ✓ Fatalities	**H**	✓ Develop a confined space procedure. ✓ Develop a permit to work system. ✓ Only authorized and trained personnel to enter confined spaces. ✓ Ensure that the gases are purged before entry. ✓ Provide employee with oxygen mask ✓ Have an employee trained in first aid ready. ✓ Confined space may not be smaller than 800mm in diameter.
	✓ Working at heights	✓ Falling	✓ Fatalities ✓ Serious injuries	**H**	✓ Proper PPE to be issued ✓ Provide rigid edge protection.
	✓ Lifting operations	✓ People hit by load ✓ Collapsing of pipe ✓ Incorrect slinging	✓ Injuries	**M**	✓ No people are allowed to be at the jacking site. ✓ Slinger to be identifiable and wear reflective PPE. ✓ Lifting machinery to be inspected prior to use. ✓ Lifting machinery to be load tested.
	✓ Deep excavation	✓ Falling	✓ Fatalities	**H**	✓ Barricade the jacking pit ✓ No unauthorized entry ✓ Site should be fenced off and locked out. ✓ Signage should be put up
	✓ Jetting rig	✓ Crushing by horizontal move of the rig; ✓ People hit by drop load	✓ Injuries	**M**	✓ Enter the shaft only once the load has reached the bottom. ✓ Signaler to make the people in the shaft aware of the moving load.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: PIPE LAYING & WELDING

Task	Hazard	Risk	Consequence	Rating	Controls
Pipe laying	✓ Steel ✓ Employees working around the excavation	✓ Static electricity ✓ Rough edges ✓ Heavy steel ✓ Hit by pipe	✓ Electrocution ✓ Injuries	**M**	✓ Ensure that pipes are earthed ✓ Provide gloves to employees ✓ Heavy pipes to be lifted mechanically
Pipe laying	✓ Crane	✓ Failure of the crane ✓ Employees	✓ Fatalities	**H**	✓ Inspect the crane prior to use. ✓ Only trained and competent person to operate the crane ✓ Employees to steer clear of lifting operations ✓ Faulty cranes to be tagged and not used ✓ Wind speed and direction to be considered before using the crane ✓ Crane to be load tested ✓ Only certified loads to be carried on the crane
Tie ins & pressure testing	✓ Pressurized water	✓ Hitting employees ✓ Burst	✓ Fatalities ✓ High water losses	**E**	✓ Ensure that the water is shut down ✓ Ensure that the correct class of pipe is used as well as valve specifications are correct ✓ Develop and follow a method statement ✓ Use only competent person to perform the task. ✓ Don't exceed pipe operating pressure, ensure pipe is correct diameter and is not damaged.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: PIPE LAYING & WELDING

Task	✓ Hazard	✓ Risk	✓ Consequence	Rating	✓ Controls
Pipe welding	✓ Welding equipment	✓ Poor maintenance	✓ Injuries	**M**	✓ Welding equipment is visually checked before each use;
	✓ Welding	✓ Sparks	✓ Fire	**H**	✓ Welding screens to be used
		✓ Sparks	✓ Burns	**L**	✓ Fire resistant overalls and apron to be worn. ✓ Develop method statement for welding inside the pipe
		✓ Glare	✓ Arc eyes	**M**	✓ Welding glasses to be used
	✓ Confined space	✓ Entrapment ✓ Inability to move	✓ Injuries ✓ Suffocation	**H**	✓ Develop method statement for welding inside the pipe. ✓ Ensure that the welder is able to fit in properly inside the pipe and move with ease ✓ Use a different method of welding where the pipe's internal diameter is less than 800mm.
Compacting	✓ Compactor ✓ Noise ✓ Dust ✓ Vibration	✓ In-competent employee using the compactor ✓ Hearing loss ✓ Hand-arm vibration syndrome ✓ Collapsing excavation wall ✓ Inhalation of dust	✓ Injuries Respiratory problems	**M**	✓ Use of earmuffs by compactor operator ✓ Dust mask to be worn by compactor operator ✓ Compactor operator to be declared competent before using the machine

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: MECHANICAL WORKS

Task	Hazard	Risk	Consequence	Rating	Controls
Installation of pumps and valves	Heavy pumps and valves	Falling	✓ Injuries ✓ Property damages	**M**	✓ Use proper lifting equipment ✓ Ensure that only the relevant people are in the work area. ✓ Ensure that lifting equipment is load tested. ✓ Only competent personnel to undertake this task
	Steel fixing	✓ Falling ✓ Slip	Injuries	**L**	✓ PPE, including safety boots and goggles must be used
Cutting and drilling	✓ Drilling ✓ Drill bit ✓ Drill sharp metal fibres ✓ High Noise Levels ✓ Cutting Grinder/Disc	✓ Vibration ✓ Cutting edges ✓ Eye penetration ✓ Finger cuts ✓ Expose to high noise level area ✓ Uncontrolled disc ✓ Electrical equipment failure ✓ Sharp window edges	✓ Damaged hearing ✓ Carpal tunnel syndrome ✓ Cuts/ injuries ✓ Eye irritation / blindness ✓ Injuries ✓ Eye injuries	**M**	✓ Use hearing protection when exposed to excessive noise levels (greater than 85 dB over an 8-hour work period) ✓ Assess noise level with sound level meter if possibility exists that level may exceed 85dB. ✓ Rotate drilling tasks to minimize worker exposure to equipment vibration. ✓ Use right size of a drill to drill different layers of the ground ✓ Assess manual guide carefully to ensure correct usage of portable electrical devices.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: MECHANICAL WORKS

Task	Hazard	Risk	Consequence	Rating	Controls
Welding	✓ Fumes	✓ Inhalation	✓ Respiratory problems	**M**	✓ Wear respiratory protection
	✓ Sparks	✓ Contact with skin	✓ Skin burns	**L**	✓ Personal Protective Equipment to include face, eye and skin protection
	✓ Sparks	✓ Fire	✓ Damage to property ✓ Fatalities	**H**	✓ Provide fire extinguisher ✓ Provide screens ✓ Remove all sources of combustion and hazardous chemicals from welding area
	✓ Welding arc	✓ Starring welding arc	✓ Eye irritation	**L**	✓ Safety goggles to be worn
Install generator	✓ Lifting equipment	✓ No SWL displayed ✓ Faulty equipment ✓ Employees standing around	✓ Serious injuries ✓ Property damages	**M**	✓ Load testing of lifting equipment ✓ Inspection of lifting tackle and equipment prior to use ✓ Display SWL ✓ Only competent people to operate the lifting equipment ✓ Access control to the lifting area
Fueling the generator	✓ Spillages	✓ Slips, trips, falls	✓ Injuries	**L**	✓ Prevent spillages ✓ Use drip trays ✓ Use funnels for fueling
	✓	✓ Fire	✓ Injuries	**M**	✓ No smoking allowed near the generator

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: MECHANICAL WORKS

Task	Hazard	Risk	Consequence	Rating	Controls
	✓ Diesel fumes	✓ Inhalation	✓ Respiratory problems	**L**	✓ Provide employees with respirators
	✓	✓ Skin contact	✓ Skin irritation	**L**	✓ Provide employees with gloves, safety boots and overalls
	✓ Running engine	✓ Explosion	✓ Injuries	**M**	✓ Switch engine off before refueling and make sure fuel cap is replaced. ✓ No smoking allowed near the generator
Running the engine	✓ Noise	✓ Over-exposure	✓ Noise-induced hearing loss	**M**	✓ Provide employees with hearing protection ✓ Provide rest periods for employees
	✓ Vibration	✓ Over exposure	✓ Raynaud's Syndrome	**L**	✓ Provide employees with vibration gloves. ✓ Rotate employees or provide rest periods.
	✓ Fumes	✓ Inhalation	✓ Respiratory problems	**L**	✓ Provide employees with respirators ✓ Never use indoors

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
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	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: TRAFFIC MANAGEMENT

Task	✓ Hazard	✓ Risk	✓ Consequence	Rating	✓ Controls
Pipe installation next to the road	✓ Moving vehicles and pedestrians ✓ Improperly placed signage ✓ Incorrect signage displayed ✓ Poor communication between flagmen	✓ Road accidents ✓ People getting knocked down by cars ✓	✓ Fatalities ✓ Serious injuries ✓ Property damages	**H**	✓ Adhere to traffic management procedures ✓ Proper training of flagpersons ✓ Ensure good communication between flagmen ✓ Display correct road signage, and put reflective barricades for additional visibility, especially at night and when it is dark / foggy. ✓ Employees should wear reflective PPE ✓ Keep area clean & clear of obstacles. ✓ Obtain wayleaves from the roads agency (JRA)
Pipe installation via trenchless methods under the road	✓ Vibration	✓ Road collapse	✓ Fatalities ✓ Property damages	**H**	✓ Only experienced service providers for pipe jacking and horizontal directional drilling should be appointed. ✓ Pipe jacking and HDD to be done within the permitted timeframes issued by JRA and SANRAL. ✓ Ensure that wayleaves from JRA and SANRAL are always valid, and are complied with.

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
	PROJECT LOCATION:	Halfway House
	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: ASBESTOS REMOVAL

Task	Hazard	Risk	Consequence	Rating	Controls
Removal of asbestos pipe	✓ Asbestos cement dust	✓ Inhalation of asbestos fibers	✓ Asbestosis	**H**	✓ No asbestos pipe should be cut. The entire length of pipe should be removed (remove clamps) ✓ Appoint a registered Asbestos Contractor
Disposal of asbestos pipe	✓ Asbestos fibers	✓ Inhalation of fibers ✓ Incorrect disposal	✓ Asbestosis	**H**	✓ Appoint a registered Asbestos Contractor for the removal and disposal of asbestos and asbestos containing waste. ✓ Appoint an AIA to conduct an asbestos survey to determine the level of exposure of the employees. ✓ Obtain a clearance certificate from the AIA ✓ Obtain a safe disposal certificate from the Asbestos contractor and keep records.
Disposal of asbestos pipe	✓ Asbestos waste	✓ Inhalation of asbestos dust ✓ Contamination of materials	✓ Lung infections	**M**	✓ Ensure that asbestos waste is removed within 90 days of accumulation by a registered asbestos contractor. ✓ Provide employees with suitable dust masks ✓ Demarcate and cover asbestos waste (soils)

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
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ACTIVITY: GENERAL ACTIVITIES ON SITE

Task	Hazard	Risk	Consequence	Rating	Controls
✓ **Working on site**	✓ Unhappy community	✓ Community coming to survey site ✓ Violence against employees	✓ Property damages ✓ Serious injuries	**H**	✓ Develop an emergency response procedure ✓ Meet with the community and all stakeholders prior to commencement of the project ✓ Have the contact details of the nearest police station / JMPD offices
	✓ Unfavourable weather conditions	✓ Exposure to temperature extremes	✓ Heat exhaustion ✓ Frost bite	**M**	✓ Provide employees with water for cooling down. ✓ Provide employees with warm jackets and gloves during winter ✓ Provide 5-minute rest periods for every 30 minutes of exposure to temperature extremes. ✓ No work to be undertaken in rainy conditions
	✓ Housekeeping	✓ Trips and falls	✓ Injuries	**M**	✓ Ensure that proper housekeeping is maintained on site at all times.
✓ **Working in open spaces**	✓ Snakes	✓ Bites ✓ Poisoning	✓ Fatalities ✓ Serious injuries	**H**	✓ Inspect the area for snakes prior to entering ✓ Conduct snake awareness training ✓ Know the do's and don'ts of what to do when coming across snakes
✓ **Working in open spaces**	✓ Bees	✓ Bites	✓ Allergic reaction	**M**	✓ Inspect the area for bees / wasps prior to entering ✓ Conduct bees awareness training ✓ Know the do's and don'ts of what to do when coming across bees

	OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION: BASELINE RISK ASSESSMENT	
Johannesburg Water	PROJECT NUMBER:	JW 14463
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ACTIVITY: GENERAL ACTIVITIES ON SITE

Task	Hazard	Risk	Consequence	Rating	Controls
✓ **Working in open spaces**	✓ Sharp objects	✓ Getting pricked by sharp objects	✓ Tetanus ✓ Injuries	**M**	✓ All employees to get Tetanus vaccination. ✓ Provide employees with proper safety boots
✓ **Working in open spaces**	✓ Criminals	✓ Getting mugged ✓	✓ Loss of personal possession	**M**	✓ Personal belongings such as phones and car keys to be safely put in pockets while working. ✓ Employees to report any suspicious activities to the local police. ✓ Equipment to be safety stored while not in use
✓ **Working in open spaces**	✓ Criminals	✓ Employees being attacked	✓ Injuries ✓ Fatalities	**H**	✓ Ensure that employees do not work in isolation. ✓ Employees to report any suspicious activities to the local police. ✓ Develop an emergency response procedure
✓ **Working in open spaces**	✓ Open excavations from other contractors	✓ Falling inside	✓ Injuries	**M**	✓ Employees to be vigilant while working on site
✓ **Working near open spaces**	✓ Water bodies	✓ Falling inside	✓ Serious injuries ✓ Fatalities	**H**	✓ Employees to be vigilant while working on site ✓ Emergency procedures to be developed
✓ **Working near residential area**	✓ Community ✓ Playing children	✓ Falling into deep excavations	✓ Fatalities	**H**	✓ Educate the community prior to starting about the dangers of open excavations. ✓ Inform nearby schools and communities about construction work to be done.

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	PROJECT DESCR:	Halfway House Water Upgrade

ACTIVITY: GENERAL ACTIVITIES ON SITE

Task	Hazard	Risk	Consequence	Rating	Controls
					✓ Ensure that all excavations are properly barricaded whilst there are activities, and closed as soon as the activities are completed.
✓	✓ Open excavations	✓ Vehicles falling inside	✓ Property damages ✓ Injuries	**H**	✓ Ensure proper barricading of all excavations. ✓ Put signage to warn motorists and pedestrians ✓ Proper traffic control and accommodation.
✓ **Working on site**	✓ Contractor interface	✓ Affected by work from other contractors	✓ Injuries ✓ Litigations	**H**	✓ Communicate with other contractors working in the vicinity ✓ Take before and after pictures where work is conducted ✓ Always ensure that unfinished work is properly barricaded.

RISK ASSESSMENT MATRIX

Likelihood	**Consequences**				
	Insignificant (minor problem easily handled by normal day to day processes	Minor (Some disruption possible e.g.,damage equal to R150k	Moderate (significant time / resources required. E.g., damage equal to R500k	Major (Operations severely damaged. E.g., damages equal to R1m	Catastrophic (business survival is at risk. Damage equal to R5m – 10m
Almost certain (90% chance)	High	High	Extreme	Extreme	Extreme
Likely (between 50-90%)	Moderate	High	High	Extreme	Extreme
Moderate (between 10-50%)	Low	Moderate	High	Extreme	Extreme
Unlikely (between 3-10%)	Low	Low	Moderate	High	Extreme
Rare (<3%)	Low	Low	Moderate	High	High

VOLUME 3

Occupational Health & Safety Specification

JW 14463

HALFWAY HOUSE WATER UPGRADE

Prepared by: OHS Department 65 Ntemi Piliso Street Newtown 2000 Tel: +27 11 688 1476	**PRINCIPAL CONTRACTOR:**	
	CEO (16.1 APPOINTEE):	
	TELEPHONE NUMBER:	
	FAX NUMBER	
	E-MAIL ADDRESS:	
	SIGNATURE:	

General Notification

This document forms an integral part of the Contract Specification and, in particular, shall constitute the Client's (Johannesburg Water SOC Ltd.) Occupational Health & Safety (OHS) Specification, as required by the Construction Regulations, 2014, as promulgated under the Occupational Health and Safety Act (Act no. 85 of 1993). The Specification shall furthermore be applied for the management of Mandatories performing activities for or on behalf of Johannesburg Water SOC Ltd, irrespective whether the contract work constitutes construction work or not.

The Contract Specification is contained in Volume 1 of the contract documents in Part 3: Scope of Work.

Acknowledgements

This Occupational Health & Safety (OHS) Specification was developed by the internal OHS Department for the sole use by Johannesburg Water SOC Ltd. The issue date of this OHS Specification is September 2016.

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ABBREVIATIONS

Abbreviation	Description
CR	Construction Regulations
COID	Compensation for Occupational Injuries and Diseases
DoL	Department of Labour
GAR	General Administrative Regulations
GMR	General Machinery Regulations
GSR	General Safety Regulations
HCS	Hazardous Chemical Substances
HIRA	Hazard Identification and Risk Assessment
JW	Johannesburg Water (SOC) Ltd
SDS	Safety Data Sheet
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment

PER	Pressure Equipment Regulations
SANS	South African National Standards
SABS	South African Bureau Standard
SOC	State Owned Company

DEFINITIONS

Word / Phrase	Definition
"WCL 1", "WCL 2" and "WCL 22"	Means the prescribed forms for reporting of incidents and occupational diseases referred to in the Compensation for Occupational Injuries and Diseases Act.
Competent Person	A person who has in respect of the work or task to be performed the required knowledge, training, experience and, where applicable, qualifications specific to that work or task: provided that where appropriate, qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act 67 of 2000).
Construction work	Any work in connection with: a) The construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure b) the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work
Contractor (inclusive of Principal Contractor)	Any organization, person, entity performing activities for or on behalf of Johannesburg Water SOC Ltd.
Corrective Action	Action to eliminate the cause of a detected nonconformity or other undesirable situation.
Employee	Any person who is employed by or works for an employer and who receives or is entitled to receive any remuneration or who works under the direction or supervision of an employer or any other person
Employer	Any person who employs or provides work for any person and remunerates that person or expressly or tacitly undertakes to remunerate him, but excludes a labour broker as defined in section I (1) of the Labour Relations Act, 1956 (Act No. 28 of 1956)
Hazard	Means a source of or exposure to danger.
Hazard identification	The identification and documenting of existing or expected hazards to the health and safety of persons, which are normally associated with the type of construction work being executed or to be executed.
Incident	Means an incident as contemplated in section 24 (1) of the OHS Act 85 of 1993.
Machinery	means any article or combination of articles assembled, arranged or connected and which is used or intended to be used for converting any form of energy to performing work, or which is used or intended to be used, whether incidental thereto or not, for developing, receiving, storing, containing, confining, transforming, transmitting, transferring or controlling any form of energy
Mandatory	Includes an agent, a contractor or a subcontractor for work, but without derogating from his status in his own right as an employer or a user
Medical surveillance	Means a planned programme or periodic examination (which may include clinical examinations, biological monitoring or medical tests) of employees by an occupational health practitioner or, in prescribed cases, by an occupational medicine practitioner.
Method Statement	A document detailing the key activities to be performed in order to reduce as reasonably as practicable the hazards identified in any risk assessment.
Principal Contractor	Any employer who performs work and is appointed by the Client to be in overall control and management of the contract work (inclusive of Mandatories).

SHE File	A file or other record in permanent form, containing the information required as contemplated in the S.H.E Specification Document and legal requirements applicable to work activities.
SHE Plan	A documented plan which seeks to address all hazards identified means and ways to control and eliminate such to ensure compliance to the S.H.E Specification.
Workplace	Any physical location in which work related activities are performed under the control of the organization.

1. Introduction

In terms of Section 37 of the Occupational Health and Safety Act (Act no. 85 of 1993), Johannesburg Water SOC Ltd is required to control persons/organizations conducting activities for or on their behalf (Mandatories) and the Construction Regulations promulgated under the Occupational Health and Safety Act (Act no. 85 of 1993), is requiring Johannesburg Water SOC) Ltd. to compile an occupational health and safety specification for any intended project classified as construction work and to provide the specification to prospective tenderers / Mandatories.

The dual objective of this specification is to ensure that the Mandatories and Principal Contractors (herein after called Principal Contractor (including Mandatories)) entering into a contractual agreement/relationship with Johannesburg Water SOC Ltd. achieves and maintains an acceptable level of occupational health, safety and environmental performance whilst conducting activities to perform the contract work.

This document forms an integral part of the Contract Specification and, in particular, shall be the OCCUPATIONAL HEALTH & SAFETY (OHS) SPECIFICATION FOR CONSTRUCTION WORK. The Contract Specification is contained in Volume 1 of the contract documents. The principal and other contractors shall ensure that this specification is included with any contract/s that they may have with other contractors and/or suppliers that are engaged for the provision of labour, goods or services for this project. The Principal Contractor and its Contractors shall furthermore implement any reasonable practicable means to ensure compliance to this Occupational Health & Safety (OHS) Specification and any other applicable legislation on their organization and/or activities performed by or for them. This OHS Specification will be read in conjunction, where issued and applicable, with the Environmental Specification issued for listed activities requiring environmental authorization by a relevant authority.

Compliance with this OHS specification does not absolve the Principal Contractor from complying with any other applicable minimum legal requirement and the Principal Contractor remains responsible for the sustainable integrity of the environment and the health and safety of its employees, mandatories as well as any persons affected by activities conducted for or on behalf of Johannesburg Water SOC Ltd (SOC) Ltd..

1.1 Johannesburg Water SOC Ltd's commitment to Occupational Health, Safety & Environmental (SHE) Management

Johannesburg Water SOC Ltd is committed to responsible occupational health, safety and environmental management. This commitment is essential to protect the environment, employees, Mandatories, visitors and provide a work environment conducive to health and safety. Principal Contractors and their Contractors shall demonstrate their commitment and concern by:

- Ensuring that decisions and practices affecting occupational health, safety and environmental performance are consistent with the issued SHE specification;
- Ensuring adequate resources are made available for the effective implementation of occupational health, safety and environmental control and mitigation measures;
- Participating in hazard identification and risk assessments and design safety reviews;
- Communicating occupational health, safety and environmental management processes, strategies and control measures with all levels of employees, contractor and/or visitors;
- Ensuring visible leadership at all sites;
- Promoting and enforcing the use of correct types of Personal Protective Equipment (PPE);
- Reporting and investigation of incidents and accidents and ensuring actions are identified and implemented to prevent similar types of incidents reoccurring;

- Participating in Client audits and meetings and ensuring required actions are implemented within reasonable time frames on the site/project;
- Recognizing and commending safe work practices and coaching employees who require guidance;
- Applying and enforcing consequence management from deviations and transgressions of/from compliance to this SHE Specification noted and/or observed, where applicable;
- Carrying out safety observations, implement corrective and preventative actions and giving immediate feedback;
- Encouraging employee participation in the formulation of work instructions and safety rules.

1.2 Scope of Occupational Health, Safety and Environmental (SHE) Specification

The scope of this Occupational Health, Safety and Environmental (SHE) Specification is to address the reasonable and foreseeable aspects of occupational health, safety and environmental management, which will be affected by the contract work.

The specification will provide the requirements that the Principal Contractor and other Contractors shall comply with in order to reduce the risks associated with the contract work, and that may lead to incidents causing injury and/or ill health or degradation of the environment, to a level as low as reasonably practicable and possible.

In particular, Johannesburg Water SOC Ltd will ensure that it shall not appoint any Principal Contractor unless it is reasonably satisfied that the contractor which it intends to appoint has the necessary competencies and resources to carry out the work safely.

1.3 Omissions from SHE Specification

Where any omission from the SHE Specification is identified, applicable legal requirements will constitute the minimum standard for compliance to the relevant omission. The responsibility will be on the Principal Contractor to provide assurance to Johannesburg Water SOC Ltd on compliance to the applicable legal requirements related to the activity / task / process.

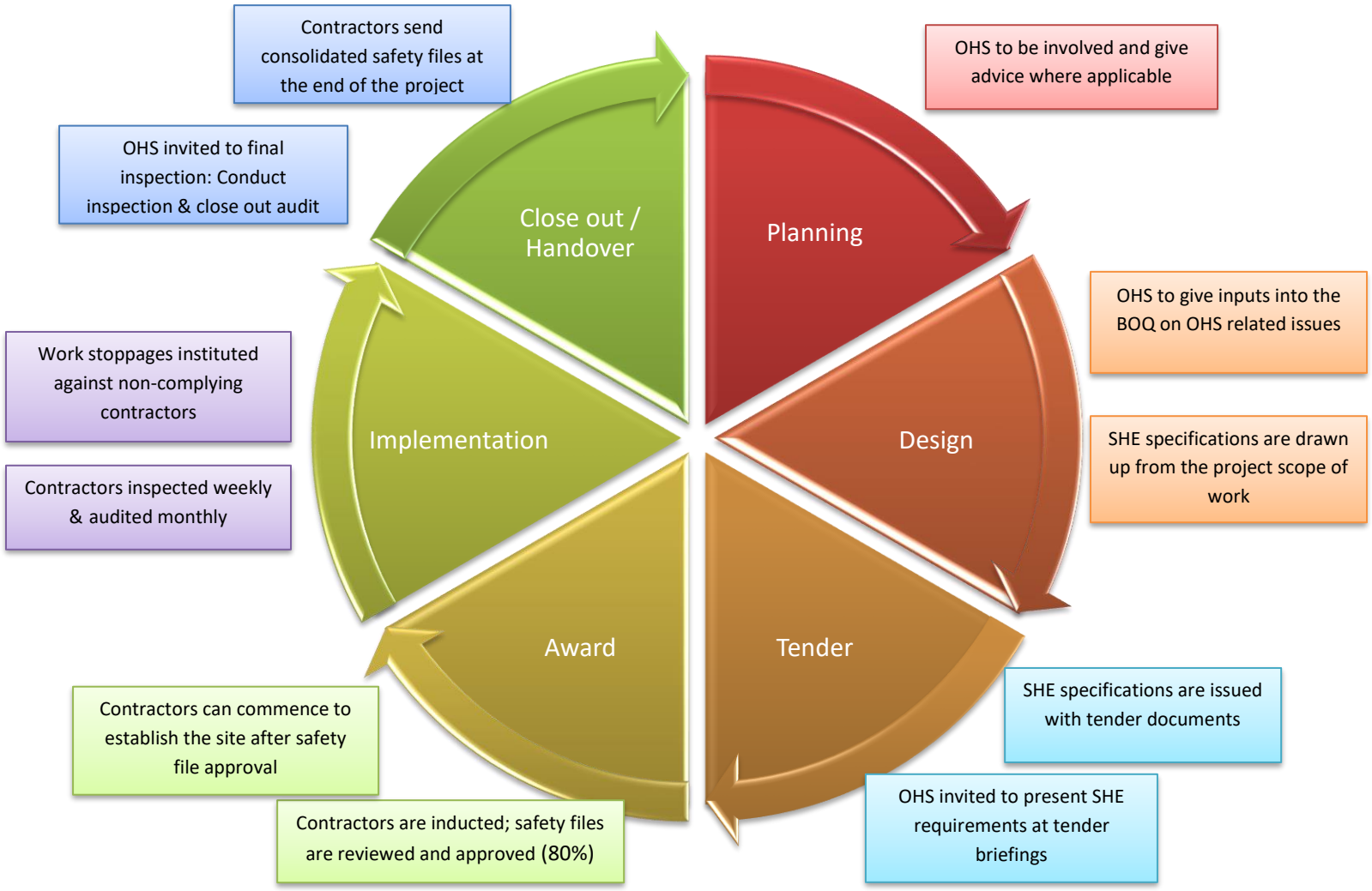
1.4 Change management

Whenever Johannesburg Water SOC Ltd identifies the need to change or review the SHE Specification, approved changes and revisions will be communicated to the Principal Contractor. A cost analysis on the implementation of the proposed changes / revisions will be calculated through a collaborative processes between Johannesburg Water SOC Ltd and the Principal Contractor – where the approved changes and/or revisions has no cost implication for the Principal Contractor the Principal Contractor will be required to accept the approved changes / revisions and ensure implementation within the SHE Plan / File framework.

2 Overview of contractor management process

The contractor management process consists of the following phases:

- Tender briefing and tender documentation;
- Competency evaluation of Principal Contractors (integrated into Supply Chain Management processes);
- Appointed contractor to attend SHE system induction;
- Preparation of SHE File by Principal Contractor;
- Evaluation of SHE File;
- Principal Contractor engagement phase;
- Project close-out and submission of consolidated Health & Safety File.


Contractors send consolidated safety files at the end of the project
OHS to be involved and give advice where applicable
OHS invited to final inspection: Conduct inspection & close out audit
Close out / Handover
Planning
OHS to give inputs into the BOQ on OHS related issues
Work stoppages instituted against non-complying contractors
Implementation
Design
SHE specifications are drawn up from the project scope of work
Contractors inspected weekly & audited monthly
Award
Tender
SHE specifications are issued with tender documents
Contractors can commence to establish the site after safety file approval
OHS invited to present SHE requirements at tender briefings
Contractors are inducted; safety files are reviewed and approved (80%)

2. SHE DOCUMENTATION

2.1 Safety file

The Principal Contractor will prepare a SHE File containing the processes / procedures and templates to be applied during the project period for the scope of work. The Principal Contractor will be evaluated during the contract period against the submitted SHE File.

Ata minimum the SHE File will contain the following documentation:

- Notification of construction work to the relevant Department of Labour (stamped on each page)
- Scope of work to be performed;
- Personnel list (Principal Contractor employees);
- OH&S / SHE Policy and other Policies;
- Updated copy of the Occupational Health and Safety Act (Act no. 85 of 1993) and its Regulations; COID Act.
- Proof of valid registration and good standing with the Compensation Commissioner or another licensed Insurer;
- SHE Plan agreed with Johannesburg Water SOC Ltd.
- Approved risk assessments, review and monitoring plans and safe work procedures (method statements);
- A list of contractors (sub-contractors) including copies of the agreements between the parties and the type of work being done by each contractor;
- All written designations and appointments for project scope of work (CV and competency copies);
- Management structure (inclusive of OH&S responsibility & meeting structure);
- Induction training and site SHE rules;
- Occupational health and safety training matrix / plan;
- Arrangements with contractors and/or mandatories;
- Description of security measures;
- The following registers (as applicable to contract scope of work):
    - Accident and/or incident notifications, investigation & control register;
    - Occupational health and safety representatives inspection register;
    - Template for entry into confined space;
    - Toolbox talks pro-forma;
    - Fall protection inspections template;
    - First-aid box content template;
    - Record of first-aid treatment template;
    - Fire equipment inspection and maintenance template;
    - Ladder inspection template;
    - Machine safety inspections template (including machine guards, lock-outs etcetera);
    - Inspection templates for lifting machines and –tackle (including daily inspections by drivers/operators);
    - Inspection templates of scaffolding;
    - Inspections templates of structures;
    - Templates of issuing of Personal Protective Equipment;
    - Monthly reporting and recording of statistics templates;
    - Keeping of any other record in terms of applicable legislation falling within the scope of SHE Legislation applicable to the project and the Principal Contractor / Contractor's activities and organization.
- Emergency preparedness and response programmes;
- Medical examination tests

2.2 Principal contractor appointment

- The principal contractor will be appointed in terms of Construction Regulations 2014, Reg 5(1) k
- All responsibilities imposed on the contractor by the Regulations will be applicable
- The duties will include:
    a) Prepare a site specific SHE file based on client SHE specification and project scope.

b) Have an updated Letter of Good standing.
c) Ensure the necessary legal appointment letters are compiled and signed by affected parties.
d) Ensure SHE file submitted before work commences to Johannesburg Water for evaluation and approval.
e) Must ensure an organizational medical programme for its employees is in place. This must address pre-employment, periodic examination, and exit examinations.
f) Ensure all employees undergo medical examination and are declared fit for the job they are employed for by a Medical Practitioner.
g) All employees undergo his control undergo company specific induction and Johannesburg water induction.
h) Ensure before work commences employees are trained on the health and safety risks associated with the work they are conducting.
i) Ensure employees are trained on company procedures, policies, method statements and informed of the Johannesburg Water SHE requirements as per the specification.
j) Ensure legislative requirements are complied with during the duration of the contract and ensure that their employees comply also.
k) Sign the 37 (2) Agreement between Johannesburg Water and themselves before any work commences and kept on their SHE file.
l) Ensure that 37(2) Agreement(s) are signed between themselves and their sub-contractors.
m) Ensure that sub-contractors have valid Compensation Commissioner Letter of Good Standing.
n) Have a disciplinary procedure to address those found to be transgressing requirements of SHE specification, SHE plan, site rules or any other OHS act and its Regulation requirement.
o) Prevent any employee or visitor who is under the influence of any alcohol or drugs (in state of intoxication) from being allowed to site.
p) Ensure the safety of employees who are taking legal medication.
q) Must hand over a consolidated SHE file at the end of the contract.
r) Stop his/her employees who are doing unsafe acts or who are creating an unsafe environment.
s) Investigate all incidents and report to Johannesburg water and ensure all reportable incidents as per the legislative requirement are complied with.
t) Ensure work is supervised by competent personnel and that work is done by competent employees.
u) Ensure pre-task risk assessment is done by a competent person and that employees are informed of the pre-task risks and the risk control measures.
v) Ensure tool box talks are conducted to communicate SHE issues in connection to the work being done and any other aspects.
w) Ensue that appointed personnel as per the SHE file are executing their duties as per the legal appointment.
x) Ensure first aid kit is made available in case of any emergency.
y) Ensure that housekeeping is maintained in good condition and that materials are store/stacked properly is designated areas.
z) Have sufficient waste receptacles and ensure the correct disposal of the different wastes.
aa) Proof of hazardous waste disposal to be requested from disposal site and to be kept inside SHE file.
bb) Take reasonable steps to ensure that each appointed sub-contractor health and safety plan is implemented and maintained on the site and SHE File documentation is up to date.
cc) Stop any work from being executed which is not in accordance with the client's health and safety specification and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons.
dd) Must maintain an up to date list of all the sub-contractors on site accountable to the principal contractor, the agreements between the parties and the type of work being done; and
ee) Ensure that all his or her employees have a valid medical certificate of fitness.

2.3 37.2 Agreement

- Johannesburg Water will enter into a 37(2) Agreement with all the appointed contractors
- A copy of the 37(2) Agreement must be kept in the SHE file of the contractor at all times.
- It is the responsibility of the contractor to ensure that there are 37(2) agreements between themselves and all their appointed sub-contractors.

2.4 SHE Plan

- The contractor shall prepare a SHE plan to address and manage all applicable sources of risk that are identified during the execution of the project. The SHE plan shall incorporate the requirements as listed in the SHE specification.
- A copy of the SHE plan shall be submitted together with SHE file for review and approval.
- It is the contractor responsibility to ensure they sub-contractor compiles a SHE plan that in line with the SHE specification requirement of Johannesburg Water.

2.5 Legislative framework

All contractors shall comply with legislation pertaining to this contract, including but not limited to:

- Constitution of the Republic of South Africa
- Occupational Health and Safety Act and its associated Regulations
- National Environmental Management Framework Legislation
- National Road Traffic Act
- Applicable South African National Standards (SANS)
- Compensation of Occupational Injuries and Diseases Act (COID)
- Local by-laws and provincial ordinances

2.6 SHE Policy

A SHE policy is a statement of intent and a commitment by the organization Chief Executive or Managing Director (OHS Act 16(1) appointee) in relation to requirements applicable to their Safety, Health and Environmental legal obligation, relevant SHE roles and responsibilities, and contractual obligations to the Client.
The contractor and their sub-contractor companies shall each have a documented SHE Policy authorized by their Chief Executive/Managing Director (OHS Act Section 16 (1) Appointee). The SHE Policy must meet the following minimum requirements;

- Organizational Mission and Goal.
- State the overall SHE objectives within the project.
- Show commitment to the prevention of injuries and ill-health.
- Show commitment to the protection of environment and the conservation of natural resources.
- Must be reviewed at predetermined intervals, or when there is change in work process, serious incident occurs.
- The SHE Policy must be in line with ISO 45001 and ISO 14001 requirements and guidance documentation.
- Must be authorized by contractor CEO.

2.7 Appointments and competencies

- The contractor and its appointed sub-contractor must make the relevant legislative and non-statutory appointments, which must be maintained valid for the entire contract duration.
- All appointees shall be suitably trained and certified competent for the responsibilities they are assigned for.
- Copies of all relevant appointments and the relevant competence certificates must be kept in the relevant SHE file.

2.8 Supervision of construction work

- The principal contractor shall ensure that the construction manager and construction health and safety officer are appointed for a ***single site*** on a full time basis.
- Where the total number of employees on site exceeds **75**, the contractor shall appoint 2 Safety Officers and an Assistant Construction Manager.
- In the event that the appointed Safety Officer / Construction Manager cannot come to work for more than 5 days, the contractor must ensure that a substitute is appointed until they are back on site.
- JW should be informed in writing of the absence of the above-mentioned on site.

Appointment index

Appointment	Legislative Ref	Competency requirements (Min)
Alternate Construction Manager	CR 8.1	N. Dip Eng + 4yrs exp
Assistant Construction Manager	CR 8.2	N. Dip Eng + 4yrs exp
Assistant Construction Supervisor	CR 8.8	-
Bulk mixing plant	CR 20	Certificate
Confined Space Supervisor	GSR 5	Certificate + Proven experience
Construction Manager	CR 8.1	N. Dip Eng + 4yrs exp Full time on site
Construction Health, Safety & Environmental Officer	CR 8.5 & JW Requirement	N. Dip Safety + 2yrs exp; OR N. Dip Enviro + 3yrs exp; OR NEBOSH / SAMTRAC + 4yrs exp Full time on site Experience in enviro / certificate **Fully registered with SACPCMP as CHSO**
Construction supervisor	CR 8.7	3 yrs experience
Construction vehicle & mobile plant supervisor	CR 23.1	Certificate
Electrical installation and appliances inspector	CR 24	
Emergency, security and fire coordinator	CR 29	Certificate
Excavation supervisor (including piling)	CR 13	3yrs exp / N. Dip building
Fall protection supervisor	CR 10.1	Certificate
First-aiders	GSR 3	Certificate
Fire fighting equipment inspector	CR 29	Certificate
General Machinery Supervisor	GMR 2.1/7	GCC (GMR 2.1)/ 3yrs exp (GMR 2.7)
Temporary work supervisor (Formwork)	CR 12.2	N. Dip building + 4yrs exp
Hazardous chemical substances supervisor	HCS Regs	Certificate
Incident investigator	GAR 9.2	Certificate
Ladder inspector	GSR 13A	-
Lifting machines and equipment inspector	DMR 18.5	Certificate + 3yrs experience
Materials hoist inspector	CR 19.8	Certificate
Occupational health and safety committee	OHS Act 19	-
Occupational health and safety representatives	OHS Act 17	Certificate
Risk assessor	CR 9.1	Certificate
Stacking and storage supervisor	CR 28	Certificate
Structures supervisor	CR 11.2	N. Dip building + 4yrs exp
Suspended platform supervisor	CR 17.1	Certificate
Welding supervisor	GSR 9	Certificate

2.9 Insurances

- The principal contractor and all his appointed contractors shall be registered with an appropriate compensation commissioner and have available a valid letter of good standing at all times.
- The obligation lies with the contractor to ensure that the Letter of Good Standing remains valid throughout the entire duration of the project.
- A copy of the said letter must be filed in all SHE files and made available during inspections and audits.

2.10 Costing for SHE

The contractor is responsible for ensuring that SHE costing is taken into consideration for the entire project/contract as this will ensure they comply with the SHE legislative requirements.

2.11 Sub-contractors

- Whenever the Principal Contractor appoints contractors or sub-contractors, it is a requirement that an Occupational Health and Safety Act (Act no. 85 of 1993) Section 37(2) agreement (i.e. Agreement with Mandatory) is entered into between the Principal Contractor and Contractors.
- The Principal Contractor will ensure that all appointed contractors comply with the Johannesburg Water SOC Ltd SHE Specification requirements.
- The Principal Contractor will establish a procedure on sub-contractor management and assurance on compliance to the established procedure will be provided to Johannesburg Water SOC Ltd on a monthly basis.
- Principal Contractors are required to formally notify Johannesburg Water SOC Ltd before appointing subcontractors.
- Johannesburg Water SOC Ltd shall approve all specialist subcontractors to be appointed and/or engaged by the Principal Contractor.

The Principal Contractor shall:

- Ensure prior to work commencing on the site that every contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993;
- Appoint each contractor in writing for the part of the project on the construction site;
- Take reasonable steps to ensure that each contractor's health and safety plan is implemented and maintained on the construction site;
- Ensure that the periodic site audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days;
- Stop any contractor from executing construction work which is not in accordance with the client's health and safety specifications and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons;
- Include and make available a comprehensive and updated list of all the contractors on site accountable to the principal contractor, the agreements between the parties and the type of work being done; and
- Ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3.

2.12 Notification of construction work

- There will not be a requirement for submitting a notification of construction work to Department of Employment and Labour.
- The Construction Work Permit will be applicable instead.

2.13 Construction work permit

- There will be a requirement for a construction work permit for this based on the number of days on site as well as project value.
- The permit can only be applied for after a contractor has been appointed, and the process will take approximately 30 days or more if requirements are not met.
- The Client will appoint a PrCHSA (Professional Construction Health and Safety Agent) registered with the SACPCMP to oversee the permit application process, and the contractor will be required to provide supporting documents for the application of the permit.

3. ORGANISATIONAL STRUCTURE

- The contractor shall develop and submit together with SHE file an organizational organogram related to the contractor, listing all the levels of responsibility from the Chief Executive down to the supervisor(s) responsible for the project.
- The organogram diagram must list all relevant positions, names of appointees and legal appointments.
- The contractor is responsible for updating the organogram timeously when there are changes to the appointments.
- All appointed sub-contractors are also required to compile their own organograms.

4. COMMITMENT TO SHE

- Visible commitment is essential to providing a safe working environment.
- Managers, supervisors and employees at all levels must demonstrate their commitment by being proactively involved in the day to day SHE operations.
- Legislation requires that each employee takes reasonable care of themselves and their fellow workers

5. HIRA

Annexure 1: List of possible hazards emanating from projects and activities conducted for or on behalf of Johannesburg Water SOC Ltd includes an assessment of site specific health and safety hazards and risks and environmental aspects and impacts that have been identified by Johannesburg Water SOC Ltd as possibly applicable to the contract work for this project. It is by no means exhaustive and is offered as assistance to the tenderers and contractors.

Development of risk assessments

Every Contractor performing construction work shall, before the commencement of any construction work or work associated with the construction work, and during construction work, ensure that a risk assessment is undertaken by a competent person, appointed in writing, and the risk assessment shall form part of the SHE plan to be applied on the site. Risk assessments shall identify occupational health and safety hazards and risks and environmental aspects and impacts emanating from the activity to be performed by the Principal Contractor / Contractor.

The risk assessment (inclusive of impact assessment) shall include (at a minimum):

- Identification of the relevant Johannesburg Water SOC Ltd Project with regard to JW Number, Project name and area;
- Date on which risk assessments were conducted / reviewed;
- The identification of the risks / hazards and aspects / impacts to which persons may be exposed to per activity;
- The analysis and evaluation of the risks / hazards and aspects / impacts identified;
- Existing control measures and proposed corrective measures;
- A plan to review the risk assessments as the work progresses and changes are introduced;
- Identification of significant risks (e.g. high; exceeding 75%);
- A documented plan of Safe Working Procedures (SWP)', and its relevance to the risk assessment, inclusive of method statements, to mitigate, reduce or control the risks and hazards that have been identified;
- A plan to monitor the application of the Safe Working Procedures (SWP);
- Signature of appointed competent person conducting risk assessment; and
- Signature of approval by Principal Contractor management and employees involved in risk assessment.

Based on the risk assessments, the Principal Contractor must develop a set of site-specific occupational SHE rules that will be applied to regulate the health, safety and environmental hazards/aspects of the construction work.

The risk assessments, together with the site-specific occupational health and safety rules, must be submitted to Johannesburg Water SOC Ltd before mobilisation on site commences. These will be included in the SHE plan. The Contractor shall ensure through his risk management process the hierarchy of controls stipulated as follows, are implemented:

- ***Eliminate*** - The complete elimination of the hazard.
- ***Substitute*** - Replacing the material or process with a less hazardous one.
- ***Redesign*** - Redesign the equipment or work process.

- ***Separate*** - Isolating the hazard by guarding or enclosing it.
- ***Administrate*** - Providing control such as training, procedures etc.
- ***Personal Protective Equipment (PPE)*** - Use of appropriate and properly fitted PPE where other controls are not practical. (PPE as the last resort)

The Principal Contractor will be required to carry out the following three forms of risk assessment:

- Baseline risk assessment;
- Issue based risk assessment;
- Continuous risk assessments.

Baseline risk assessments

The Principal Contractor is required to develop a baseline risk assessment taking the resources, competency levels, nature and scale of their organization into consideration for submission during SHE File evaluation phase. The hazards and risks to which persons, plant, vehicles and facilities may be exposed during the construction should be identified and evaluated. The aspects and impacts resulting in environmental pollution or degradation should also be identified and evaluated. Measures to reduce or control these risks or hazards should be defined during this assessment. The effectiveness of the measures defined and the baseline risk assessment prepared shall be monitored and reviewed from time to time to ensure that it remains relevant and accurate.

Issue based risk assessments

The Contractor will be required to carry out separate risk assessments during construction of the project when methods and procedures are varied, for example when:

- Designs are amended;
- New machines are introduced;
- Plant is periodically cleaned and maintained;
- Plant is started-up or shut-down;
- Systems of work change or operations alter;
- Indents or near-misses occur; or
- Technological developments invalidate prior risk assessments.

Continuous risk assessments

The Occupational Health and Safety Act (Act no. 85 of 1993) specifically requires that employers shall provide and maintain working environments that are safe and without risk to health. The general awareness of hazards needs to be raised as work ethic to maintain a safe and risk free environment on an on-going basis. This is achieved by continuous risk assessments, a form of risk assessment that takes place as an integral part of day-to-day management. Examples of continuous risk assessments include:

- Maintaining general hazard awareness, and
- Pre-work risk assessments / Daily Safety Task Instructions.

Occupational health and safety risks or environmental impacts that are identified during the risk assessment process shall be communicated before the commencement of the said activity to every employee whose work is associated with the risk. Each employee shall sign to confirm understanding of the safety, health or environmental risks in the tasks.

Review of risk assessments

The Principal Contractor is required to review the hazards identified, the risk assessments and the Safe Work Procedures as the contract work develops and progresses and each time changes are made to the designs, plans and construction methods and/or processes. Revisions to the approved risk assessments and Safe Work Procedures will be presented at each production planning and progress meeting.

Risk assessments are to be reviewed whenever there is change on the scope of work, process, and accidents or when required by Johannesburg Water SOC Ltd

The Principal Contractor must provide Johannesburg Water SOC Ltd, other contractors and all other concerned or affected parties with copies of any changes, alterations or amendments to risk assessments and Safe Work Procedures within 14 days of such changes.

6. SAFE WORK PROCEDURES / METHOD STATEMENTS

Method statements or written safe work procedures shall be documented for all high risk activities:

- Design change or scope change/addition
- Change in job or task
- Introduction of new machinery, equipment or substance.

Method statements or written safe work procedures shall identify following:

- Tasks that are to be undertaken
- The hazards and associated risks of the task(s)
- The control measures for the task(s)
- The equipment and substances that are associated with task(s)
- Any training or qualification needed to do the task
- Personal protective equipment to be worn.

7. INCIDENT MANAGEMENT

7.1 Reporting of accidents and incidents

The Principal Contractor must report all incidents where an employee is injured on duty to the extent that he:

- Dies
- Becomes unconscious
- Loses a limb or part of a limb
- Is injured or becomes ill to such a degree that he is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or continue with the activity for which he was usually employed

Or where -

- A major incident occurred
- The health or safety of any person was endangered
- Where a dangerous substance was spilled
- The uncontrolled release of any substance under pressure took place
- Machinery or any part of machinery fractured or failed resulting in flying, falling or uncontrolled moving objects
- Machinery ran out of control

to Johannesburg Water SOC Ltd within two days and to the Provincial Director of the Department of Labour within seven days from date of incident (Section 24 of the Occupational Health and Safety Act (Act no. 85 of 1993) and General Administrative Regulations), except that, where a person has died, has become unconscious for any reason or has lost a limb or part of a limb or may die or suffer a permanent physical defect, the incident must be reported to both Johannesburg Water SOC Ltd and the Provincial Director of the Department of Labour forthwith by telephone, telefax or e-mail.

- All other reports required by this specification must also be completed. Reporting of accidents / incidents to Johannesburg Water SOC Ltd will be on the prescribed format.
- The Principal Contractor is required to provide Johannesburg Water SOC Ltd with copies of all statutory reports required in terms of the Occupational Health and Safety Act (Act no. 85 of 1993) within 7 days of the incident occurring.
- The Principal Contractor is required to provide Johannesburg Water SOC Ltd with copies of all internal and external accident/incident investigation reports, within 7 days of the incident occurring.

7.2 Accident and incident investigation

- The Principal Contractor is responsible for the investigation of all accidents and/or incidents where employees and non-employees were injured to the extent that they had to receive medical treatment other than first aid.
- The results of the investigation are to be entered into the accident and/or incident register. The Principal Contractor is responsible for the investigation of all incidents, including those described in Section 24 (1) (b) and (c) of the Occupational Health and Safety Act (Act no. 85 of 1993) and for keeping a record of the results of the investigations including the steps taken to prevent similar accidents in future.
- The Principal Contractor is responsible for the investigation of all road traffic accidents, related to the construction activities, and for keeping a record of the results of the investigations including the steps taken to prevent similar accidents in future.
- Johannesburg Water SOC Ltd reserves the right to hold its own investigation into an incident or call for an independent external investigation.

7.3 Close out

- All incident investigation reports will be closed out once all the recommendations to prevent further incidents have been implemented.
- A copy of the investigation report must be handed to JW Safety Officer conducting the investigation.

8. MEDICAL SCREENING REQUIREMENTS

- The Principal Contractor shall ensure that a medical surveillance programme is implemented for all employees.
- An initial health evaluation shall be carried out by an occupational health practitioner immediately, before after a person commences employment, where any exposure exists or may exist, which comprises:
  - an evaluation of the employees medical and occupational history;
  - a physical examination; and
  - any other essential examination which in the opinion of the occupational health practitioner is desirable in order to enable the practitioner to do a proper evaluation.
- Medical surveillance and immunisation shall be done accredited at / by institutions or occupational health personnel, including, but not limited to:
  - Audiograms.
  - A cardio-respiratory examination / Lung function test;
  - Chest X-rays
  - Eye/ sight tests.
  - A general physical examination;
  - A review of previous medical history.
  - Glucose levels
  - Blood pressure

- An entry medical certificate shall be obtained for all workers prior to commencing with site activities from approved medical institution. Copies of all medical certificates shall be retained in the SHE File prior to site establishment and before an employee is allowed to come onto site.
- Specific attention shall be given to the physical and psychological fitness of people who will be required to work in elevated positions and operators of mobile machinery.
- An exit medical certificate shall be obtained for all workers at the end of the contract and for all workers who leave the employment of the Contractor before the end of the Project. Copies of all exit medical certificates shall be submitted to the Johannesburg Water SOC Ltd Project Specialist or Appointed OHS Agent.

9 EMERGENCY MANAGEMENT

The Principal Contractor must appoint a competent person to act as emergency controller and/or coordinator.

The Principal Contractor must conduct an emergency identification exercise and establish what emergencies could possibly develop. He must then develop detailed contingency plans and emergency procedures, taking into account any emergency plan that Johannesburg Water SOC Ltd may have in place.

In the event where a contractor incorporates the services of a 3rd party service provider for the provision of Emergency Response Services, the following criteria must be met:

- Identification of 3rd party emergency response services (organization & contact details);
- Notification of contractor to 3rd party emergency response service of incorporation of services into contractor's emergency response plan (written agreement / signed letter).

The Principal Contractor and the other contractors must hold regular practice drills of contingency plans and emergency procedures to test them and familiarise employees with them.

First-aid

The Principal Contractor must provide first-aid equipment (including a stretcher) and have qualified first-aider(s) on site as required by General Safety Regulations promulgated in terms of the Occupational Health and Safety Act (Act no. 85 of 1993).

The contingency plan of the Principal Contractor must include arrangements for the speedy and timeous transporting of injured and/or ill person(s) to a medical facility or of getting emergency medical aid to person(s) who may require it.

The Principal Contractor must have written arrangements in place with his other contractors regarding the responsibility of the other contractors towards their own injured and/or ill employees.

10 SHE TRAINING

All employees in jobs requiring training in terms of the Occupational Health and Safety Act (Act no 85 of 1993) and any other applicable legislative requirements are to be in possession of valid proof of training. Other occupational health, safety and environmental training requirements of the Occupational Health and Safety Act (Act no 85 of 1993) and Construction Regulations can include:

- General induction;
- Site and job specific induction, including visitors;
- Occupational health and safety representatives;
- Training of the legal and nominated appointees;
- Operators and drivers of construction vehicles and mobile plant;
- Basic fire prevention and protection;
- Basic first-aid;
- Storekeeping methods and safe stacking; and
- Emergency planning and coordination
- Incident investigation
- Risk Assessment
- Planned job observations (supervisors)

All operators, drivers and users of construction vehicles, mobile plant and other equipment are to be in possession of valid proof of training and, where applicable, valid licenses.

12.1 General Job training

The contractor is required to ensure that before an employee commences work their direct supervisor or line manager who is responsible for the employee has informed the employees of his scope of authority, hazards and risks associated with the work to be performed as well as the safety control measure(s). This will involve discussion in connection with ay work standard, job description or company policy or procedure.

12.2 Awareness and promotion

The Principal Contractor is required to have a promotion and awareness programme in place to create an occupational health and safety culture within employees. The following are some of the methods that may be used:

- Toolbox talks;
- Posters;
- Videos;
- Competitions;
- Suggestion schemes;
- Participative employee activities such as “occupational health and safety circles”.

The Principal Contractor is, at a minimum, required to provide awareness programmes to employees on the following:

- General Health and Safety Awareness
- Environmental Awareness;
- HIV / AIDS awareness.

12.3 General competence requirement

The Principal Contractor shall ensure that his personnel and other contractors’ personnel are trained and competent to carry out work safely and without risk to health has been completed before work commences. The Principal Contractor shall ensure that follow-up and refresher training is conducted as the work progresses and whenever the scope or nature of the work changes.

A “**competent person**” in relation to construction work, means any person having the knowledge, training and experience specific to the work or task being performed: Provided that where appropriate qualifications and training are registered in terms of the provisions of the South African Qualifications Authority Act, 1995 (Act No. 58 of 1995), these qualifications and training shall be deemed to be the required qualifications and training. It is the responsibility of the Contractor to determine whether any appropriate qualifications and training are registered in terms of the provisions of the South African Qualifications Authority Act.

Records of all training must be kept in the SHE File. The contents of the file will be audited from time to time.

At a minimum, the Principal Contractor will provide training on Safe Work Procedures / Safe Operating Standards to personnel responsible for performing the related task. Records of training on Safe Work Procedures / Safe Operating Standards will be retained. Competence and skill levels by the employees responsible for performing the task on the implementation of the Safe Work Procedures / Safe Operating Standards will be measured through Planned Job Observations.

12.4 Site-specific induction training

The Principal Contractor will be required to develop a project specific induction-training course based on the baseline risk assessment for the contract work. He will ensure that all his employees and other contractors and their employees have received training on the submitted induction-training programme.

All employees of the principal and other contractors are to be in possession of proof (on person) that they have attended a site-specific occupational health and safety induction-training course.

No contractor shall allow or permit any employee, visitor or any other person to enter the site, unless such employee or person has undergone health, safety and environmental induction training pertaining to the hazards prevalent on the site at the time of entry.

Where the Principal Contractor is required to operate within Johannesburg Water SOC Ltd Depot’s the Principal Contractor will ensure that all employees undergo the Johannesburg Water SOC Ltd induction.

11 PPE REQUIREMENTS

- The Principal Contractor is required to continuously identify the hazards in the workplace and deal with them. He must either remove them or, where impracticable take steps to protect workers and make it possible for them to work safely and without risk to health under the hazardous conditions.
- The Principal Contractor will establish a Personal Protective Equipment Policy and a Personal Protective Equipment study will be conducted to determine the types of Personal Protective Equipment (PPE) to be supplied related to the hazards and risks emanating from the tasks.
- Cognisance shall be given to the gender of individuals required to where PPE; size required by the employee and size issued.
- Personal protective equipment should, however, be the last resort and there should always first be an attempt to apply engineering and other solutions to mitigating hazardous situations before the issuing of personal protective equipment is considered.
- Where it is not possible to create an absolutely safe and healthy workplace the Principal Contractor is required to inform employees regarding this and issue, free of charge, suitable equipment to protect them from any hazards being present and that allows them to work safely and without risk to health in the hazardous environment.
- It is a further requirement that the Principal Contractor maintains the equipment, instructs and trains the employees in the use of the equipment and ensures that the employees use the prescribed equipment.
- Employees do not have the right to refuse to use and/or wear the equipment prescribed by the employer and, if it is impossible for an employee to use or wear the prescribed protective equipment through health or any other reason, the employee cannot be allowed to continue working under the hazardous condition(s) for which the equipment was prescribed. An alternative solution has to be found that may include relocating the employee.
- The Principal Contractor may not charge any fee for protective equipment prescribed by him but may charge for equipment under the following conditions:
    - Where the employee requests additional issue in excess of what is prescribed;
    - Where the employee has patently abused or neglected the equipment leading to early failure; and
    - Where the employee has lost the equipment.

All employees shall, as a minimum, be required to wear the following personal protective equipment on any of Johannesburg Water SOC Ltd's projects:

- Protective overalls;
- Protective footwear;
- Protective headwear; and
- Eye, face and ear protection.
- NO SHORTS OR DRESSES WILL BE ALLOWED ON SITE!!!

All Personal Protective Equipment will clearly display the branding components of the Principal Contractor's organization (e.g. Name of Organization, logo).

12 DISCIPLINARY PROCESSES

- The contractor is required to implement disciplinary process in order to enforce compliance with requirements.
- All sub-contractors are required to have the same.

13 SITE RULES

- The Principal Contractor must develop a set of site-specific OH&S rules that will be applied to regulate the Health and Safety Plan and associated aspects of the construction.

- When required for a site by law, visitors and non-employees upon entering the site shall be issued with the proper Personal Protective Equipment (PPE) as and when necessary**.**

14 PUBLIC HEALTH AND SAFETY

The Principal Contractor is responsible for ensuring that non-employees affected by the construction work are made aware of the dangers likely to arise from the construction work as well as the precautionary measures to be observed to avoid or minimise those dangers. This includes:

- Non- employees entering the site for whatever reason;
- The surrounding community; and
- Passers-by the site.

- The Principal Contractor shall organize the site in such a manner that pedestrians and vehicles can move safely and without risks to health, including sufficient and suitable traffic routes and safe walkways with relevant signage.
- Appropriate signage must be posted to this effect and all employees on site must be instructed to ensure that non-employees are protected at all times.
- All non-employees entering the site must receive induction into the hazards and risks of the site and the control measures to be observed.
- The Principal Contractor shall recognize that the Community Liaison Officer (CLO) is the link between Johannesburg Water SOC Ltd and the community and provide all reasonable support to the Community Liaison Officer to ensure relevant responsibilities are fulfilled and positive relationships with the community are maintained.
- Where activities are performed close to public routes, the Principal Contractor will establish a traffic management plan incorporating the requirements of relevant by-laws. At a minimum, barricading, warning signage and flagmen will be provided to ensure the protection of workers from vehicles in transit. Where required, the Principal Contractor will interact with the local traffic department to establish minimum requirements to be implemented on public routes.

15 REFUSAL TO WORK

- Section 14 of the OHS Act states that employees shall carry out any lawful orders given to them, suggesting that they have the right to refuse to obey any unlawful order or work instruction.
- In terms of legal and JW requirements, if an employee has reasonable belief that the work to be carried out is likely to endanger themselves or other persons in any way, he/she has the right to refuse to work.
- An employee may also refuse to work in term of Section 29 of NEMA, if the work would result in imminent and serious threat to the environment.
- All contractors shall ensure that their employees are conversant with hazards associated with their work and work environment, and be aware of the precautionary measures to take.
- The contractor must ensure that all refusals to work are investigated promptly and resolved timeously.

16 SECURITY

The Principal Contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must, amongst other, include the rule that non-employees will not be allowed on site unaccompanied.

The Principal Contractor must develop a set of security rules and procedures and maintain these throughout the construction period.

The Principal Contractor shall:

- Provide a guardhouse for security personnel. The guardhouse should be in good condition and at-least meet minimum requirements as per Environmental Regulations for Workplaces as promulgated under the Occupational Health and Safety Act (Act no. 85 of 1993).
- Supply an access card containing the name, surname, employee number and photograph for all appointed employees (full or part time) for the site.

- Ensure that no person enters the construction site without wearing the necessary Personal Protective Equipment (PPE).
- Ensure that no children are allowed on the construction site.
- Ensure that no family members are sleeping over on the construction site.
- Ensure that no pets are allowed on the construction site.

17 ACCOMMODATION ON SITE

No employees shall be accommodated on site.

18 WELFARE FACILITIES

The provision of toilets for each sex is required in terms of the National Building Regulations and Construction Regulation 28. Chemical toilets are allowed instead of the water borne sewerage type. Toilets have to be provided at a ratio of 1 toilet per 30 workers. The Principal Contractor shall provide flushing toilets on the construction premises.

- At least cold-water showers for each sex have to be provided at a ratio of 1 shower per 15 workers.
- Some form of screened off changing facility must be provided separately for each sex.
- Some form of eating facility sheltered from the sun, wind and rain must be provided.

The employer needs to provide his employees with the following:

- Potable water for drinking;
- Water and soap for hand washing
- Toilet paper

19 COMPLIANCE MONITORING

19.1 Inspections

- Contractors will be inspected at least once per week by the JW Project Inspectors.
- Feedback of the inspections will be issued immediately on work instructions, and a formal report sent within 7 days of conducting the inspection to all relevant stakeholders.
- Johannesburg Water SOC Ltd. reserves the right to conduct other ad-hoc assessments and inspections as deemed necessary.
- This may include, amongst other measures, site safety walks. Corrective actions will be identified by Johannesburg Water SOC Ltd. and the Principal Contractor's representative and implemented by the Principal Contractor (at no cost to Johannesburg Water SOC Ltd.) to ensure SHE Performance improvement.

19.2 Monthly audits

- Monthly audits will be conducted within periods not exceeding 30 days.
- The Principal Contractor is to conduct his own monthly internal audits and inspections to verify compliance with his own occupational health and safety plan and management system as well as compliance with the requirements of the Johannesburg Water SOC Ltd. SHE Specification.

- The Principal Contractor will also assess and inspect the compliance of other contractors under its control. Management members of the Principal Contractor will be involved in the internal assessments and inspections.

19.3 Monthly compliance rating

A monthly compliance rating will be calculated for each Principal Contractor as per a formula determined by Johannesburg Water SOC Ltd focussing on or incorporating outcomes of assurance (e.g. monthly audit), operational (e.g. behavioural based safety inspection) assessments and other requirements, as necessary. Johannesburg Water SOC Ltd reserves the right to adjust the monthly compliance calculation formula as and when required – each revision of the monthly compliance calculation formula will be communicated to the Principal Contractor before implementation.

Each Principal Contractor is required to maintain a minimum compliance rating of 93% (Ninety Three Percent).

Scoring	Classification	Classification description
93% -100%	Good	Substantial compliance
80% -92%	Average	Compliance status needs to be improved
60% - 79%	Poor	Methods to ensure compliance require substantial improvement - operations with substantial non-compliance risks
<60%	Very poor	Methods to ensure compliance failed completely - troubled operation with severe non-compliance risks

19.4 Work stoppages

Work stoppages will be identified for 2 (two) types of work stoppages to be implemented:

- Overall work stoppage – the Principal Contractor and its Contractors are not allowed to continue with any type of construction / site work up until the work stoppage has been closed-out;
- Activity work stoppage – The Principal Contractor and its Contractors are not allowed to continue with the specific activity / task / job up until the work stoppage has been closed-out.

Overall work stoppages will be issued where non-conformances are identified against the criteria in the following table.

NR	DESCRIPTION OF AUDIT NON-CONFORMANCE / NON-COMPLIANCE
1	**NOTIFICATION OF CONSTRUCTION WORK**
1.1	Local Department of Labour not notified of construction work before commencement of construction activities
1.2	Notification of construction work not stamped by local Department of Labour (no faxed copies)
1.3	Copy of notification of construction work not available on site
2	**PROOF OF REGISTRATION WITH COMPENSATION COMMISSIONER**
2.1	Proof of registration with Compensation Commissioner or other insurer not available
2.2	Registration with Compensation Commissioner or other insurer not valid and up-to-date
3	**POLICY COMMITMENT & SHE SPECIFICATION**
3.1	SHE Plan not compiled, approved by contractor management and available on site

NR	DESCRIPTION OF AUDIT NON-CONFORMANCE / NON-COMPLIANCE
4	**SECTION 37(2) AGREEMENT**
4.1	Signed section 37(2) Agreement not signed and available on site
5	**RISK ASSESSMENTS**
5.1	Risk assessments not developed/ not applicable to scope of work issued by Client
6	**CONSTRUCTION MANAGER**
6.1	No construction manager appointed / available on site
6.2	Appointed construction manager does not meet requirements
6.3	Proof of competency not available on-site
7	**SITE SAFETY OFFICER**
7.1	No safety officer appointed/ available on site
7.2	Safety officer does not meet requirements
8	**SHE FILE**
8.1	No file on site

Activity work stoppages will be issued where non-conformance are identified per activity where the health and safety of employees or the public is compromised.

20.4 Non-compliance management process

The following actions will be instituted where non-conformances are identified in terms of compliance to relevant legislative requirements and the Johannesburg Water SOC Ltd SHE Specification.

CRITERIA	ACTION TO BE INSTITUTED	RESPONSIBLE PARTY
Compliance rating: 93-100%	Non-conformance closure	Principal Contractor / Contractor
Compliance rating: 80-92%	Letter of compliance improvement to Principal Contractor	Johannesburg Water SOC Ltd
	Non-conformance closure	Principal Contractor / Contractor
Compliance rating: 60-79%	Non-compliance hearing	Johannesburg Water SOC Ltd
	Letter of commitment for performance improvement	Principal Contractor / Contractor
	Non-conformance closure	Principal Contractor / Contractor
Compliance rating: <60%	Non-compliance hearing	Johannesburg Water SOC Ltd
	Letter of commitment for performance improvement	Principal Contractor / Contractor
	Non-conformance closure	Principal Contractor / Contractor
	Supply Chain Management to be informed of non-compliance standing	Johannesburg Water SOC Ltd

CRITERIA	ACTION TO BE INSTITUTED	RESPONSIBLE PARTY
3 x Work stoppages	Non-compliance hearing	Johannesburg Water SOC Ltd
	Letter of commitment for performance improvement	Principal Contractor / Contractor
	Non-conformance closure	Principal Contractor / Contractor
	Supply Chain Management to be informed of non-compliance standing	Johannesburg Water SOC Ltd
3 x Non-conformance to <93% monthly compliance rating	Non-compliance hearing	Johannesburg Water SOC Ltd
	Letter of commitment for performance improvement	Principal Contractor / Contractor
	Non-conformance closure	Principal Contractor / Contractor
	Supply Chain Management to be informed of non-compliance standing	Johannesburg Water SOC Ltd
3 x consecutive repeat findings	Non-compliance hearing	Johannesburg Water SOC Ltd
	Letter of commitment for performance improvement	Principal Contractor / Contractor
	Non-conformance closure	Principal Contractor / Contractor
	Escalation to SCMU & CAPEX	Johannesburg Water SOC Ltd

20 OPERATIONAL REQUIREMENTS

20.1 EXCAVATIONS

- Where excavations will exceed 1.5 m in depth the contractor will be required to submit a method statement to Johannesburg Water SOC Ltd for approval before commencing with the excavation and Johannesburg Water SOC Ltd will issue a permit to proceed once the risk assessment and method statement is approved.
- Excavations must be limited to 100m per day, or equated to the amount of work to be done for the day.
- All open excavations shall be closed within 3 days of excavation. No excavation will remain open beyond 3 days or during holidays.
- Excavation work must be carried out under the supervision of a competent person, who has been appointed in writing, with at least two years' experience in excavation work. Before excavation work begins the stability of the ground must be evaluated.
- Whilst excavation work is being performed, the contractor must take suitable and sufficient steps to prevent any person from being buried or trapped by a fall or dislodgement of material.
- No person may be required or permitted to work in an excavation that has not been adequately shored or braced.
- Where the excavation is in stable material and where the sides of the excavation are sloped back to at least the angle of repose of the excavated material, shoring or bracing may be left out but only after written permission has been obtained from the appointed competent person.
- Shoring and bracing must be designed and constructed to safely support the sides of the excavation.
- Where uncertainty exists regarding the stability of the soil the opinion of a competent professional engineer or professional technologist must be obtained whose opinion will be decisive. The opinion must be in writing and signed by the engineer or technologist as well as the appointed competent person.
- No load or material may be placed near the edge of an excavation unless suitable shoring has been installed to be able to carry the additional load.

- Neighbouring/adjoining buildings, structures or roads that may be affected or endangered by the excavation must be suitably protected.
- Every excavation must be provided with means of access that must be within 6 metres of any worker within the excavation.
- The location and nature of any existing services such as water, electricity, gas etc. must be established before any excavation is commenced with and any service that may be affected by the excavation must be protected and made safe for workers in the excavation.
- The appointed competent person must inspect every excavation, including the shoring and bracing or any other method to prevent collapse, as follows:
    - Daily before work commences
    - After every blasting operation
    - After an unexpected collapse of the excavation
    - After substantial damage to any supports
    - After rain
- The results of any inspections must be recorded in a register kept on site and in the safety file.
- Every excavation accessible to the public or that is adjacent to a public road or thoroughfare or that threatens the safety of persons, must be adequately barricaded or fenced to at least one meter high and as close to the excavation as practicable, regardless of the depth of the excavation.
- Every excavation must be provided with warning lights or visible boundary indicators after dark or when visibility is poor.
- Upon entering an excavation the requirements of General Safety Regulation 5, work in confined spaces, must be observed:
- Any confined space may only be entered after the air quality has been tested to ensure that it is safe to breathe and does not contain any flammable or noxious air mixture.
- The confined space must be purged and ventilated of any hazardous or flammable gas, vapour, dust or fumes.
- The safe atmosphere must be maintained and, where necessary.
- Employees are to be provided with breathing apparatus and must wear a safety harness with a rope with the free end of the rope being continuously attended to by a person outside the confined space.
- Furthermore, an additional person, trained in resuscitation, to be in full-time attendance immediately outside the confined space.
- Additional serviceable breathing and rescue apparatus is kept immediately outside the confined space for rescue purposes.
- All pipes, ducts etc. that may leak into the confined space to be blanked off sufficiently to prevent any leakage or seepage.
- The employer must ensure that all employees have left the confined space after the completion of work.
- Where flammable gas is present in a confined space no work may be performed in close proximity to the flammable atmosphere.
- Excavations and other openings must be provided with sufficient barriers to prevent construction vehicles and mobile plant from falling into them.
- Excavations left open for extended periods of time (exceeding 48 hours) must be approved the relevant Engineer / Construction Supervisor.

20.2 EXISTING SERVICES

- The Contractor shall note that although the drawings have been prepared using available information they show only the approximate positions of existing services where applicable.

- The information is supplied in good faith but shall be used as a guide only and does not relieve the Contractor of his responsibility to exercise due caution when working in areas where existing services can reasonably be expected, nor his obligation to liaise with the authorities in this regard and the obtaining of the necessary work permits and wayleaves.
- The Contractor shall be responsible to locate and safeguard any existing service he may encounter during construction. The Contractor shall be responsible for any damage to such existing services and works in the execution of this contract and shall reimburse the Employer, authority or the owner concerned for any repairs required following damages due to the Contractor's negligence.
- The Contractor shall be responsible for immediately notifying the Engineer and the authorities concerned regarding any damage caused to public services and existing works.
- Any alterations to public services shall be carried out by the Authority concerned unless the Contractor is instructed otherwise.

20.3 SETTING OUT OF WORKS

- Reference and level beacons will be shown to the Contractor by the Engineer at the commencement of the Contract and the Contractor will be responsible for transferring the datum to the Site of Works.
- The Contractor shall check the condition and accuracy of all reference and level beacons and satisfy himself that they have not been disturbed and are true with regard to position and level. A beacon that has been disturbed shall not be used until its true position and level have been re-established and the new values have been certified by the Engineer. The Contractor shall thereafter be held entirely responsible for the protection of all reference and level beacons.
- The Contractor shall employ a capable surveyor to set out the Works to the required lines and levels. The Engineer shall be informed immediately should any discrepancy be discovered between the levels or dimensions obtained by the Contractor and those shown on the drawings.
- Where a beacon is likely to be disturbed during construction operations, the Contractor shall establish suitable reference beacons at locations where they will not be disturbed during construction. No beacons shall be covered over, disturbed or destroyed before accurate reference beacons have been established and details of the positions and levels of such beacons have been submitted to the Engineer. The Contractor's reference beacons shall be of at least the same accuracy and sturdiness of construction as the existing beacons.
- The Contractor shall submit the method of setting out he proposes to employ to the Engineer. Accurate control of line and level shall be provided by the Contractor at all stages of construction.
- Work set out by the Contractor may be checked by the Engineer and any errors found shall be rectified by the Contractor at his own expense. The Contractor shall supply any instrument, equipment, material and labour required by the Engineer for this survey work. Any assistance, including checking given to the Contractor by the Engineer or any setting out done by the Engineer for Contractor shall not be held as relieving the Contractor of his responsibility for the accurate construction of the Works.
- The Contractor's survey instruments and survey equipment shall be suitable for the accurate setting out of the Works and shall be subject to the approval of the Engineer. They shall furthermore be checked and correctly adjusted by the authorized agents before the commencement of the contract and subsequently when required by the Engineer and when otherwise necessary.
- Survey work shall not be measured and paid for directly and compensation for the work involved in setting out shall be deemed to be covered by the rates tendered and paid for the various items of work included under the contract.

20.4 CONFINED SPACE ENTRY

- Enclosed space work necessitates a Confined Space Permit. This may only be obtained from the authorized person nominated in writing.
- The responsibility for safe procedure, both at the time of entry and during the entire operation of entering and working in confined spaces, rests with the Contractor.
- The Contractor shall be sure that adequate steps have been taken to eliminate or control hazards.
- Before working in an area that contains dust, the area is to be ventilated and hosed down to settle and dampen the dust.
- The Contractor shall provide all necessary equipment to manage confined spaces, including all necessary monitoring and rescue equipment (such as tripods, breathing equipment and the like).
- The Contractor shall ensure all persons working in a confined space or managing entry to a confined space are appropriately trained.
- Compulsory - Continuous monitoring, trained rescue teams, radio communication & adequate ventilation.

- The contractor shall take steps to ensure that a confined space is entered by an employee or other person only after:
  - the air therein has been tested and evaluated by a person who is competent to pronounce on the safety thereof,
  - the competent person has certified in writing that the confined space is safe and will remain safe while any person is in the confined space, taking into account the nature and duration of the work to be performed therein.

- Where these provisions cannot be complied with, the contractor shall ensure that:
  - the confined space is purged and ventilated to provide a safe atmosphere therein and measures necessary to maintain a safe atmosphere therein have been taken; and
  - the confined space has been isolated from all pipes, ducts and other communicating openings by means of effective blanking other than the shutting or locking of a valve or a cock, or, if this is not practicable, only when all valves and cocks which are a potential source of danger have been locked and securely fastened by means of chains and padlocks.

- Where the above provisions cannot be complied with, the contractor shall ensure that the confined space in question is entered only when:
- the employee or person entering is using breathing apparatus of a type approved by the Chief Inspector;
- the confined space is purged and ventilated to provide a safe atmosphere therein and measures necessary to maintain a safe atmosphere therein have been taken; and
- the confined space has been isolated from all pipes, ducts and other communicating openings by means of effective blanking other than the shutting or locking of a valve or a cock, or, if this is not practicable, only when all valves and cocks which are a potential source of danger have been locked and securely fastened by means of chains and padlocks.
- any employee or person entering the confined space is using a safety harness or other similar equipment, to which a rope is securely attached which reaches beyond the access to the confined space, and the free end of which is attended to by a person trained in resuscitation.
- at least one other person trained in resuscitation is and remains in attendance immediately outside the entrance of the confined space in order to assist or remove any or persons from the confined space, if necessary; and
- effective apparatus for breathing and resuscitation of a type approved by the chief inspector is available immediately outside the confined space.
- The contractor shall take steps to ensure that all persons vacate a confined space on completion of any work therein

- Where hazardous gas, vapour, dust or fumes are of an explosive or flammable nature, an employer or user of machinery shall further take steps to ensure that such a confined space is entered only if --
    - the concentration of the gas, vapour, dust or fumes does not exceed 25 per cent of the lower explosive limit of the gas, vapour, dust or fumes concerned where the work to be performed is of such a nature that it does not create a source of ignition; or
    - such concentration does not exceed 10 per cent of the lower explosive limit of the gas, vapour, dust or fumes where other work is performed.
- The provisions of this regulation shall mutatis mutandis also apply, in so far as they can be so applied, to any work which is performed in any place or space on the outside of and bordering on or in the immediate vicinity of, any confined space, and in which place or space, owing to its proximity to the confined space, any hazardous article, oxygen-deficient atmosphere or dangerous concentration of gas, vapour, dust or fumes may occur or be present.

Pump sumps & valve chambers

Ventilation

- All available manholes or ventilation covers must be removed and the compartment ventilated for 10 (ten) to 15 (fifteen) minutes, using compressed air or a portable blower.
- Such ventilation must be continued while personnel are in the compartment.
- Ensure that exhaust fumes from blower do not enter the confined space.
- Before entering any sump or compartment, the atmosphere must be tested by the Principal Contractor's competent person (trained by the supplier of the gas monitoring equipment) by lowering the gas monitoring equipment to the bottom of the sump or compartment by means of a rope.
- A register must be kept indicating that the atmosphere has been tested and that the sump or compartment is fit to work in.
- The Principal Contractor's construction supervisor must check and co-sign this register each time he visits a site to ensure that the atmosphere is continuously being monitored.

Entering sump

- When entering a sump the person entering the sump must wear the safety harness, gas detector as well as a self-rescuer.
- A lifeline must be attached to the safety harness and a person on the surface must be in continuous contact with the person in the sump.
- At least one person on the surface must be trained in basic first aid and CPR and a first aid kit with resuscitation equipment must be available outside the entrance of the confined space for emergencies.
- Should the alarm sound when a person is in the confined space, the area must be evacuated immediately and the atmosphere re-tested and certified safe before re-entry into the confined space.
- In no circumstance shall any person remain within a sump for a period of more than one hour at a time.
- A five-minute rest on the surface must be taken after this period before re-entering.
- No naked lights, smoking or unprotected electrical apparatus which may cause sparks, shall be permitted in any sump or in their vicinity.

Confined spaces & water chambers

General

- All employees working in confined spaces or sewer manholes must be issued with gas monitoring equipment and safety harnesses and self- rescuers where applicable.
- All these employees must be trained in their use.
- Where over pumping between manholes is involved, only leakage free pumping machines and conveyance tubes will be allowed.
- Under no circumstances may any confined space be entered unless it has been certified safe to work in.
- Safety harnesses and attachments must be checked for damage to webbing, metal fittings and ropes on a monthly basis and the findings recorded in a register.

- Should a harness be damaged, it must be reported to the construction supervisor immediately.

The following records shall be taken and maintained by the Principal Contractor:

- Confined space entry permits
- Confined space entry registers
- Safety harness registers

Ventilation

- All available manholes or ventilation covers must be removed and the chamber ventilated for 10 (ten) to 15 (fifteen) minutes, using compressed air or a portable blower.
- Such ventilation must be continued while personnel are in the chamber.
- Ensure that exhaust fumes from blower do not enter the confined space.
- Before entering any chamber, the atmosphere must be tested by the Principal Contractor's competent person (trained by the supplier of the gas monitoring equipment) by lowering the gas monitoring equipment to the bottom of the chamber by means of a rope.
- A register must be kept indicating that the atmosphere has been tested and that the area is fit to work in.
- The Principal Contractor's construction supervisor must check and co-sign this register every time he visits the site to ensure that the atmosphere is continuously being monitored.
- Fumes must be extracted from the chamber while welding.

Entering chamber

- When entering a chamber the person entering the chamber must wear a safety harness as well as the gas detector.
- A lifeline must be attached to the safety harness and a person on the surface must be in continuous contact with the person in the manhole.
- At least one person on the surface must be trained in basic first aid and CPR and a first aid kit with resuscitation equipment must be available outside the entrance of the confined space for emergencies.
- In no circumstances shall any person remain within a chamber for a period of more than one hour at a time. A five-minute rest on the surface must be taken after this period before re-entering.
- Should the alarm sound when a person is in the confined space, the area must be evacuated immediately and the atmosphere re-tested and certified safe before re-entry into the confined space.
- When the activity to undertake inside the pipeline includes the use of any hazardous chemical substances or substances, which might cause hazardous fumes or gasses the contractor, must comply with 5.24 Hazardous Chemical Substances.

Safety equipment

- All teams must be issued with gas monitoring equipment and safety harnesses and self-rescuers where applicable.
- All employees must be trained in the use thereof.

20.5 BARRICADING

- Barricading plans are to be presented by the Principal Contractor for any major operations involving site works for approval by Johannesburg Water SOC Ltd. Where areas are unsafe, they should be enclosed with barricading. Examples are people working overhead, welding splatter etc.
- Where there is a risk of injury, the area should be barricaded off with secure solid barricades.
- Barricading for the prevention of access into areas with a potential risk of injury shall as a minimum be constructed of a handrail, knee-rail and appropriately supported as to prevent any person from falling into the restricted/risk area.
- Appropriate signage shall be affixed to the barricade indicating the risk associated (i.e. deep excavation, lifting operations etc.) and the responsible Supervisor and contact details shall be displayed. All barricading shall have a "No Entry" signs on all sides and at each change of direction. Signage shall be placed at 20 m intervals where lengths exceed. All signage shall be a minimum size of 290 mm x 290 mm.

- Danger tape shall not be utilised to prevent personnel from entering into areas.
- Where no risk exists of injury to personnel such as stacking and storage areas, the use of wire for hand and knee rails netting shall be acceptable to demarcate the area.
- All barricades will have a dedicated entrance where it is required that personnel enter the areas.
- Appropriate signage shall be placed at the entrance indicating which Contractor has right of entry.
- It is the Contractor's responsibility to remove all redundant barricades directly after use. The Contractor's Safety Officers will maintain a marked-up site plan indicating where barricades are erected.
- It will be a requirement that the contractor protects employees against contact with exposed rebar and poles by the installation of rebar-caps on all exposed areas where there is a potential that an employee could be injured.

20.6 SYMBOLIC SIGNGAGE

Contractors shall use mandatory and prescribed symbolic safety signs at their lay down and site areas. The display of the following signs is mandatory:

- "Radio-Active Material" symbolic signs at radioactive storage areas.
- "Eye Protection" symbolic signs shall be displayed at all grinding machines and at any area where it is mandatory to wear eye protection or where there is danger of an eye injury being sustained.
- "Ear Protection" symbolic signs shall be displayed at all areas where there is a danger of noise induced hearing loss being sustained.
- Every separate room of a workplace shall be consecutively numbered.
- All toilets or urinals shall be marked in a conspicuous place with painted or stencilled letters to indicate the sex for which they are intended.
- The location of every first aid box is to be clearly indicated by means of a sign.
- In any room, cabinet or enclosure where flammable substances are used or stored shall be fixed a suitable and conspicuous sign prohibiting smoking or the use of naked flames in the area.
- At the entrance to premises where machinery is used
- Restricted access on "Authorised Person Only" signs on entry. "No person shall enter the workplace or premises without the permission of the employer or user of the machinery".
- At every place where machinery is used a notice (English & Pictograms) shall be posted.
- Explosive Power Tool shall have a sign warning people when it is in use.
- Electrical Control Gear. A notice shall be posted so as to warn against the re-closing of a switch of control gear whilst a person is working on such equipment.
- Emergency contact telephone numbers.
- Adequate scaffolding signs. (When applicable).
- Adequate fire fighting equipment signs.
- Speed limit signs.
- Warning notices at openings through which people may fall.
- Risk based signage depending on the task being performed e.g.:
    - "Men working above", "Men working below', "Road closed – detour", "Excavation in progress", "No walkway" etc.;
- No-entry signs to incomplete platforms

The Principal Contractor shall install a notification board indicating the following information at the site entrance:

- Johannesburg Water SOC Ltd project number;
- Principal Contractor identification details (name, telephone number)
- Name and contact details of Construction Supervisor;
- Name and contact details of site safety officer;
- Monthly compliance rating;
- Lost Time Injury Rate;

The Principal Contractor will ensure that information on the notification board is kept up-to-date.

20.7 USE AND STORAGE OF FLAMMABLES

The Principal Contractor to ensure that:

- No person is required or permitted to work in a place where there is the danger of fire or an explosion due to flammable vapours being present unless adequate precautions are taken;
- No flammable material is used or applied e.g. in spray painting, unless in a room or cabinet or other enclosure specially designed and constructed for the purpose unless there is no danger of fire or explosion due to the application of adequate ventilation;
- The workplace is effectively ventilated. Where this cannot be achieved:
    - Employees must wear suitable respiratory equipment
    - No smoking or other source of ignition is allowed in the area
    - The area is conspicuously demarcated as “flammable”
- Flammables stored on a construction site are stored in a well-ventilated, reasonably fire-resistant container, cage or room that is kept locked with access control measures in place. Sufficient fire fighting equipment is installed and fire prevention methods practiced. Proper housekeeping may achieve this;
- Flammables stored in a permanent flammable store are stored so that no fire or explosion is caused.
- Stored in a locked and well-ventilated reasonably fire resistant container, cage or room conspicuously demarcated as “Flammable Store – No Smoking or Naked Lights”
- The flammables store to be constructed of two-hour fire retardant walls and roof and separated from adjoining rooms or workplaces by means of a two-hour fire retardant fire wall
- Adequate and suitable fire fighting equipment installed around the flammables store and marked with the prescribed signs
- All electrical switches and fittings to be of a flameproof design
- Any work done with tools in a flammable store or work areas to be of a non-sparking nature
- No Class A combustibles such as paper, cardboard, wood, plastic, straw and the like to be stored together with flammables
- The flammable store to be designed and constructed such that in the event of spillage of liquids the store is able to contain the full quantity + 10% of the liquids stored
- A sign indicating the capacity of the store to be displayed on the door
- Only one day’s quantity of flammable is to be kept in the workplace;
- Containers (including empty containers) to be kept closed to prevent fumes/vapours from escaping and accumulating in low lying areas;
- Metal containers to be bonded to earth whilst decanting to prevent build-up of static forces; and
- Welding and other flammable gases to be stored segregated according to the type of gas and empty and full cylinders.

20.8 HAZARDOUS CHEMICAL SUBSTANCES

The Principal Contractor must ensure that:

- Employees receive the necessary information and training to be able to use and store hazardous chemical substances safely;
- Employees obey lawful instructions regarding:
    - The wearing and use of protective equipment
    - The use and storage of hazardous chemical substances
    - The prevention of the release of hazardous chemical substances
    - The wearing of exposure monitoring and measuring equipment
    - The cleaning up and disposal of materials containing hazardous chemical substances
    - Housekeeping, personal hygiene and the protection of the environment
- The risk assessments required in terms of Construction Regulation include employee exposure to hazardous chemical substances and that the necessary measures be taken to protect persons from being detrimentally affected by hazardous chemical substances present or used in the workplace;
- Suppliers provide the necessary information in the form of a material safety data sheet regarding a hazardous chemical substances required to ensure the safe use and storage of that substances;

- An up-to-date list is kept on site of hazardous chemical substances stored and used together with the material safety data sheet of the hazardous chemical substances;
- Hazardous chemical substances containers be clearly marked with the contents and main hazardous category e.g. “Flammable” or “Corrosive” and the reference number of the hazardous chemical substances on the list indicated above;
- Hazardous chemical substances, for example asbestos dust, are not cleared by using compressed air but should be vacuumed;
- No person eats or drinks in a hazardous chemical substances workplace; and
- Hazardous chemical substances waste is disposed of safely in terms of hazardous waste disposal requirements.
- MSDS’s to be in 16 point format- available on site

20.9 FIRE PREVENTION AND PROTECTION

The Principal Contractor must ensure that:

- The risk of fire is avoided;
- Sufficient and suitable storage for flammables is provided;
- Sources of ignition are removed wherever flammable or highly combustible material is present in the workplace, for example:
    - Notices prohibiting smoking are displayed and enforced
    - Welding and flame cutting is only allowed under controlled conditions that includes written hot work permits
    - Only spark-free hand and power tools are used
    - No grinding, cutting and shaping of ferrous metals is allowed using electrically driven power tools that produce sparks
    - Flameproof switches and fittings are to be used in the flammable atmosphere
    - Good housekeeping is maintained to prevent the accumulation of unnecessary combustibles
    - Adequate ventilation is maintained
    - Adequate and suitable fixed and portable fire fighting equipment is provided and maintained in good working order.
- Maintenance must include:
    - Regular inspection of fire equipment by a competent person appointed in writing and keeping a register
    - Annual inspection and service by an accredited service provider
- All employees are instructed in the use of the fire fighting equipment and know how to attempt to extinguish a fire;
- A sufficient number of employees are appointed and trained to act as an emergency team to deal with fires and other emergencies;
- Employees are informed regarding emergency evacuation procedures and escape routes;
- Emergency escape routes are kept clear at all times and clearly marked;
- Evacuation assembly points are demarcated;
- Evacuation is practiced to ensure that all persons are evacuated timeously;
- Roll call is held after evacuation to account for all personnel and ensure that no-one has been left behind; and
- A siren or alarm is fitted which is clearly audible to all persons on site.

20.10 STACKING AND STORAGE

The Principal Contractor must ensure that:

- A competent person is appointed in writing to supervise all stacking and storage on a construction site;
- Adequate storage areas are provided and demarcated;
- The storage areas are kept neat and under control;
- The base of any stack is level and capable of sustaining the weight exerted on it by the stack;
- The items in the lower layers can support the weight exerted by the top layers;

- Cartons and other containers that may become unstable due to wet conditions are kept dry;
- Pallets and containers are in good condition and no material is allowed to spill out;
- The height of any stack does not exceed 3 times the base unless stepped back at least half the depth of a single container at least every fifth tier or the approval of an inspector has been obtained to build the stacks higher with the aid of a machine. The operator of the machine must be protected against items falling from overhead off the stack and no items may overhang;
- The articles that make up a single tier are consistently of the same size, shape and mass;
- Structures for supporting stacks are structurally sound and able to support the mass of the stack;
- No articles are removed from the bottom of the stack first but from the top tier first;
- Anybody climbing onto a stack must do it in a safe manner, taking reasonable safety precautions, and ensuring that the stack is stable and capable of supporting him or her
- Stacks that are in danger of collapsing are broken down and restacked;
- Stability of stacks are not threatened by vehicles or other moving plant and machinery;
- Stacks are built in a header and stretcher fashion and that corners are securely bonded;
- Stacks are stepped back at least half the depth of a single container at least every fifth tier; and
- Persons climbing onto stacks do not approach unguarded moving machinery or electrical installations.
- Laydown area is allocated for Contractor-supplied items.
- At all times, the Contractor shall be responsible for the safe and adequate storage of all materials and equipment on site which he is to install, whether they are supplied by himself or others.
- The safe handling, unloading and loading of material receipts and dispatches at site or storage areas shall be the Contractors' responsibility.

The Contractor shall provide a suitable and adequate lock-up store for the storage of items of equipment and material, which would be damaged or pilfered if stored in the open. The Principal Contractor shall provide all facilities required for weather-proofing, dust proofing or vermin proofing.

The Contractor is responsible for the proper storage and maintenance of all equipment until issue of the Certificate of Practical Completion.

All equipment and materials will be stored on suitable wood poles or pallets which will not protrude more than a meter from any of the stored material. Safe access ways shall be maintained between all stored items preventing employees from having to climb over or under equipment to retrieve the necessary.

20.11 HOUSEKEEPING

The Principal Contractor to ensure that:

- Housekeeping is continuously implemented and maintained;
- Materials and equipment are properly stored;
- Scrap, waste and debris is removed regularly;
- Materials placed for use are placed safely and not allowed to accumulate or cause obstruction to the free-flow of pedestrians and vehicular traffic;
- Waste and debris not to be removed from heights by throwing but rather by chute or crane;
- Where practicable, construction sites are fenced off to prevent entry of unauthorised persons;
- Catch platforms or nets are erected over entry and exit ways or over places where persons are working to prevent them being struck by falling objects;
- An unimpeded work space is maintained for every employee;
- Every workplace is kept clean, orderly and free of tools, materials and the like that are not required for the work being done;
- As far as is practicable, every floor, walkway, stair, passage and gangway is kept in good state of repair, skid-free and free of obstruction, waste and materials;
- The walls and roof of every indoors workplace sound and leak-free; and
- Openings in floors, hatchways, stairways and open sides of floors or buildings are barricaded, fenced, boarded over or provided with protection to prevent persons from falling.

20.12 PUBLIC HEALTH AND SAFETY

The Principal Contractor is responsible for ensuring that non-employees affected by the construction work are made aware of the dangers likely to arise from the construction work as well as the precautionary measures to be observed to avoid or minimise those dangers. This includes:

- Non- employees entering the site for whatever reason;
- The surrounding community; and
- Passers-by the site.

- The Principal Contractor shall organize the site in such a manner that pedestrians and vehicles can move safely and without risks to health, including sufficient and suitable traffic routes and safe walkways with relevant signage.
- Appropriate signage must be posted to this effect and all employees on site must be instructed to ensure that non-employees are protected at all times. All non-employees entering the site must receive induction into the hazards and risks of the site and the control measures to be observed.
- The Principal Contractor shall recognize that the Community Liaison Officer (CLO) is the link between Johannesburg Water SOC Ltd and the community and provide all reasonable support to the Community Liaison Officer to ensure relevant responsibilities are fulfilled and positive relationships with the community are maintained.

20.13 TRAFFIC MANAGEMENT

- Where activities are performed close to public routes, the Principal Contractor will establish a traffic management plan incorporating the requirements of relevant by-laws.
- At a minimum, barricading, warning signage and flagmen will be provided to ensure the protection of workers from vehicles in transit.
- Where required, the Principal Contractor will interact with the local traffic department to establish minimum requirements to be implemented on public routes.

20.14 HAND TOOLS

The Principal Contractor must inspect all hand tools before it is brought onto the site.

- As far as possible all hand tools must be numbered and placed on register to be inspected monthly by a person designated to do so.
- Any tools found to be in an unsafe condition must immediately be removed from service and either discarded or rectified.
- No chisels with “mushroomed” heads must be used.
- No hammer shall be used with a cracked or damaged handle.
- All files must be fitted with handles.
- All trolleys, pushcarts, etc. used on site must be identifiable, placed on register and inspected at least once every month.
- Non-sparking tools must be used in areas where the risk of fire or explosion is present.
- No homemade hand tools are allowed on the project.
- All tools shall be attached to a suitable lanyard when utilised in elevated positions

20.15 PORTABLE ELECTRICAL EQUIPMENT

Portable electrical tools and equipment includes every unit that takes electrical power from a 15 ampere plug point and is moved around for use in the workplace for example; drills, saws, grindstones, portable lights, etcetera. Other electrical appliances such as fridges, hotplates, heaters, and etcetera must be inspected and maintained to the same standards as portable electrical tools and appliances.

The use, inspection and maintenance of portable electrical tools and equipment shall be as follows:

- Periodical inspections must be carried out by a competent person appointed in writing;
- Inspection results must be recorded in a register;
- Only competent authorised persons are allowed to use portable electrical tools and equipment; and
- The correct protective equipment must be worn or used whilst operating portable electrical tools and equipment.

This equipment:

- Must be maintained in good condition at all times to prevent an electrical shock to the user;
- The main power source should incorporate an earth leakage protection device or receive power through a double wound transformer or be double insulated and clearly marked as such; and
- All equipment must be fitted with a switch to allow for safe and easy starting and stopping.

The following requirements apply to portable lights:

- Must be fitted with a robust non-hygroscopic non-conducting handle;
- Live metal parts or parts which may become live must be protected against contact;
- The lamp must be protected by a strong guard;
- The cable lead-in must withstand rough handling;
- Inspections must be undertaken that concentrate on plug, cord, switch and any obvious faults;
- A register be kept for each piece of equipment with findings of regular inspections undertaken to evaluate the condition of these lights; and
- When used in wet/damp/metal container conditions, the lamp must be protected.

20.16 LIFTING EQUIPMENT & MACHINERY

Lifting equipment must be designed and constructed in accordance with the manufactures/designers specifications as well as generally accepted technical standards and operated, used, inspected and maintained in accordance with the manufactures requirements as well as that of the of Driven Machinery Regulations promulgated in terms of the Occupational Health and Safety Act (Act no 85 of 1993).

The Driven Machinery Regulations requires that:

- Lifting equipment is clearly and conspicuously marked with the maximum mass load (MML) that it is designed to carry safely. When the MML varies with the conditions of use a table showing the maximum mass load with respect to every variable condition shall be posted up by the user in a conspicuous, place easily visible to the operator and the table shall be used by the driver/operator;
- Each winch on a lifting machine must at all times have, at least, three full turns of rope on the drum when the winch has been run to its lowest limit;
- Lifting equipment shall be fitted with a brake or other device capable of holding the MML. This brake or device shall automatically prevent the downward movement of the load when the lifting power is interrupted;
- Lifting equipment shall be fitted with a load limiting device that automatically arrest the lift when the load reaches its highest safe position or when the mass of the load is greater than the MML;
- Every chain or rope on a lifting machine that forms an integral part of the machine must have a factor of safety as prescribed by the manufacturer of the machine. Where no standard is available the factor of safety must be:
    - chains – 4 (four)
    - steel wire ropes 5 (five)
    - fibre ropes- 10 (ten)
- Every hook or load attaching device must be designed to prevent the load from slipping off or disconnecting;
- Every lifting machine must be inspected and load tested by a competent person every time it has been dismantled and re-erected and every 12 months after that. The load test must be in accordance with the manufacturer's requirements or to 110% of the MML. In addition, all ropes, chains, hooks or other attaching devices, sheaves, brakes and safety devices forming an integral part of a lifting machine must be inspected every 6 months by a competent person;
- All maintenance, repairs, alterations and inspection results must be recorded in a log book and each lifting machine must have its own log book; and

- No person may be lifted by a lifting machine not designed for lifting persons unless in a cradle approved by the inspector of the Department of Labour.

General requirements for cranes and lifting equipment

All documentation must be provided to the Johannesburg Water SOC Ltd Project Engineer prior to mobilisation. Failure to do so and the resulting cost of any delays and/or remedial activities will be for the Contractor's account.

All crane operators must be authorised by the relevant Engineer before they may operate a crane or lifting machine. The Load charts must be displayed at the crane.

Daily pre-use inspections of the cranes must be done and be kept on the file. The inspections must be logged in a logbook. The area in which a lift is performed must always be barricaded to prevent employees from entering.

A crane or lifting machine must not be left unattended and the keys may never be left in the ignition when the operator is not present. Properly constructed out rigger pads must be used when soil is uneven or unstable. (Only sleepers or appropriately designed steel plate pads may be used for this purpose).

Only a competent rigger may direct a lift of any kind unless the following requirements are met. Rigger assistants used for performing lifting operations shall be limited to lifts with all of the following requirements:

- Lifts lower than 5 tons
- Easy lifts that does not require the load to be lifted over structures, equipment or machinery
- Equipment that is not critical
- Rigging configuration that requires the attachment of several parts of lifting equipment such as chain blocks to adjust the angle of loads.
- All safety devices on a crane or lifting machine must be functional.

Certification will be required for record purpose, and shall cover the following:

- A Brake or other device capable of holding the maximum mass should the power fail, or which is such that it shall automatically prevent the uncontrolled downward movement of the load when the raising effort is interrupted; and
- A Limiting device which shall automatically arrest the driving effort when:
- The Hook or Load attachment point of the Power Driven lifting machine reaches its highest safe position; and
- In the case of a Winch Operated lifting machine with a lifting capacity of 5000kg or more, the load is greater than the rated mass load of such machine.

The user shall ensure that every lifting machine is operated by an Operator specifically trained for a particular type of lifting machine; the user shall not require or permit a person to operate such lifting machine unless the operator is in possession of a certificate of training, issued by an accredited person or organisation.

No Crane shall be used at arrival on site before copies of all documentation have been handed over to the Johannesburg Water SOC Ltd and the Crane have been checked by a person duly authorised and signed off as acceptable. Copies of all documentation shall be kept in the SHE File at all times.

No Crane shall be used without a pre-use check and findings entered on an approved checklist. Before any cranes are established on site the following must be inspected and approved:

- Operator's licences
- Training certificates
- Medical fitness certificate.
- The cranes load test certificate.
- Rope test certificates including Mill / Destructive test.
- The lifting gear load test certificates.
- The load limiting device calibration certificate.
- Proof that the hooks have been measured for spreading.
- The service inspection history.

- Monthly comprehensive inspection certificate
- Operation and maintenance Manuals and crane condition.

Cranes and Lifting Machines

A contractor shall ensure that where tower cranes are used:

- Account is taken of the effects of wind forces on the structure;
- Account is taken of the bearing capacity of the ground on which the tower crane is to stand;
- The bases for the tower cranes and tracks for rail-mounted tower cranes are firm and level;
- The tower cranes are erected at a safe distance from excavations;
- There is sufficient clear space available for erection, operation and dismantling;
- The tower crane operators are competent to carry out the work safely; and
- The tower crane operators are physically and psychologically fit to work in such an environment by being in possession of a medical certificate of fitness."

No user shall use or permit any person to use a Jib-Crane with a lifting capacity of 5000kg or more at a minimum Jib radius, unless it is provided with:

- A load indicator that shall indicate to the operator of the Jib-Crane the mass of the load being lifted, provided that such a device shall not require manual adjustment from the application of the load, to the Jib-Crane, until the release of the load.
- A Limiting Device, which shall automatically arrest the driving effort whenever the load is lifted, is greater than the rated mass load of the Jib-Crane.

Mobile Crane near Power Lines

No mobile cranes are to be used near overhead power lines until the Johannesburg Water SOC Ltd representative has been notified and provided safe access conditions and a valid permit to work is obtained. Mobile cranes shall be effectively earthed when working in the vicinity of electrical wires. Assume that all electrical equipment and wires are live and avoid them.

Lifting tackle

The following requirements will apply to lifting tackle:

- Manufactured of sound material, well-constructed and free from patent defects;
- Clearly and conspicuously marked with an identity number;
- MML factor of safety:
    - Natural fibre ropes - 10(ten)
    - Man-made fibre ropes and woven webbing - 06(six)
    - Steel wire ropes – single rope - 06(six)
    - Steel wire ropes – combination slings - 08(eight)
    - Mild Steel chains - 05(five)
    - High tensile/alloy steel chains - 04(four)
- Steel wire ropes must be examined by a competent person every three months and the results recorded in a designated logbook. The ropes must be discarded (not used any further for lifting purposes) when wear and corrosion is evident.

20.17 LADDERS

The following requirements for ladders will apply:

- All ladders used on the site shall be constructed and used in compliance with the OH&S Act and Regulations.
- Ladders, which provide access to a working platform, shall extend one metre above the platform where it provides access, and shall be secured to prevent slipping.
- Timber ladders shall not be painted other than with clear preserving oils, clear varnishes or clear plastics.
- Ladders, which are in a damaged condition, shall not be used and shall be labelled accordingly and removed from the Premises.

- All Ladders shall be numbered, logged in a register, and inspected monthly.
- A ladder in use shall be held by an assistant and/or properly tied down in position.
- Only ladders that do not conduct electricity shall be used in live electrical sub-stations and switching rooms.
- Ladders shall be removed after use and stored in an appropriate facility as to not expose them unnecessarily to the elements or potential damage by surrounding activities.

20.18 CONSTRUCTION VEHICLES AND MOBILE PLANT

Johannesburg Water SOC Ltd will inspect construction vehicles and mobile plant prior to being allowed on a project site. Suppliers of hired vehicles, plant and equipment will be required to comply with this specification as well as the Occupational Health and Safety Act (Act no. 85 of 1993) and Regulations.

Construction vehicles and mobile plant to be:

- Of acceptable design and construction;
- Maintained in good working order;
- Used in accordance with their design and intention for which they were designed;
- Operated and/or driven by trained, competent and authorised operators/drivers. No unauthorised persons are to be allowed to drive construction vehicles and mobile plant;
- Provided with safe and suitable means of access;
- Fitted with adequate signalling devices to make movement safe including reversing;
- Provided with roll-over protection (where applicable);
- Inspected daily before start-up by the driver, operator and/or user and the findings recorded in a register/log book;
- Fitted with two head and two tail lights that are in good working condition and must be used whilst operating under poor visibility conditions;
- When used for transporting persons must have seats firmly secured and sufficient for the number of persons being transported.

Operators and drivers of construction vehicles and mobile plant must be in possession of a valid medical certificate declaring the operator and/or driver physically and psychologically fit to operate or drive construction vehicles and mobile plant.

No loose tools, materials etc. are allowed in the driver and/or operators compartment/cabin or in the compartment in which any other persons are transported.

No person shall ride on any construction vehicle or mobile plant otherwise than in a safe place provided thereon for that purpose. Employees shall only be transported if provision for seating and safety belts has been provided with an adequate canopy or rollover protection.

All construction vehicles and mobile plant left unattended at night, adjacent to a freeway in normal use or adjacent to construction areas where work is in progress, must have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, in order to identify the location of the vehicles or plant.

Bulldozers, scrapers, loaders, and other similar mobile plant must, when being repaired or when not in use, be fully lowered or blocked with controls in a neutral position, motors stopped and brakes set.

<u>Self-Propelled Mobile Machinery</u>
All Self-Propelled Mobile Machinery must be inspected daily and the findings recorded in a register. Pre-use inspection checklist shall identify critical items that would stop the operator from operating machinery should a defect be detected.

All operators shall be tested on their ability to operate machinery and equipment inspected prior to be used on any of the premises by the Johannesburg Water SOC Ltd Project Inspectors and Responsible Engineer. Relief drivers shall be made available for mobile machinery where there is a need for on-going operations and the contractor shall establish a rotation schedule.

All Drivers/Operators shall be appointed under the applicable legislation prior to operating any type of mobile equipment or machinery:

- If Driver/Operator does not adhere to the rules and regulations his appointment as operator shall be cancelled and he shall not be able to carry on with his duty.
- No Driver/Operator shall be appointed without proof of training, driver's licence or letter of competency.
- No training of Drivers/Operators on Site.
- No passengers on dump truck, Loaders or Excavators.
- No eating or drinking allowed while operating equipment.
- No vehicle shall be left unattended with engine running or key in ignition.
- Drivers may use no cellular phones during operations.

Equipment Approval

Authorization for the use of equipment shall be given in writing only after the following minimum requirements and documentation have been verified and shall as a minimum include the following:

- Minimum two lights in front and rear of vehicle
- Communications system (where required);
- Reflective Taping;
- First-aid kit, fire-fighting equipment and emergency roadside triangles;
- Tyres in good condition;
- Windscreen clear of cracks;
- Safety belts fitted for all occupants;
- Signage for clear identification;
- Windscreen wipers;
- Warning hooter and reverse alarm;
- Rotating warning lights (where applicable);
- Maximum number of persons indicated;
- Equipment free of oil and other leaks;
- Maintenance/Service & Equipment manuals available;

Operator Approval

Authorization for operators for the use of equipment shall be given in writing only after the following minimum requirements and documentation have been verified and shall as a minimum include the following:

- Operator's Certificate (accredited training organisation);
- Operators Licence appropriate to the nature of the Mobile equipment;
- Operator's knowledge tested and familiar with the controls for the vehicle;
- Public driver's permit where required;
- Medical fitness certificate.

20.19 Fall protection (Working in elevated positions)

A pre-emptive risk assessment will be required for any work to be carried out above **two metres** from the ground or any floor level. This work will be classified as "work in elevated positions".

As far as is practicable, any person working in an elevated position will work from a platform, ladder or other device that is at least as safe as if he is working at ground level. Whilst working in this position he shall be wearing a single belt with lanyard to prevent the person falling from the platform, ladder or other device. This safety belt will be, as far as is possible, secured to a point away from the edge over which the person might fall and the lanyard must be of such a length and strength that the person will not be able to move over the edge.

Alternatively, any platform, slab, deck or surface forming an edge over which a person may fall may be fitted with suitable guard rails at two different heights as prescribed in the relevant South African National Standard for the design, erection, use and inspection of access scaffolding.

Where the requirement in the paragraph above is not practicable, the person will be provided with a full body harness that will be worn at all times and shall be attached above the wearer's head at all times. The lanyard must be fitted with a shock-absorbing device or the person must be attached to a fall arrest system (anchorage connector; body wear; and connecting device) approved by Johannesburg Water SOC Ltd.

Where the requirements in the paragraph above are not practicable, a suitable catch net must be erected.

Employees working in elevated positions must be trained to work without risk to their health and safety or to the health and safety of others and be declared medically and psychologically fit to perform work at elevated positions.
Where work on roofs is carried out, the risk assessment must take into account the possibility of persons falling through fragile material, i.e. skylights and openings in the roof.

Access scaffolding

Access scaffolding must be erected, used and maintained safely in accordance with Construction Regulations and relevant SA Bureau of Standards Code of Practice.

Detailed consideration must be given to all scaffolding to ensure that it is properly planned to meet the working requirements, designed to carry the necessary loadings and maintained in a sound condition. Sufficient material must be available to erect the scaffolding properly.

Scaffolding must only be erected, altered or dismantled by persons who have adequate training and experience and are competent in this type of work and under the continuous supervision of such a person.

20.20 Structures

The Principal Contractor must ensure that:

- Only skilled employees are allowed to erect structures and that the skills of these employees are verified at regular intervals.
- Steps are taken to ensure that no structure becomes unstable or collapses due to construction work being performed on it or in the vicinity of it.
- No structure is overloaded to the extent that it becomes unsafe.
- He has received from the designer the following information:
    - Information on known or anticipated hazards relating to the construction work and the relevant information required for the safe execution of the construction work.
    - A geo-scientific report (where applicable).
    - The loading the structure is designed to bear.
    - The methods and sequence of the construction process.

All drawings relating to the design are on site and available for inspection.

20.21 Explosive powered tools

Every explosive powered tool must be:

- Provided with a guard around the muzzle to confine flying fragments or particles; and
- Must be fitted with a firing mechanism that will prevent the explosive powered tool from firing unless it is pushed against the surface and at the right angle. Where the explosive powered tool is fitted with an intermediate piston between the charge and the nail this requirement is waived.

The Principal Contractor or user must ensure that:

- Only the correct type of cartridge is used;

- The explosive powered tool is cleaned and inspected daily before use by an appointed competent person. The competent person will keep a register with the findings of his inspection and the details of cleaning, service and repairs;
- The safety devices are in good working order before the explosive powered tool is used;
- When the explosive powered tool is not being used it is stored in an unloaded condition together with the cartridges in a safe and secure place inaccessible to unauthorised persons;
- A warning notice is displayed at the point where the explosive powered tool is in use;
- The issue and return of cartridges must be by issue/returns register signed by both issuer and user and empty cartridge cases must be returned with unspent cartridges;
- Users and operators of the explosive powered tool have received the necessary training and has been authorised as competent to use/operate the explosive powered tool; and
- Users and operators must wear the prescribed personal protective equipment whilst using and/or operating the tool.

20.22 Bulk mixing plants (Batch plants)

- All contractors shall ensure that all bulk mixing plants are operated and supervised by a competent person who has been appointed in writing.
- All contractors shall ensure that the placement and erection of a bulk mixing plant complies with the requirements set out by the manufacturer and that such plant is erected as designed.
- All contractors shall ensure that all devices to start and stop a bulk mixing plant are provided and that these devices are:
- Placed in an easily accessible position; and
- Constructed in such a manner as to prevent accidental starting.
- The contractor shall ensure that the machinery and plant selected is suitable for the task and that all dangerous moving parts of a mixer are placed beyond the reach of persons by means of doors, covers or other similar means.
- No person shall be permitted to remove or modify any guard or safety equipment relating to a bulk mixing plant, unless authorized to do so by the appointed person.
- The contractor shall ensure that all persons authorized to operate the bulk mixing plant are fully aware of all the dangers involved in the operation thereof and conversant with the precautionary measures to be taken in the interest of health and safety.
- No person supervising or operating a bulk mixing plant shall authorize any other person to operate the plant, unless such person is competent to operate machinery.
- The contractor shall ensure that all precautionary measures as stipulated for confined spaces in “good safe practices” are adhered to when entering any silo.
- The contractor shall ensure that a record is kept of any repairs or maintenance to a bulk mixing plant and that it is made available, on site, to an inspector, client, client’s agent or employee upon request.
- The contractor shall ensure that all lifting machines and lifting tackle used in the operation of a bulk mixing plant complies with the requirements of the Regulations promulgated.
- The contractor shall ensure that all precautionary measures are adhered to regarding the usage of electrical equipment in explosive atmospheres, when entering a silo, as contemplated in the Regulations.

20.23 Working in proximity to Eskom power lines

- No mechanical equipment, including mechanical excavators, may be used under or in close proximity to Eskom's services without the prior approval of Eskom's authorized representatives. No excavations may be executed closer than 3 meters from any of Eskom underground electric power cables and 10 meters from Eskom overhead electrical power lines unless Eskom authorized representative is on site.
- No excavations may take place closer than 5m from any overhead line infrastructure (poles and stays and only excavation by hand will be allowed. Only excavation by hand will be allowed on the same route and in close proximity to the Eskom’s 132 kV cables.

- The use of explosives of any type within 500 meters of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the applicant must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process.
- The contractor shall be liable for any death or injury to any person or for the loss of or damage to any property caused in whatsoever manner by the contractor, his employees, agents or sub-contractors. The contractor's attention is drawn to section 27(3) of the Electricity Act 1987.
- The contractor is advised to negotiate a proper route with the CNC (Customer Network Centre. Lat Long co-ordinates of all proposed routes to be provided on site and during the application process. The contractor is required to provide the same to the CNC on site during the signing of the Stakeholder On-Site Risk Identification Form.
- Parallel encroachment into overhead power line servitudes is limited to one meter from the boundary of the servitude. (Where applicable for underground pipelines only.)
- All Eskom servitudes to be kept clear of any obstacles and other services. No dumping, manholes and illegal structures whether occupied by equipment or humans, shall be allowed directly underneath or within Eskom servitude areas.

- Eskom Overhead Lines, Cables and Eskom Plant to be adequately protected against other services and water sources.

- Adequate protection fence should be installed around all Eskom Overhead Structures. The type of fence will be proposed and approved by Eskom CNC / Engineering as listed above.
- Interlocking bricks to be used along all roads and reserves as to ensure Eskom cables could be easily accessed for maintenance and repair / emergency purposes. No roads should be tarred with Eskom cables within the road.
- For developer projects and other works that might affect access to Eskom mini-subs, an appropriate fence with access / gate as approved by the CNC should be installed on street front side.
- The applicant shall ensure that the existing natural ground level is maintained within the Eskom servitude area and where Eskom cables are affected. Should there be a need for the lifting of lines and / or replacement of existing structures / cables and application should be made via **Eskom Customer Services**.
- The vertical clearance required between the road surface and the 11kV / 22kV power-lines shall be at least 6.4m. (Where applicable.)
- Eskom Plant and Cables to be protected from proposed landscaping i.e. no big trees and large plants / scrubs (large roots.) to be planted in close proximity to Eskom services.
- Construction / Amendment of boundary wall/s / fences to be closely monitored with guidance from the CNC – where walls / fences are in close proximity of Eskom Plant.
- At all entrances and road crossings, corrosion-free sleeves must be installed at least 600 mm below undisturbed ground level to provide for existing and future installation of Eskom cables. (Where applicable.)
- Cross trenches by hand need to be done for each road crossing on both sides of the road before the services are installed, to ensure Eskom services do not get damaged during drilling operations. For installations where the service will be installed parallel to Eskom services, cross trenches need to be done by hand at regular intervals, which is to be determined by site conditions and the Eskom PPM cables representative.
- The contractor must inform and update Eskom PPM cables on a weekly basis of the on-site work being planned and performed.
- Equipment shall be regarded electrically live and therefore dangerous at all times.
- Eskom may stipulate any additional requirements to illuminate any possible exposure to Customers or Public to coming into contact or be exposed to any dangers of Eskom plant.
- Security must be on-site 24/7 when trenching and working in close proximity to the Eskom 132 kV cables
- Extra care must be taken when working in close proximity to the 132 kV cables. (Eskom's PPM cables can assist in identifying these cables on-site.)
- The contractor in charge of the construction or maintenance work on site must at all times be in possession of the Approved Wayleave letter of the affected Eskom services, as well as all plans related to the wayleave application. This should be available upon the request of any Eskom and Municipal official, during site visits.

If no approval is presented, then the Eskom Official(s) can order that all work to be ceased until approval can be presented.

20.24 Welding, flame cutting, soldering and similar operations

1. No contractor shall require or permit welding or flame cutting operations to be undertaken, unless -

- the person operating the equipment has been fully instructed in the safe operation and use of such equipment and in the hazards which may arise from its use;
- effective protection is provided and used for the eyes and respiratory system and, where necessary, for the face, hands, feet, legs, body and clothing of persons performing such operations, as well as against heat, incandescent or flying particles or dangerous radiation;
- leads and electrode holders are effectively insulated; and
- the workplace is effectively partitioned off where practicable and where not practicable all other persons exposed to the hazards contemplated in bullet two are warned and provided with suitable protective equipment.

2. No contractor shall require or permit welding or flame cutting operations to be undertaken in a confined space, unless:

- effective ventilation is provided and maintained; or
- masks or hoods maintaining a supply of safe air for breathing are provided and used by the persons performing such operations.

3. No contractor shall require or permit electric welding to be undertaken in wet or damp places, inside metal vessels or in contact with large masses of metal, unless --

- the insulation of the electrical leads is in a sound condition;
- the electrode holder is completely insulated to prevent accidental contact with current-carrying parts;
- the welder is completely insulated by means of boots, gloves or rubber mats; and
- at least one other person who has been properly instructed to assist the welder in case of an emergency is and remains in attendance during operations: Provided that the provisions of this sub-regulation shall not apply to a welding process where the maximum voltage to earth does not exceed 50 volts.

4. No contractor shall require or permit welding, flame cutting, grinding, soldering or similar work to be undertaken in respect of any tube, tank, drum, vessel or similar object or container where such object or container --

- is completely closed, unless a rise in internal pressure cannot render it dangerous; or
- contains any substance which, under the action of heat, may --
  - (i) ignite or explode; or
  - (ii) react to form dangerous or poisonous substances,

unless a person who is competent to pronounce on the safety thereof has, after examination, certified in writing that any such danger has been removed by opening, ventilating or purging with water or steam, or by any other effective means.

(5) Where hot work involving welding, cutting, brazing or soldering operations is carried out at places, other than workplaces which have been specifically designated and equipped for such work, the employer shall take steps to ensure that proper and adequate fire precautions are taken.

20.25 Tunnelling

No person may enter a tunnel, which has a height dimension of less than 800 millimetres.

20.26 Horizontal Drilling

- All HDD work shall be carried out under the supervision of a competent person.
- All employees involved in HDD shall be trained.
- A risk assessment as well as a method statement for the HDD shall be compiled and submitted for approval by the Client.
- Contractor will submit specifications on directional boring equipment to be used to ensure that the equipment will be adequate to complete the project. Spares inventory shall be included
- The directional boring equipment shall consist of a directional boring rig of sufficient capacity to perform the bore and pullback the pipe, a boring fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system.
- All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.
- The directional boring machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head.
- The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing.
- The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations.
- Hydraulic system shall be free of leaks.
- Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.
- The rig shall be grounded during boring and pull-back operations.
- Sufficient spares shall be kept on hand for any break-downs which can be reasonably anticipated.
- The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system.
- The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.
- The Engineer must be notified 48 hours in advance of starting work.
- The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made.
- The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.
- It shall be the responsibility of Engineer to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

20.28 Pipe jacking / tunnelling

- No person may enter a tunnel, which has a height dimension of **less than 800 millimetres**.
- Pipe Jacking shall be supervised and undertaken only by persons fully conversant with this work.
- Pipe Jacking to comply to SANS standards (SPEC 1200 LG-1983), Mine Health and Safety Act. 29 of 1996 and Mineral and Petroleum Resources Development Act (Act 28 of 2002).
- Adequate ventilation and lighting must be provided to employee working inside the tunnel at all times.
- Employees involved in drilling and operation of jackhammers must be provided with ear muffs and shock absorbing gloves
- The launch and reception pits should be properly secured from collapsing, and must be inspected daily by a competent person appointed in writing.

- The working area must be completely fenced off and the pits must be adequately barricaded.
- Where there is presence of groundwater or mud, steel toed gumboots must be provided.
- Employees shall be trained by a competent person on the safe use of the Hydraulic Power pack or winch used to push the pipes
- Hydraulic power packs and winches shall be pressure and load tested and records thereof retained
- Detailed method statements for each area shall be submitted to Johannesburg Water prior to the commencement of the work.
- A calibrated gas tester/ oxygen measuring meter shall at all times be placed at the working area, and employees will be trained on the use thereof
- An adequate emergency procedure must be submitted to Johannesburg Water prior to the commencement of the work.

20.29 WATER ENVIRONMENTS

- The contractor must ensure that where construction work is done over or in close proximity to water, provision is made for—
    - preventing persons from falling into water; and
    - the rescuing of persons in danger of drowning.
- The contractor must ensure that where a person is exposed to the risk of drowning by falling into the water, the person is provided with and wears a lifejacket.

20.30 Asbestos work

- If asbestos is identified on site, then the contractor must ensure that any asbestos work is carried out by an Asbestos Contractor registered with the Department of Employment and Labour.
- All work must be halted and the area where asbestos identified demarcated.
- In the case of type 2 and type 3 asbestos work, the registered asbestos contractor must:
    - undertake only the type of asbestos work for which they are registered by the chief inspector;
    - appoint an occupational health and safety representative.
    - Obtain an up-to-date inventory of asbestos prior to asbestos work taking place from the Client
- Before commencement of any asbestos work and during such work, the registered asbestos contractor must ensure that—
    - a risk assessment is performed that includes—
        (i) identification of the hazards to which persons may be exposed;
        (ii) an assessment of the risks related to the hazards based on a documented method; and
        (iii) documented control measures to mitigate the risk;
    - the risk assessment) is reviewed—
        (i) at regular documented intervals;
        (ii) when an incident has occurred; and
        (iii) when the scope of work changes; and
        (iv) an up-to-date copy of the risk assessment is made available at the relevant asbestos work site.
- The registered asbestos contractor must—
    - ensure that the approved plan of work is submitted to the Chief Director: Provincial Operations at least seven days prior to commencement of asbestos work;

- appoint in writing an asbestos removal supervisor for each asbestos work site, who must ensure—

  (i) occupational health and safety compliance on the asbestos removal site;
  (ii) compliance with safe asbestos removal or repair procedures;
  (iii) the correct use of personal protective equipment; and
  (iv) proper decontamination and waste disposal;

- adhere to the repair or removal methodology and associated control measures provided in the plan of work approved for that specific asbestos work;

- ensure that the employee medical and training records are available on site for inspection and validation;

- ensure that at least the following information for every employee is recorded and kept for a minimum period of 50 years-

  (i) Physical address of every asbestos work project; and
  (ii) names and identification numbers of employees potentially exposed;

- before commencement of asbestos work, ensure that—

  (i) an approved inspection authority has been appointed in writing by the asbestos client; and
  (ii) the registered asbestos contractor is registered and in good standing with the Compensation Fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993; and

- where a fatality or permanent disabling injury occurs during asbestos work, ensure that a report about the fatality or injury is provided to the Chief Director: Provincial Operations, and that the report includes the measures that the contractor intends to implement to ensure safe asbestos work.

21. Monthly reporting

- The Principal Contractor is required to provide Johannesburg Water SOC Ltd. with a monthly report in the format provided on the last working day of the month.
- The report will include the monthly man-hours, incidents, training, inductions, audits, etc

22. Project close out

- Upon completion of the project, the contractor is required to hand over a consolidated project file to the Client with all the working documents for retention.

Annexure 1: Calculation of monthly compliance rating

The monthly compliance rating will be calculated as follows:

Final monthly compliance rating = Achieved score – repeat findings

- Where achieved score = sum of all audit sections (**Table 2**) and
- Repeat findings = total number of all findings repeated from previous month/s

TABLE 1: CALCULATION OF MONTHLY COMPLIANCE RATING

Audit Outcome					
Achieved Score					**0,00%**
Repeat findings	1-5 = (-1.5%)	6-10 (-2.5%)	11-20 (-5%)	***RF***	
Final score					**0,00%**

TABLE 2: SUMMARY OF SECTIONS & POSSIBLE SCORES

SUMMARY OF SCORES OBTAINED		MAX	ACTUAL	%
SEC 1	MANDATORY REQUIREMENTS	26	0	0,0%
SEC 2	LEGAL APPOINTMENTS	58	0	0,0%
SEC 3	RISK ASSESSMENTS	16	0	0,0%
SEC 4	COMPETENCY	56	0	0,0%
SEC 5	PROCEDURES	64	0	0,0%
SEC 6	TRAINING AND AWARENESS	24	0	0,0%
SEC 7	SUB-CONTRACTOR MANAGEMENT	24	0	0,0%
SEC 8	MEDICAL SURVEILLANCE	8	0	0,0%
SEC 9	INSPECTIONS AND MONITORING	40	0	0,0%
SEC 10	HAZARDOUS CHEMICAL SUBSTANCES	22	0	0,0%
SEC 11	OPERATIONAL & QUALITY CONTROL	286	0	0,0%
SEC 12	WELFARE FACILITIES	52	0	0,0%
SEC 13	BEHAVIOURAL ASSESSMENTS	20	0	0,0%
SEC 14	INCIDENT MANAGEMENT	24	0	0,0%
SEC 15	EMERGENCY PREPAREDNESS	38	0	0,0%
SEC 16	FIRST AID MEASURES	10	0	0,0%
SEC 17	SUBMISSION OF MONTHLY REPORT	12	0	0,0%
		780	**0**	**0,0%**

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IMPACT. ENGINEERED.

Johannesburg Water

HALFWAY HOUSE WATER UPGRADE
111242-0000-REG-ZUT-001

DRAWING REGISTER

Register Issue Date: November 5, 2024
Register Revision: T1

TENDER DRAWINGS **PROJECT NO: JW14463**

DRAWING NUMBER	DRAWING TITLE	REV	PRELIM PHASE A	PRELIM PHASE B	PRELIM PHASE C	PRELIM PHASE D	TENDER PHASE T0	TENDER PHASE T1	TENDER PHASE T2	TENDER PHASE T3	CONSTRUCTION PHASE 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	WATER LAYOUTS																														
111242-0000-DRG-WW-0200	BULK WATER FEEDER AND SUPPLY PIPELINE SCHEMATIC LAYOUT	T1	08/2017				10/2021	11/2024																							
111242-0000-DRG-WW-0201	BULK WATER FEEDER AND SUPPLY PIPELINE KEY PLAN	T1	08/2017				10/2021	11/2024																							
111242-0000-DRG-WW-0202	BULK WATER FEEDER PIPELINE LAYOUT SHEET 1 OF 2	T1	08/2017				10/2021	11/2024																							
111242-0000-DRG-WW-0203	BULK WATER SUPPLY PIPELINE LAYOUT SHEET 2 OF 2	T1	08/2017				10/2021	11/2024																							
	WATER SECTIONS																														
111242-0000-DRG-WW-0301	PLAN AND LONGSECTION: SHEET 1 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0302	PLAN AND LONGSECTION: SHEET 2 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0303	PLAN AND LONGSECTION: SHEET 3 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0304	PLAN AND LONGSECTION: SHEET 4 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0305	PLAN AND LONGSECTION: SHEET 5 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0306	PLAN AND LONGSECTION: SHEET 6 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0307	PLAN AND LONGSECTION: SHEET 7 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0308	PLAN AND LONGSECTION: SHEET 8 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0309	PLAN AND LONGSECTION: SHEET 9 OF 10	T1	03/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0310	PLAN AND LONGSECTION: SHEET 10 OF 10	T1	03/2020				10/2021	11/2024																							
	WATER DETAILS																														
111242-0000-DRG-WW-0500	TYPICAL DETAILS OF AIR VALVE CHAMBER	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0501	TYPICAL DETAILS OF ISOLATING VALVE CHAMBER	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0502	TYPICAL DETAILS OF SCOUR VALVES SHEET 1 OF 2	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0503	TYPICAL DETAILS OF SCOUR VALVES SHEET 2 OF 2	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0504	TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0505	THRUST BLOCK DETAILS	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0506	TYPICAL PIPE JACKING DETAILS	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0507	TYPICAL DETAILS OF MARKER BLOCK	T1	08/2020				10/2021	11/2024																							
111242-0000-DRG-WW-0508	TYPICAL WATER METER CHAMBER DETAIL	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0509	DETAILS OF ACCESS CHAMBER 1	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0510	TYPICAL DETAIL - DN 700 SUPPORT BRACKET DETAILS	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0511	TYPICAL RIVER CROSSING DETAILS	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0512	TYPICAL DETAILS FOR N1 CROSSING	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0513	DETAILS OF ACCESS CHAMBER 2	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0514	FENCING AROUND ACCESS CHAMBERS	T1					10/2021	11/2024																							
	MECHANICAL																														
111242-0000-DRG-WW-0516	ACCESS CHAMBERS VENTILATION SHEET 1 OF 3	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0517	ACCESS CHAMBERS VENTILATION SHEET 2 OF 3	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0518	ACCESS CHAMBERS VENTILATION SHEET 3 OF 3	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0519	ACCESS CHAMBERS 2 PRV DETAILS SHEET 1 OF 2	T1					10/2021	11/2024																							
111242-0000-DRG-WW-0520	ACCESS CHAMBERS 2 PRV DETAILS SHEET 2 OF 2	T0					11/2024																							
111242-0000-DRG-WW-0521	STANDARD DETAIL ANCHOR PIPE SUPPORT GALVANISED STEEL	T0					11/2024																							
	ELECTRICAL																														
111242-0000-DRG-EL-2000	ELECTRICAL SERVICES LIGHTING LAYOUT	T0					11/2024																								
111242-0000-DRG-EL-2001	ELECTRICAL SERVICES POWER LAYOUT	T0					11/2024																								
111242-0000-DRG-EL-2002	ELECTRICAL SERVICES CONTAINMENT LAYOUT	T0					11/2024																								
111242-0000-DRG-EL-2003	ELECTRICAL SERVICES DISTRIBUTION BOARD SINGLE LINE DIAGRAM	T0					11/2024																								
	STRUCTURAL																														
111242-0000-DRG-SS-3000	CHAMBER & CULVERT LOCATION PLAN LAYOUT, SECTIONS, DETAILS & 3D VIEWS	T1					10/2021	11/2024																							
111242-0000-DRG-SS-3001	CHAMBER 1 LAYOUT, SECTIONS, DETAILS & 3D VIEW	T1					10/2021	11/2024																							
111242-0000-DRG-SS-3002	CHAMBER 2 LAYOUT, SECTIONS, DETAILS	T1					10/2021	11/2024																							
111242-0000-DRG-SS-3003	CHAMBER 2 LAYOUT, DETAILS & 3D VIEWS	T1					10/2021	11/2024																							

GENERAL NOTES:

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2. ALL MATERIALS USED IN INSTALLING WATER MAINS SHALL COMPLY WITH THE RELEVANT SANS 1200 SPECIFICATIONS AND WITH THE MINIMUM JOHANNESBURG WATER SPECIFIC REQUIREMENTS.
3. THE POSITION AND DEPTH OF ALL THE EXISTING SERVICES ON THE SITE AND OFF THE SITE, WHERE AFFECTED BY WORKS, SHALL BE CONFIRMED PRIOR TO ANY CONSTRUCTION WORK.
4. TIE-IN POSITIONS TO BE CONFIRMED ON SITE. PROPOSED TIE-IN POSITIONS TO BE EXPOSED TO CONFIRM EXISTING PIPELINE POSITION. FINAL CONNECTION POINT TO BE CONFIRMED ON SITE AND SUBMITTED TO DESIGN ENGINEER FOR REVIEW.
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6. BACKFILLING OF TRENCHES AND OTHER EXCAVATIONS SHALL, EXCEPT IN ROCK, BE LESS PERMEABLE THAN THE SURROUNDING MATERIAL. MINIMUM COMPACTION STANDARD TO BE 93 % MOD AASHTO, PROVIDED PERMEABILITY REQUIREMENTS ARE MET. THE USE OF NONCOHESIVE SINGLE SIZE GRADED SAND OR CRUSHER SAND FOR BEDDING, SURROUND BLANKETS AND BACKFILL SHALL NOT BE ALLOWED, UNLESS OTHERWISE STATED.
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10. ALL STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF SANS 719, AND GRADE X42 TO API 5L. STEEL PIPES JOINTS MUST BE WELDED JOINTS WITH SOLVENT FREE EPOXY LINING AND EXTERNALLY COATING TO BE RECOMMENDED BY A SPECIALIST OR SIMILAR APPROVED BY JOHANNESBURG WATER.
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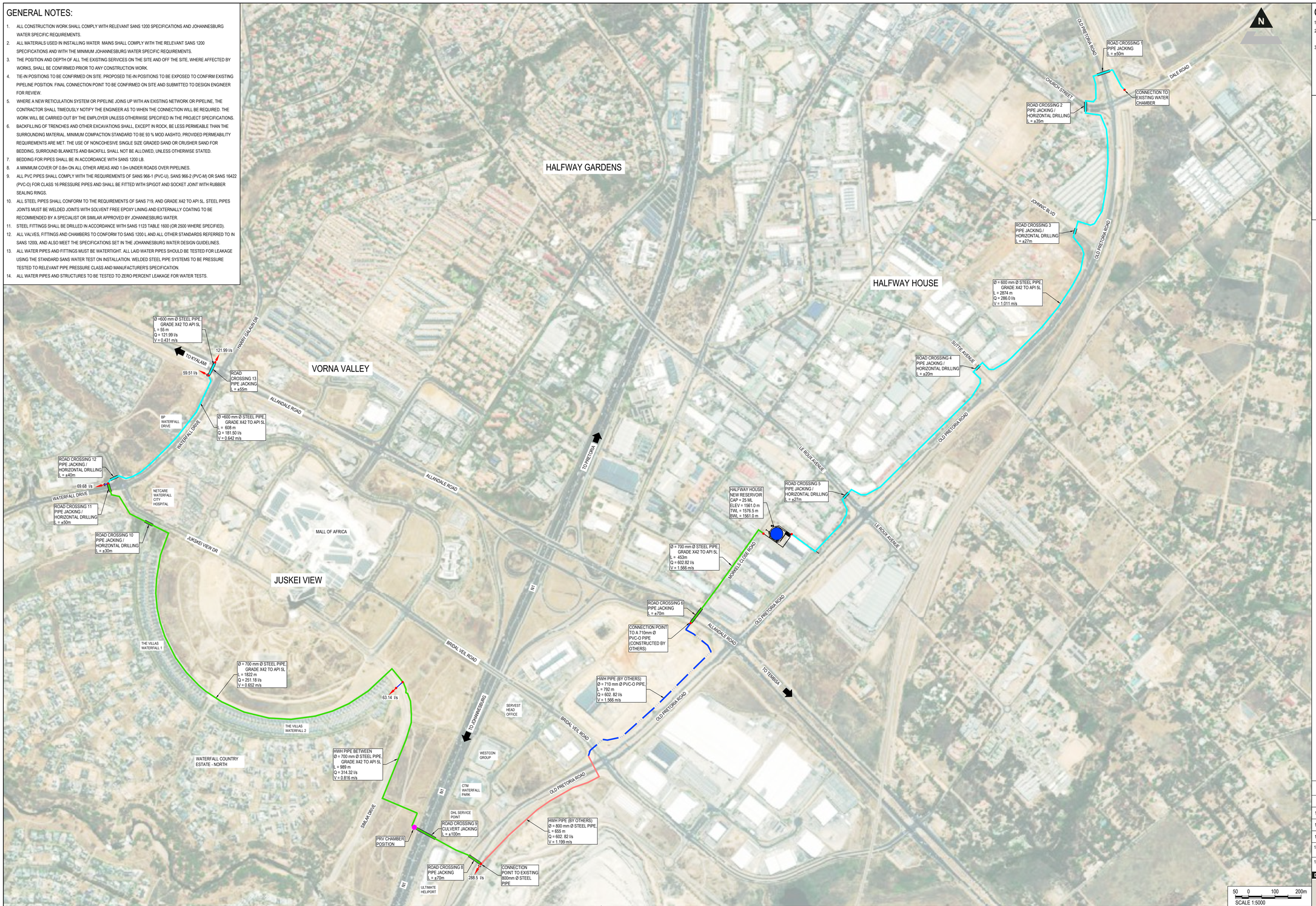

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LEGEND

- 25ML HALFWAY HOUSE RESERVOIR
- 315mm Ø mPVC PIPELINE
- 600mm Ø STEEL PIPELINE
- 700mm Ø STEEL PIPELINE
- 710mm Ø PVC-O PIPELINE (BY OTHERS)
- 800mm Ø EXISTING STEEL PIPELINE
- OFFTAKE
- NODES
- PRV CHAMBER POSITION

REFERENCE DRAWINGS

DRAWING NUMBER	DESCRIPTION
111242-0000-DRG-WW-0201	BULK WATER FEEDER AND SUPPLY PIPELINE KEY PLAN
111242-0000-DRG-WW-0202	BULK WATER FEEDER PIPELINE LAYOUT SHEET 1 OF 2
111242-0000-DRG-WW-0203	BULK WATER SUPPLY PIPELINE LAYOUT SHEET 2 OF 2
111242-0000-DRG-WW-0301-0304	PLAN AND LONGSECTION: BULK WATER FEEDER PIPELINE SHEET 1 TO SHEET 4
111242-0000-DRG-WW-0305-0310	PLAN AND LONGSECTION: BULK WATER SUPPLY PIPELINE SHEET 5 TO SHEET 10

DISCLAIMER

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CONSULTING ENGINEERS
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TEL: +27 11 214 4500

CLIENT
65 NTEMI PILISO STREET
NEWTOWN
JOHANNESBURG
2001

DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

Johannesburg Water

65 NTEMI PILISO STREET
NEWTOWN
JOHANNESBURG
2001
TEL: (011) 688-1400
FAX: (011) 688-1529

Joburg

HALFWAY HOUSE WATER UPGRADE

BULK WATER FEEDER AND SUPPLY PIPELINE
SCHEMATIC LAYOUT

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE 1:5000

REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0200 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 1 OF 1
FILE No.

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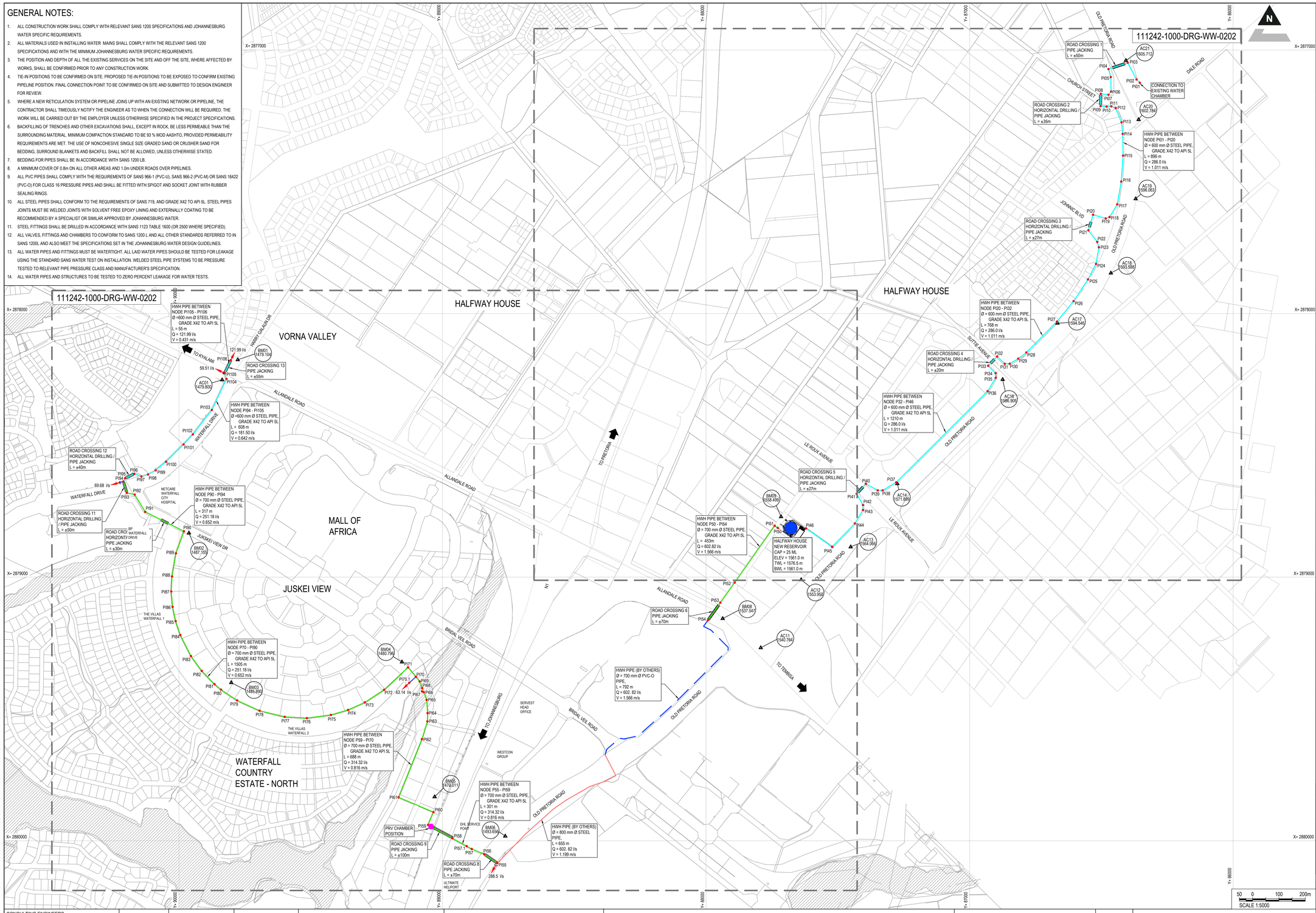

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LEGEND

- 25ML HALFWAY HOUSE RESERVOIR
- 315mm Ø mPVC PIPELINE
- 600mm Ø STEEL PIPELINE
- 700mm Ø STEEL PIPELINE
- 710mm Ø PVC-0 PIPELINE (BY OTHERS)
- 800mm Ø EXISTING STEEL PIPELINE
- OFFTAKE
- NODES
- PRV CHAMBER POSITION
- BENCH MARK

COORDINATES LIST FOR BENCHMARKS WGS-84 LO-29

POINT	Y-COORD	X-COORD	ELEVATION
AC14	87274.412	2878645327	1571.899
AC16	86874.566	2878250.117	1586.905
AC17	86666.769	2878036.563	1594.546
AC18	86463.985	2877846.301	1593.588
AC19	86369.850	2877564.432	1596.063
AC20	86358.763	2877264.062	1602.784
AC21	86406.811	2877039.572	1605.712
BM01	89777.011	2878175.145	1479.104
BM02	89962.306	2878832.699	1487.155
BM03	89801.829	2879400.365	1485.890
BM04	89153.887	2879321.940	1480.796
BM05	89030.003	2879833.571	1470.011
BM06	88762.039	2879982.686	1493.656
BM08	87936.929	2879157.181	1537.547
BM09	87715.479	2878770.787	1558.499

REFERENCE DRAWINGS

DRAWING NUMBER	DESCRIPTION
111242-0000-DRG-WW-0200	BULK WATER FEEDER AND SUPPLY PIPELINE SCHEMATIC LAYOUT
111242-0000-DRG-WW-0202	BULK WATER FEEDER PIPELINE LAYOUT SHEET 1 OF 2
111242-0000-DRG-WW-0203	BULK WATER SUPPLY PIPELINE LAYOUT SHEET 2 OF 2
111242-0000-DRG-WW-0301-0304	PLAN AND LONGSECTION: BULK WATER FEEDER PIPELINE SHEET 1 TO SHEET 4
111242-0000-DRG-WW-0305-0310	PLAN AND LONGSECTION: BULK WATER SUPPLY PIPELINE SHEET 5 TO SHEET 10

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Johannesburg Water
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JOHANNESBURG
2001
TEL: (011) 688-1400
FAX: (011) 688-1529

DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

Joburg

HALFWAY HOUSE WATER UPGRADE

BULK WATER FEEDER AND SUPPLY PIPELINE
KEY PLAN

APPROVAL BY JW DEPOT			SCALE
CHECKED			1:5000
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

AMENDMENTS

DRAWING No.

111242 - 0000-DRG-WW-0201 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 1 OF 1

FILE No.

GENERAL NOTES:

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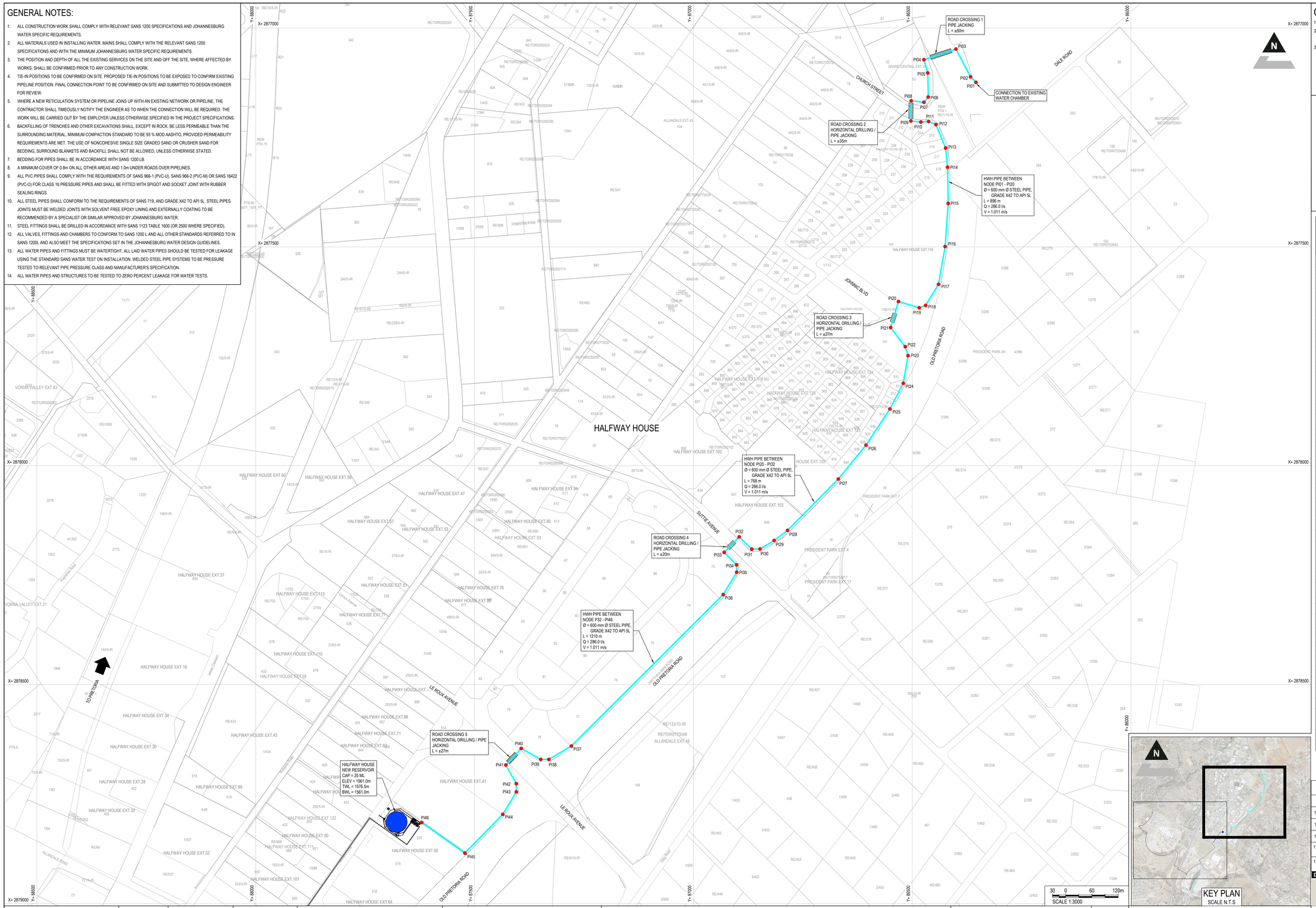
7. BEDDING FOR PIPES SHALL BE IN ACCORDANCE WITH SANS 1200 LB.
8. A MINIMUM COVER OF 0.8m ON ALL OTHER AREAS AND 1.0m UNDER ROADS OVER PIPELINES.
9. ALL PVC PIPES SHALL COMPLY WITH THE REQUIREMENTS OF SANS 966-1 (PVC-U), SANS 966-2 (PVC-M) OR SANS 16422 (PVC-O) FOR CLASS 16 PRESSURE PIPES AND SHALL BE FITTED WITH SPIGOT AND SOCKET JOINT WITH RUBBER SEALING RINGS.
10. ALL STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF SANS 719, AND GRADE X42 TO API 5L. STEEL PIPES JOINTS MUST BE WELDED JOINTS WITH SOLVENT FREE EPOXY LINING AND EXTERNALLY COATING TO BE RECOMMENDED BY A SPECIALIST OR SIMILAR APPROVED BY JOHANNESBURG WATER.
11. STEEL FITTINGS SHALL BE DRILLED IN ACCORDANCE WITH SANS 1123 TABLE 1600 (OR 2500 WHERE SPECIFIED).
12. ALL VALVES, FITTINGS AND CHAMBERS TO CONFORM TO SANS 1200 L AND ALL OTHER STANDARDS REFERRED TO IN SANS 1200L AND ALSO MEET THE SPECIFICATIONS SET IN THE JOHANNESBURG WATER DESIGN GUIDELINES.
13. ALL WATER PIPES AND FITTINGS MUST BE WATERTIGHT. ALL LAID WATER PIPES SHOULD BE TESTED FOR LEAKAGE USING THE STANDARD SANS WATER TEST ON INSTALLATION. WELDED STEEL PIPE SYSTEMS TO BE PRESSURE TESTED TO RELEVANT PIPE PRESSURE CLASS AND MANUFACTURER'S SPECIFICATION.
14. ALL WATER PIPES AND STRUCTURES TO BE TESTED TO ZERO PERCENT LEAKAGE FOR WATER TESTS.



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- NODES

COORDINATES LIST FOR BULK WATER FEEDER PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI01	86354.144	2877124.222	1602.850
PI02	86366.465	2877111.690	1602.590
PI03	86399.882	2877048.215	1601.463
PI04	86473.080	2877072.443	1601.395
PI05	86464.208	2877102.715	1601.479
PI06	86463.203	2877157.787	1601.605
PI07	86473.043	2877169.783	1601.635
PI08	86502.084	2877166.286	1601.665
PI09	86502.838	2877212.507	1601.665
PI10	86479.964	2877214.991	1601.675
PI11	86462.315	2877213.744	1601.675
PI12	86445.603	2877220.745	1601.649
PI13	86423.407	2877274.310	1600.372
PI14	86419.118	2877318.073	1599.322
PI15	86417.523	2877400.849	1597.202
PI16	86424.589	2877499.247	1595.963
PI17	86439.741	2877585.592	1594.905
PI18	86469.085	2877633.759	1594.703
PI19	86483.684	2877639.267	1594.960
PI20	86531.249	2877624.869	1595.735
PI21	86549.162	2877684.357	1595.669
PI22	86515.662	2877728.097	1594.584
PI23	86509.358	2877748.529	1594.192
PI24	86520.220	2877811.647	1593.594
PI25	86550.748	2877870.406	1593.535
PI26	86605.312	2877953.002	1593.511
PI27	86668.684	2878030.363	1592.749
PI28	86784.654	2878147.765	1588.501
PI29	86815.282	2878170.892	1587.763
PI30	86847.637	2878190.242	1587.067
PI31	86866.346	2878190.606	1586.722
PI32	86895.202	2878162.630	1585.943
PI33	86929.525	2878197.963	1585.655
PI34	86901.159	2878226.443	1584.968
PI35	86900.810	2878243.302	1584.540
PI36	86931.657	2878294.467	1582.478
PI37	87278.638	2878640.395	1569.754
PI38	87329.990	2878670.952	1569.660
PI39	87348.509	2878670.926	1569.619
PI40	87393.315	2878645.806	1566.830
PI41	87428.465	2878683.754	1566.544
PI42	87404.371	2878726.492	1566.401
PI43	87404.406	2878745.159	1566.349
PI44	87435.324	2878796.453	1566.040
PI45	87522.007	2878885.020	1560.681
PI46	87620.585	2878815.115	1560.217

REFERENCE DRAWINGS

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111242-0000-DRG-WW-0201	BULK WATER FEEDER AND SUPPLY PIPELINE KEY PLAN
111242-0000-DRG-WW-0203	BULK WATER SUPPLY PIPELINE LAYOUT SHEET 2 OF 2
111242-0000-DRG-WW-0301-0304	PLAN AND LONGSECTION: BULK WATER FEEDER PIPELINE SHEET 1 TO SHEET 4
111242-0000-DRG-WW-0305-0310	PLAN AND LONGSECTION: BULK WATER SUPPLY PIPELINE SHEET 5 TO SHEET 10

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DRAWN	T. SHABALALA	OCTOBER 2024
CHECKED	K. BRINK	OCTOBER 2024
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Joburg

HALFWAY HOUSE WATER UPGRADE

BULK WATER FEEDER PIPELINE LAYOUT
SHEET 1 OF 2

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

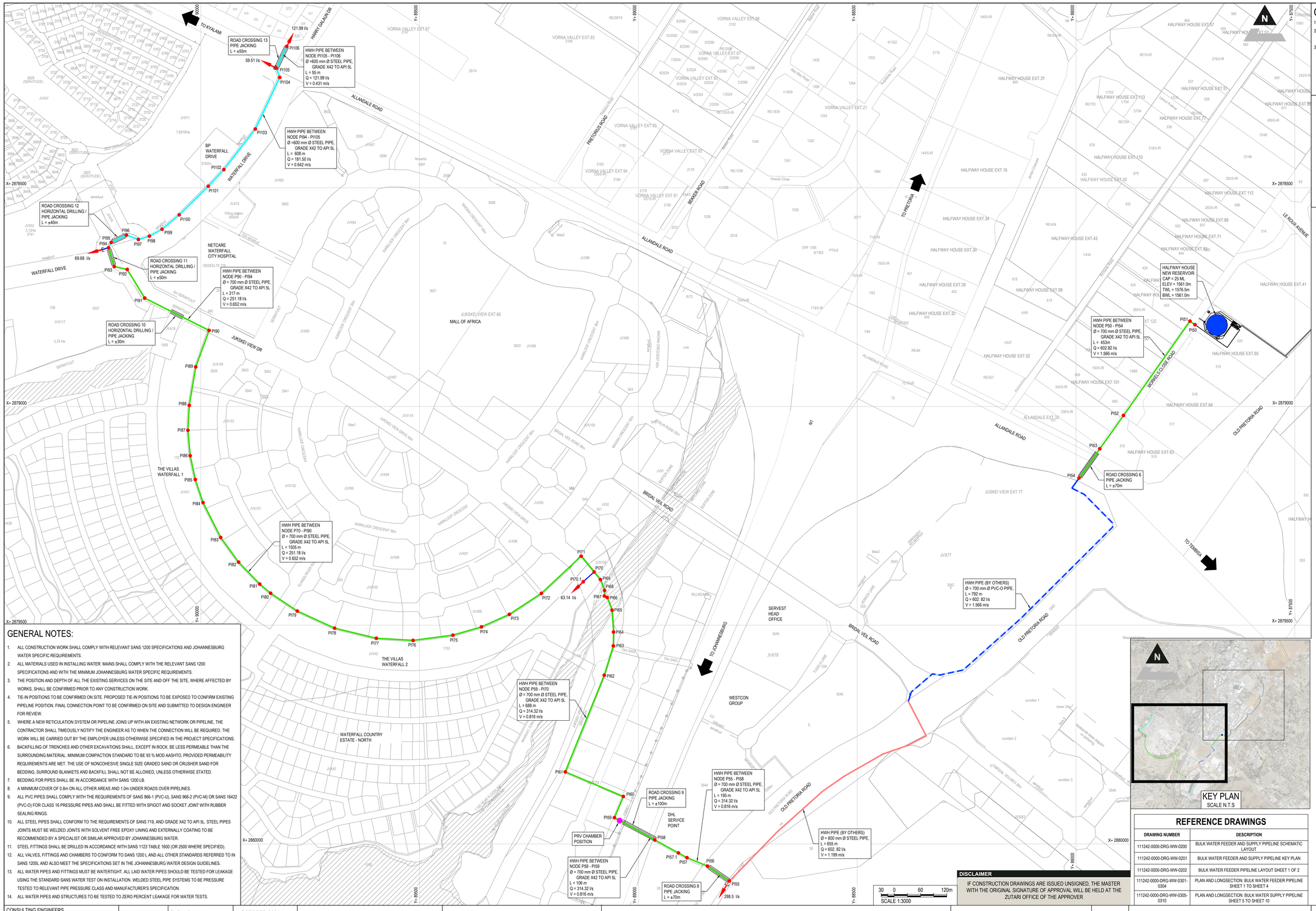
SCALE 1:4000

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0202 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 1 OF 2
FILE No.



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- NODES
- PRV CHAMBER POSITION

COORDINATES LIST FOR BULK WATER SUPPLY PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI50	87728.232	2878813.015	1554.431
PI51	87739.591	2878804.960	1554.377
PI52	87891.409	2879020.588	1538.957
PI53	87945.576	2879096.835	1532.293
PI54	87993.123	2879163.762	1531.957
PI55	88792.161	2880084.893	1485.119
PI56	88842.349	2880050.726	1480.375
PI57	88888.971	2880031.493	1478.407
PI57.1	88908.483	2880020.699	1478.407
PI58	88962.401	2879991.063	1465.312
PI59	89054.771	2879939.991	1464.748
PI60	89034.278	2879891.628	1464.471
PI61	89167.058	2879835.365	1457.409
PI62	89077.991	2879614.437	1466.701
PI63	89057.283	2879547.325	1466.946
PI64	88056.718	2879515.696	1468.061
PI65	89060.046	2879465.855	1470.068
PI66	89071.075	2879436.737	1471.527
PI67	89077.607	2879433.403	1471.526
PI68	89077.183	2879420.636	1471.527
PI69	89086.728	2879395.819	1472.176
PI70	89101.097	2879378.360	1472.761
PI70.1	89125.956	2879400.763	1474.008
PI71	89130.742	2879342.343	1474.013
PI72	89221.660	2879427.352	1474.412
PI73	89294.746	2879475.241	1474.827
PI74	89358.538	2879503.907	1475.263
PI75	89423.717	2879522.805	1475.774
PI76	891514.810	2879534.809	1476.615
PI77	89698.739	2879529.935	1477.471
PI78	89694.213	2879506.832	1478.453
PI79	89779.332	2879467.813	1479.498
PI80	89840.369	2879427.015	1480.384
PI81	89865.219	2879406.026	1480.819
PI82	89913.495	2879355.899	1481.768
PI83	89954.372	2879299.639	1482.597
PI84	89994.751	2879219.837	1483.530
PI85	90012.451	2879166.944	1482.994
PI86	90024.124	2879112.587	1482.333
PI87	90029.377	2879054.387	1481.576
PI88	90026.182	2878997.423	1480.867
PI89	90011.447	2878909.551	1481.690
PI90	89980.959	2878826.132	1484.048
PI91	90128.082	2878752.226	1478.849
PI92	90168.012	2878686.732	1476.855
PI93	90197.720	2878680.136	1475.989
PI94	90210.587	2878637.173	1475.775
PI95	90204.437	2878625.124	1475.737
PI96	90169.816	2878608.207	1475.608
PI97	90142.534	2878618.220	1476.100
PI98	90117.466	2878610.661	1476.653
PI99	90088.488	2878594.940	1477.276
PI100	90049.196	2878561.948	1478.149
PI101	89982.724	2878496.547	1479.556
PI102	89947.134	2878458.450	1480.234
PI103	89875.213	2878365.759	1481.500
PI104	89819.544	2878247.760	1475.961
PI105	89827.521	2878226.351	1474.788
PI106	89803.463	2878176.845	1474.503

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SCALE 1:3000

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NEWTOWN
JOHANNESBURG
2001

DESIGNED	T. SHABALALA	OCTOBER 2024
DRAWN	T. SHABALALA	OCTOBER 2024
CHECKED	K. BRINK	OCTOBER 2024
APPROVED BY:	C. KAN	OCTOBER 2024
	SIGNATURE	DATE
ECSA REG. No.	980570	
CHECKED BY:		
	SIGNATURE	DATE
ECSA REG. No.		

Johannesburg Water

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Joburg

HALFWAY HOUSE WATER UPGRADE

BULK WATER SUPPLY PIPELINE LAYOUT
SHEET 2 OF 2

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

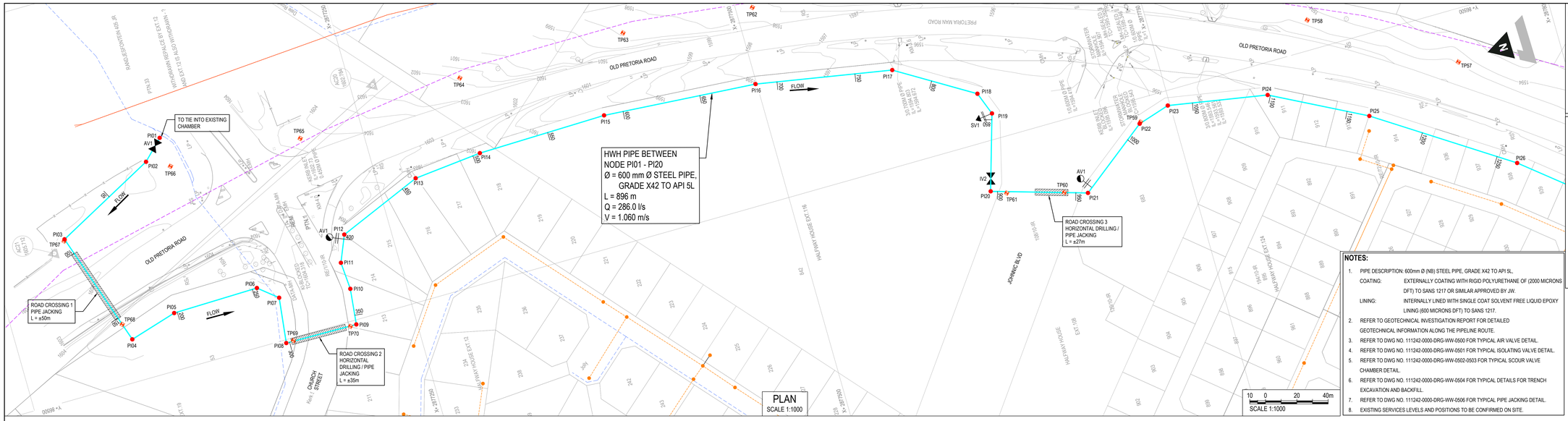
SCALE 1:4000

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0203 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 2 OF 2
FILE No.



PLAN
SCALE 1:1000

SCALE 1:1000

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LEGEND

- 600mm Ø STEEL PIPELINE
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- TEST PITS
- BOREHOLES
- ISOLATING VALVE
- AIR VALVE
- SCOUR VALVE

NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L,
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
   LINING: INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217.
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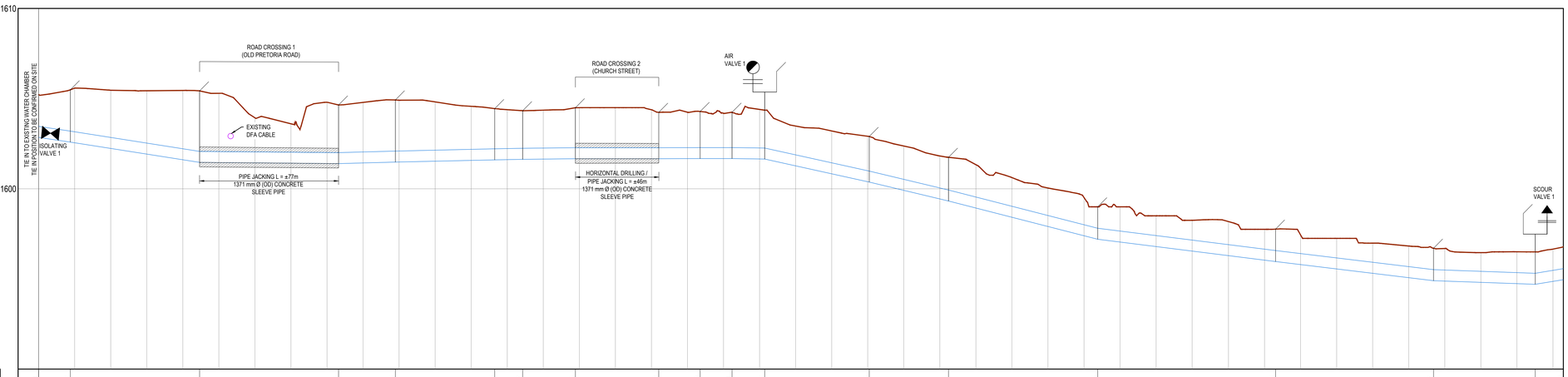
5. REFER TO DWG NO. 111242-0000-DRG-WW-0502-0503 FOR TYPICAL SCOUR VALVE CHAMBER DETAIL.
6. REFER TO DWG NO. 111242-0000-DRG-WW-0504 FOR TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL.
7. REFER TO DWG NO. 111242-0000-DRG-WW-0506 FOR TYPICAL PIPE JACKING DETAIL.
8. EXISTING SERVICES LEVELS AND POSITIONS TO BE CONFIRMED ON SITE.

COORDINATES LIST FOR BULK WATER FEEDER PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI01	86354.144	2877124.222	1602.850
PI02	86366.465	2877111.690	1602.590
PI03	86399.882	2877048.215	1601.463
PI04	86473.080	2877072.443	1601.395
PI05	86464.208	2877102.715	1601.479
PI06	86463.203	2877157.787	1601.605
PI07	86473.043	2877169.783	1601.635
PI08	86502.084	2877166.286	1601.665
PI09	86502.838	2877212.507	1601.665
PI10	86479.964	2877214.991	1601.675
PI11	86462.315	2877213.744	1601.675
PI12	86445.603	2877220.745	1601.649
PI13	86423.407	2877274.310	1600.372
PI14	86419.118	2877318.073	1599.322
PI15	86417.523	2877400.849	1597.202
PI16	86424.589	2877499.247	1595.963
PI17	86439.741	2877585.592	1594.905
PI18	86469.085	2877633.759	1594.703
PI19	86483.684	2877639.267	1594.960
PI20	86531.249	2877624.869	1595.735
PI21	86549.162	2877684.357	1595.669
PI22	86515.662	2877728.097	1594.584
PI23	86509.358	2877748.529	1594.192
PI24	86520.220	2877811.647	1593.594
PI25	86550.748	2877870.406	1593.535
PI26	86605.312	2877953.002	1593.511
PI27	86668.684	2878030.363	1592.749



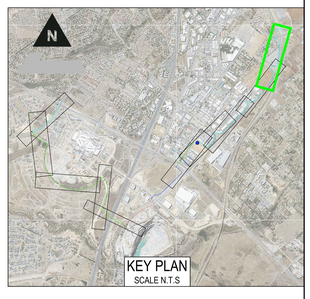
LEGEND
- NATURAL GROUND LEVEL (NGL)
- WATER PIPES
- PIPE JACKING / HORIZONTAL DRILLING
- PREFABRICATED BEND > 5°

SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1590

		PI01	PI02	PI03	PI04	PI05	PI06	PI07	PI08	PI09	PI10	PI11	PI12	PI13	PI14	PI15	PI16	PI17	PI18	PI19
CHAINAGE (m)		0.000	17.574	89.308	166.412	253.038	288.553	297.804	344.031	367.041	384.733	402.852	469.534	497.698	584.806	687.249	773.914	836.315	845.519	
GROUND LEVEL (m)		1605.220	1605.486	1604.430	1604.646	1604.445	1604.329	1604.494	1604.238	1604.285	1604.246	1604.399	1602.901	1599.000	1597.761	1596.703	1596.921	1596.785	1596.785	
PIPE INVERT (m)		1602.850	1602.590	1601.463	1601.395	1601.479	1601.605	1601.635	1601.665	1601.665	1601.675	1601.649	1600.372	1597.202	1595.963	1594.905	1594.703	1594.960	1594.960	
DEPTH TO INVERT (m)		2.380	2.896	3.967	3.251	3.448	2.840	2.894	2.573	2.610	2.571	2.710	2.529	1.798	1.798	1.798	1.798	1.798	1.798	1.825
PIPE LENGTH / SLOPE		17.575 m 1.479%	71.743 m 1.571%	77.104 m 0.089%	31.545 m 0.267%	55.081 m 0.229%	15.515 m 0.191%	29.251 m 0.103%	46.227 m 0.000%	23.009 m 0.045%	17.693 m 0.000%	18.119 m 0.147%	57.996 m 2.202%	43.985 m 2.387%	82.819 m 2.561%	98.659 m 1.255%	87.671 m 1.208%	56.402 m 0.358%	10.606 m 1.647%	
CHANGE IN DIRECTION	HORIZONTAL		16.7°	80.5°	88.0°	15.2°	40.4°	57.5°	95.9°	84.7°	10.2°	26.7°	44.1°	16.9°	4.4°	5.2°	5.8°	21.3°	37.3°	37.5°
	VERTICAL																			
PEAK FLOW / VELOCITY		286.000 l/s 1.060 m/s																		
PIPE SIZE / PIPE TYPE		600mmØ (NB) STEEL PIPE, GRADE X42 TO API 5L, INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217 AND EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW																		
STATIC PRESSURE (m)		6.951	6.821	7.948	8.016	7.932	7.806	7.776	7.746	7.746	7.736	7.736	7.762	9.039	10.089	12.209	13.448	14.506	14.708	14.451
HYDRAULIC GRADE (m) / HEAD LOSS		1609.411	0.026 m	1609.385	0.106 m	1609.279	0.114 m	1609.165	0.047 m	1609.118	0.082 m	1609.036	0.023 m	1609.013	0.043 m	1608.970	0.069 m	1608.901	0.034 m	1608.867	0.026 m	1608.841
		1608.814	0.086 m	1608.728	0.065 m	1608.663	0.123 m	1608.540	0.146 m	1608.394	0.130 m	1608.264	0.084 m	1608.180	0.023 m	1608.157				

LONGSECTION: PI01 - PI19



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JOHANNESBURG
2001

DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 1 OF 10

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

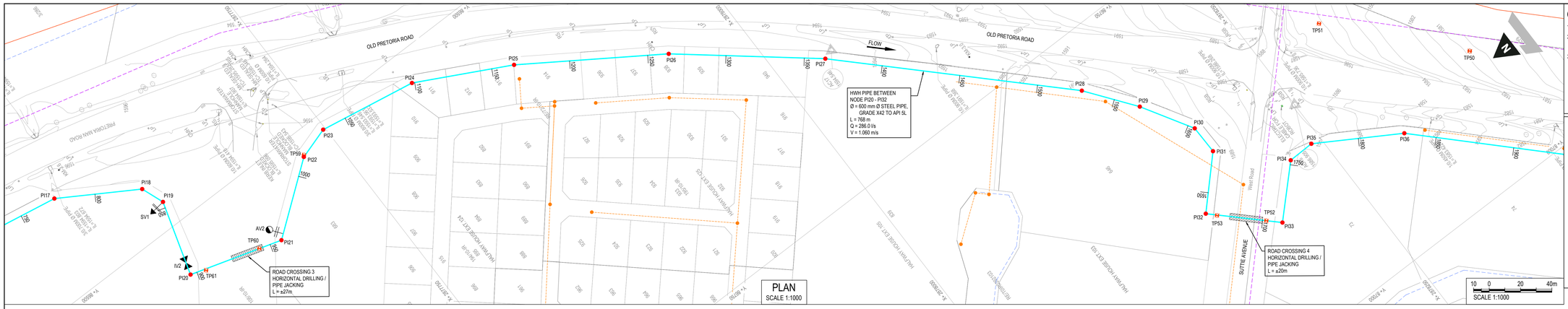
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0301 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 1 OF 10

FILE No.



PLAN
SCALE 1:1000

10 0 20 40m
SCALE 1:1000

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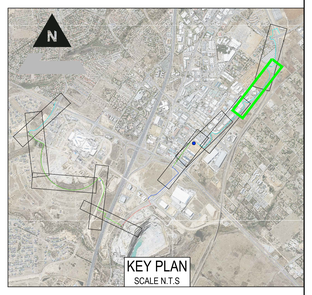
LEGEND

- 600mm Ø STEEL PIPELINE
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- TEST PITS
- BOREHOLES
- IV — ISOLATING VALVE
- AV — AIR VALVE
- SV — SCOUR VALVE

COORDINATES LIST FOR BULK WATER FEEDER PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI23	86509.358	2877748.529	1594.192
PI24	86520.220	2877811.647	1593.594
PI25	86550.748	2877870.406	1593.535
PI26	86605.312	2877953.002	1593.511
PI27	86668.684	2878030.363	1592.749
PI28	86784.654	2878147.765	1588.501
PI29	86815.282	2878170.892	1587.763
PI30	86847.637	2878190.242	1587.067
PI31	86866.346	2878190.606	1586.722
PI32	86895.202	2878162.630	1585.943
PI33	86929.525	2878197.963	1585.655
PI34	86901.159	2878226.443	1584.968
PI35	86900.810	2878243.302	1584.540
PI36	86931.657	2878294.467	1582.478

LONGSECTION: PI19 - PI32



NOTES:

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DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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FAX: (011) 688-1529

Joburg

HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 2 OF 10

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

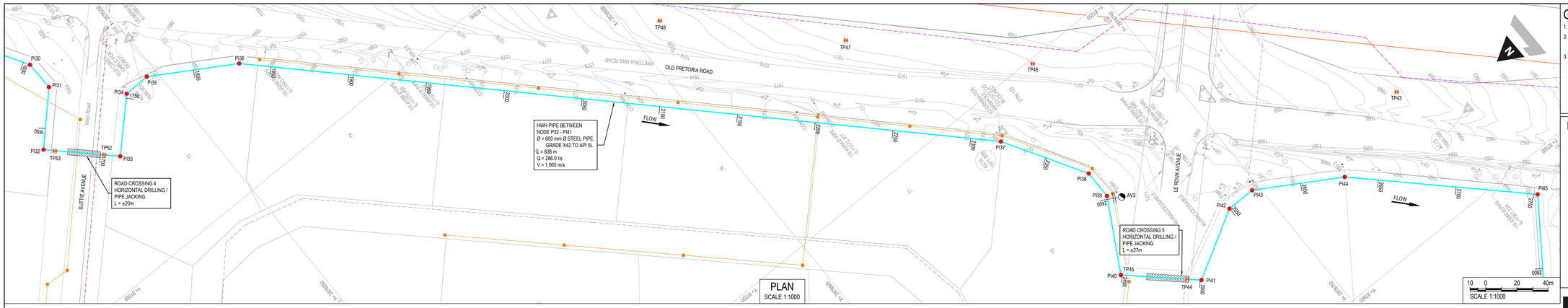
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0302 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 2 OF 10

FILE No.



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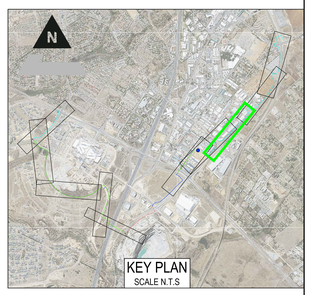
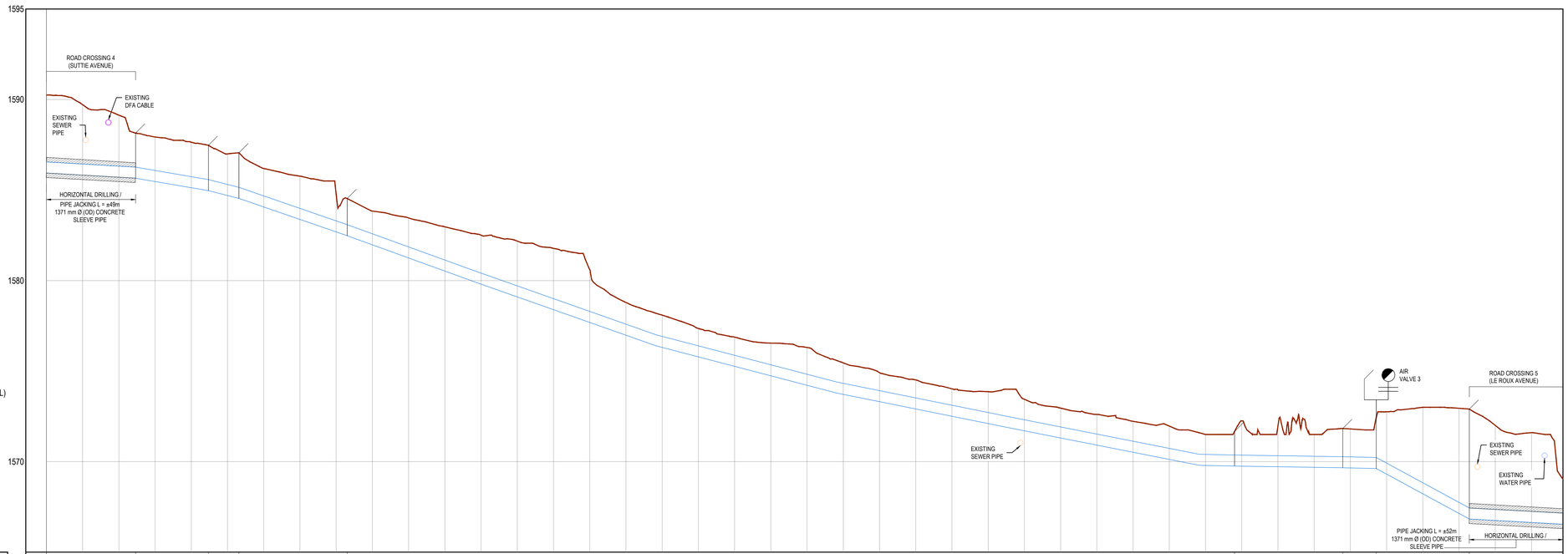
LEGEND

- 600mm Ø STEEL PIPELINE
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- TEST PITS
- BOREHOLES
- IV — ISOLATING VALVE
- AV — AIR VALVE
- SV — SCOUR VALVE

COORDINATES LIST FOR BULK WATER FEEDER PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI36	86931.657	2878294.467	1582.478
PI37	87278.638	2878640.395	1569.754
PI38	87329.990	2878670.952	1569.660
PI39	87348.509	2878670.926	1569.619
PI40	87393.315	2878645.806	1566.830
PI41	87428.465	2878683.754	1566.544
PI42	87404.371	2878726.492	1566.401
PI43	87404.406	2878745.159	1566.349
PI44	87435.324	2878796.453	1566.040





LEGEND

- NATURAL GROUND LEVEL (NGL)
- WATER PIPES
- PIPE JACKING / HORIZONTAL DRILLING
- PREFABRICATED BEND > 5°

SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1560

		PI32	PI33	PI34	PI35	PI36	PI37	PI38	PI39	PI40	PI41
CHAINAGE (m)		1693.480	1712.740	1752.936	1769.799	1820.544	2000.000	2100.000	2200.000	2319.504	2493.872
GROUND LEVEL (m)		1590.250	1588.143	1587.470	1587.060	1584.632	1576.197	1575.583	1573.812	1571.953	1569.032
PIPE INVERT (m)		1585.843	1585.655	1584.968	1584.540	1582.478	1576.359	1575.783	1573.755	1571.753	1566.544
DEPTH TO INVERT (m)		4.307	2.488	2.502	2.521	2.054	1.798	1.798	2.044	1.909	2.488
PIPE LENGTH / SLOPE		49.261 m 0.584%	40.203 m 1.709%	16.868 m 2.542%	59.780 m 3.451%	70.503 m 3.621%	100.000 m 3.527%	100.000 m 2.614%	100.000 m 2.017%	100.000 m 1.969%	19.504 m 0.229%
CHANGE IN DIRECTION	HORIZONTAL	89.9°	89.0°	43.7°	32.2°	14.0°					14.1°
	VERTICAL										
PEAK FLOW / VELOCITY		286.000 l/s 1.060 m/s									
PIPE SIZE / PIPE TYPE		600mmØ (NB)									
STATIC PRESSURE (m)		STEEL PIPE, GRADE X42 TO API 5L, INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217 AND EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW									
HYDRAULIC GRADE (m) / HEAD LOSS		23.468	23.756	24.443	24.871	26.933	29.484	33.012	35.626	37.643	39.613
		1607.060	0.073 m 1606.987	0.060 m 1606.927	0.025 m 1606.902	0.089 m 1606.813	0.727 m				1606.086

		PI42	PI43	PI44	PI45
CHAINAGE (m)		2319.504	2373.260	2397.779	2503.872
GROUND LEVEL (m)		1571.953	1571.829	1572.448	1569.032
PIPE INVERT (m)		1571.753	1571.660	1569.619	1566.544
DEPTH TO INVERT (m)		1.909	2.169	2.829	2.488
PIPE LENGTH / SLOPE		19.504 m 0.229%	59.756 m 0.156%	18.519 m 0.221%	51.443 m 5.429%
CHANGE IN DIRECTION	HORIZONTAL	14.1°	30.8°	2.9°	2.7°
	VERTICAL			29.1°	76.4°
PEAK FLOW / VELOCITY					
PIPE SIZE / PIPE TYPE					
STATIC PRESSURE (m)					
HYDRAULIC GRADE (m) / HEAD LOSS		39.657	39.751	39.792	42.581
		0.089 m 1606.568	0.027 m 1606.577	0.076 m 1606.560	0.077 m 1606.874

LONGSECTION: PI32 - PI41

NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L,
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
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DRAWN	T. SHABALALA	OCTOBER 2024	
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APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
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ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 3 OF 10

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

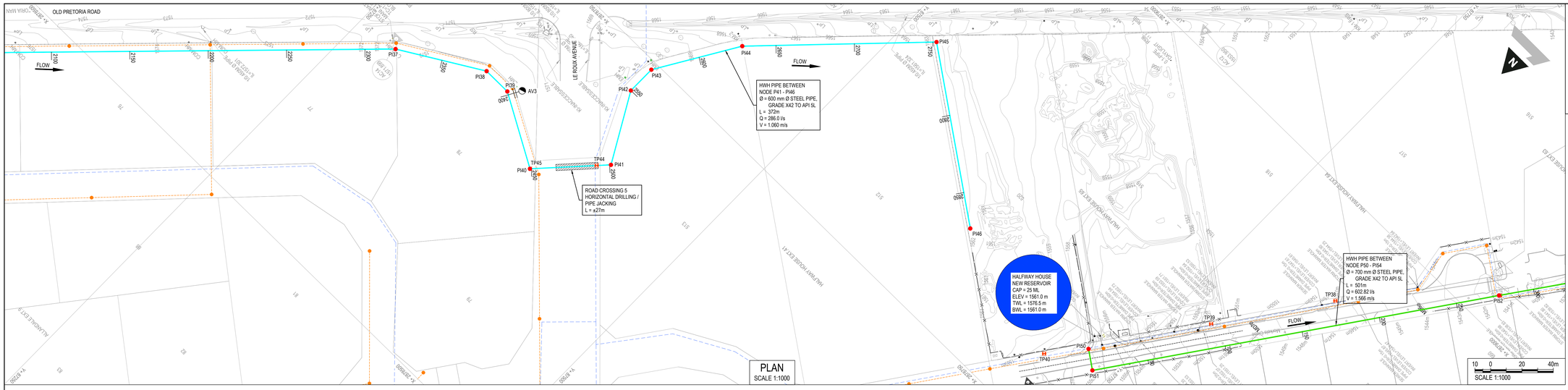
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0303 - T1
PROJECT No. DRAWING No. REV.

A0 SHEET 3 OF 10
ORIGINAL PAGE SIZE

FILE No.



PLAN
SCALE 1:1000

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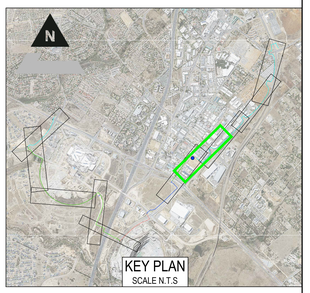
LEGEND

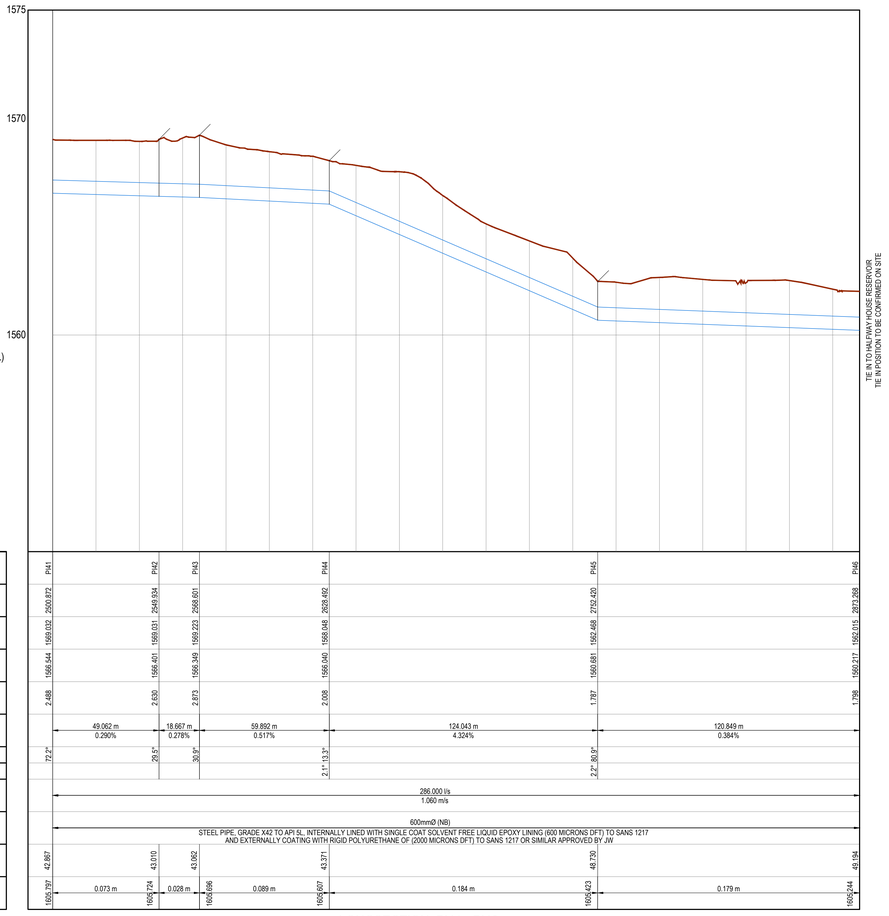
- 700mm Ø STEEL PIPELINE
- 600mm Ø STEEL PIPELINE
- 710mm Ø PVC-O PIPELINE (BY OTHERS)
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- OFFTAKE
- TEST PITS
- BOREHOLES
- ISOLATING VALVE (IV)
- AIR VALVE (AV)
- SCOUR VALVE (SV)

COORDINATES LIST FOR BULK WATER FEEDER PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI44	87435.324	2878796.453	1566.040
PI45	87522.007	2878885.020	1560.681
PI46	87620.585	2878815.115	1560.217



KEY PLAN
SCALE N.T.S



LONGSECTION: PI41 - PI46

LEGEND
- NATURAL GROUND LEVEL (NGL)
- WATER PIPES
- PIPE JACKING / HORIZONTAL DRILLING
- PREFABRICATED BEND > 5°

SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1550

PI	
CHAINAGE (m)	
GROUND LEVEL (m)	
PIPE INVERT (m)	
DEPTH TO INVERT (m)	
PIPE LENGTH / SLOPE	
CHANGE IN DIRECTION	HORIZONTAL / VERTICAL
PEAK FLOW / VELOCITY	
PIPE SIZE / PIPE TYPE	
STATIC PRESSURE (m)	
HYDRAULIC GRADE (m) / HEAD LOSS	

NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L,
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
   LINING: INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217.
2. REFER TO GEOTECHNICAL INVESTIGATION REPORT FOR DETAILED GEOTECHNICAL INFORMATION ALONG THE PIPELINE ROUTE.
3. REFER TO DWG NO. 111242-0000-DRG-WW-0500 FOR TYPICAL AIR VALVE DETAIL.
4. REFER TO DWG NO. 111242-0000-DRG-WW-0501 FOR TYPICAL ISOLATING VALVE DETAIL.
5. REFER TO DWG NO. 111242-0000-DRG-WW-0502-0503 FOR TYPICAL SCOUR VALVE CHAMBER DETAIL.
6. REFER TO DWG NO. 111242-0000-DRG-WW-0504 FOR TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL.
7. REFER TO DWG NO. 111242-0000-DRG-WW-0506 FOR TYPICAL PIPE JACKING DETAIL.
8. EXISTING SERVICES LEVELS AND POSITIONS TO BE CONFIRMED ON SITE.

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JOHANNESBURG
2001

DESIGNED	T. SHABALALA		OCTOBER 2024
DRAWN	T. SHABALALA		OCTOBER 2024
CHECKED	K. BRINK		OCTOBER 2024
APPROVED BY:	C. KAN		OCTOBER 2024
		SIGNATURE	DATE
ECSA REG. No.	980570		
CHECKED BY:			
		SIGNATURE	DATE
ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 4 OF 10

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

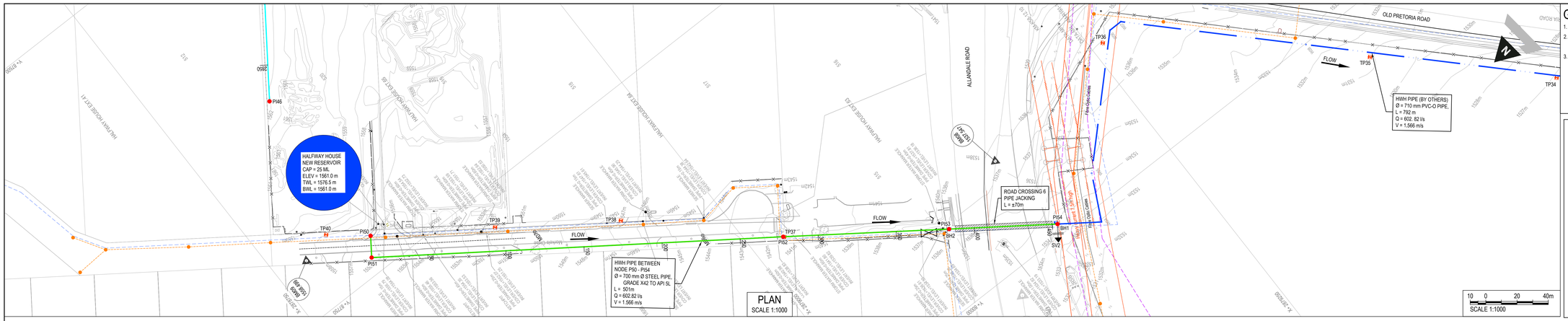
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0304 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 4 OF 10

FILE No.



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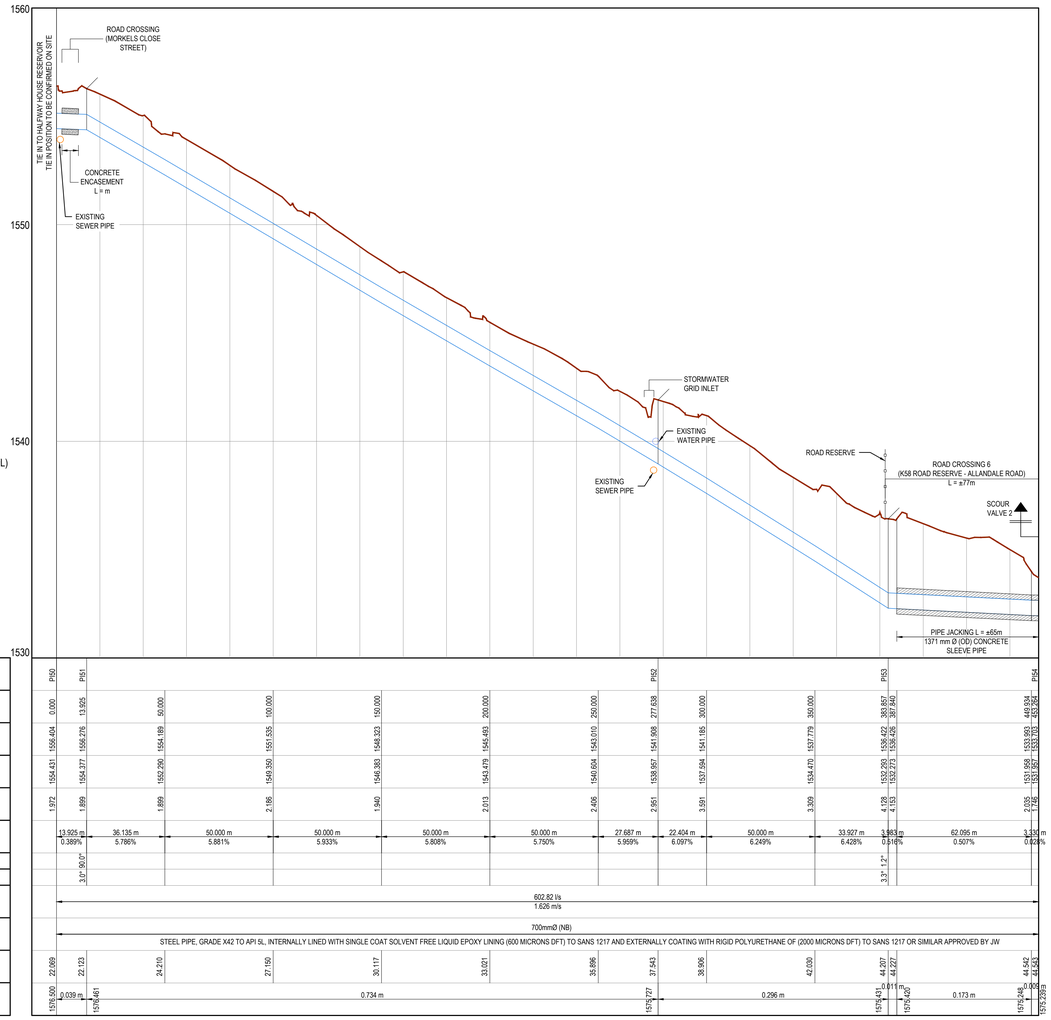
LEGEND

- 700mm Ø STEEL PIPELINE
- 600mm Ø STEEL PIPELINE
- 710mm Ø PVC-O PIPELINE (BY OTHERS)
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- OFFTAKE
- TEST PITS
- BOREHOLES
- ISOLATING VALVE (IV)
- AIR VALVE (AV)
- SCOUR VALVE (SV)



LEGEND

- NATURAL GROUND LEVEL (NGL)
- WATER PIPES
- PIPE JACKING / HORIZONTAL DRILLING
- PREFABRICATED BEND > 5°

SCALES:
Horizontal 1:1000
Vertical 1:100

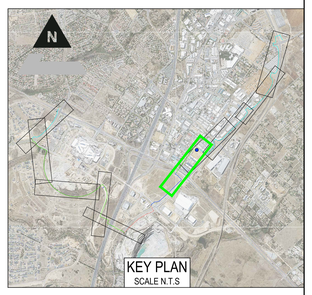
DATUM 1530

PI		PI50 | PI51 | PI52 | PI53 | PI54
CHAINAGE (m)		0.000 | 13.925 | 50.000 | 100.000 | 150.000 | 200.000 | 250.000 | 277.688 | 300.000 | 350.000 | 383.857 | 446.047 | 449.934
GROUND LEVEL (m)		1556.404 | 1556.276 | 1554.189 | 1551.535 | 1548.933 | 1545.483 | 1543.010 | 1541.908 | 1541.185 | 1537.779 | 1536.422 | 1536.436 | 1533.993 | 1533.703
PIPE INVERT (m)		1554.431 | 1554.377 | 1552.290 | 1549.350 | 1546.383 | 1543.479 | 1540.604 | 1538.957 | 1537.694 | 1534.470 | 1533.293 | 1533.173 | 1531.668 | 1531.667
DEPTH TO INVERT (m)		1.972 | 1.899 | 1.899 | 2.186 | 1.940 | 2.013 | 2.406 | 2.951 | 3.991 | 3.909 | 4.128 | 4.153 | 2.025 | 1.736
PIPE LENGTH / SLOPE		13.925 m 0.389% | 36.135 m 5.786% | 50.000 m 5.881% | 50.000 m 5.933% | 50.000 m 5.808% | 50.000 m 5.750% | 27.687 m 5.959% | 22.404 m 6.097% | 50.000 m 6.249% | 33.927 m 6.428% | 3.963 m 0.516% | 62.095 m 0.507% | 3.330 m 0.028%
CHANGE IN DIRECTION	HORIZONTAL	3.0° 90.0°
	VERTICAL	3.3° ∟2°
PEAK FLOW / VELOCITY		602.82 l/s 1.626 m/s
PIPE SIZE / PIPE TYPE		700mmØ (NB) STEEL PIPE, GRADE X42 TO API 5L, INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217 AND EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW
STATIC PRESSURE (m)		22.069 | 22.123 | 24.210 | 27.150 | 30.117 | 33.021 | 35.866 | 37.543 | 38.906 | 42.030 | 44.207 | 44.227 | 44.542 | 44.542
HYDRAULIC GRADE (m) / HEAD LOSS		1575.500 | 0.039 m | 1575.461 | 0.734 m | 1575.727 | 0.296 m | 1575.431 | 0.011 m | 1575.420 | 0.173 m | 1575.246 | 0.006 m | 1575.240 m

LONGSECTION: PI50 - PI54

COORDINATES LIST FOR BULK WATER SUPPLY PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI50	87728.232	2878813.015	1554.431
PI51	87739.591	2878804.960	1554.377
PI52	87891.409	2879020.588	1538.957
PI53	87945.576	2879096.835	1532.293
PI54	87993.123	2879163.762	1531.957



NOTES:

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   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
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DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
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CHECKED BY:			
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ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 5 OF 10

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

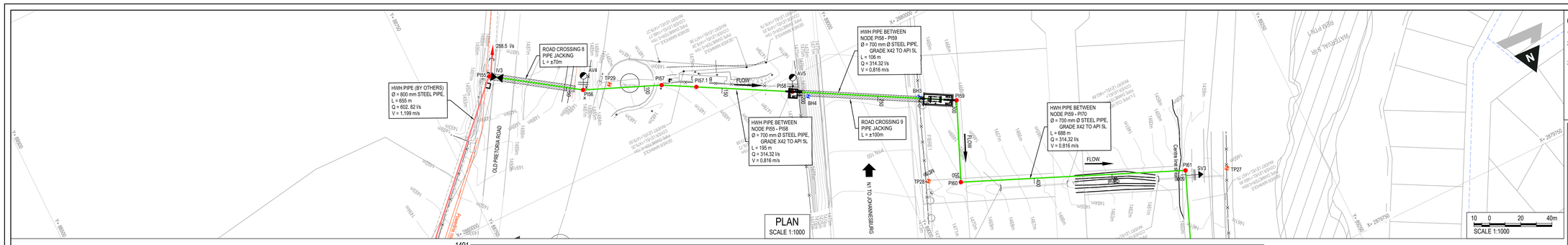
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0305 - T1
PROJECT No. DRAWING No. REV.

A0 SHEET 5 OF 10
ORIGINAL PAGE SIZE

FILE No.



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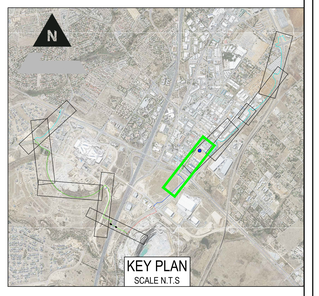
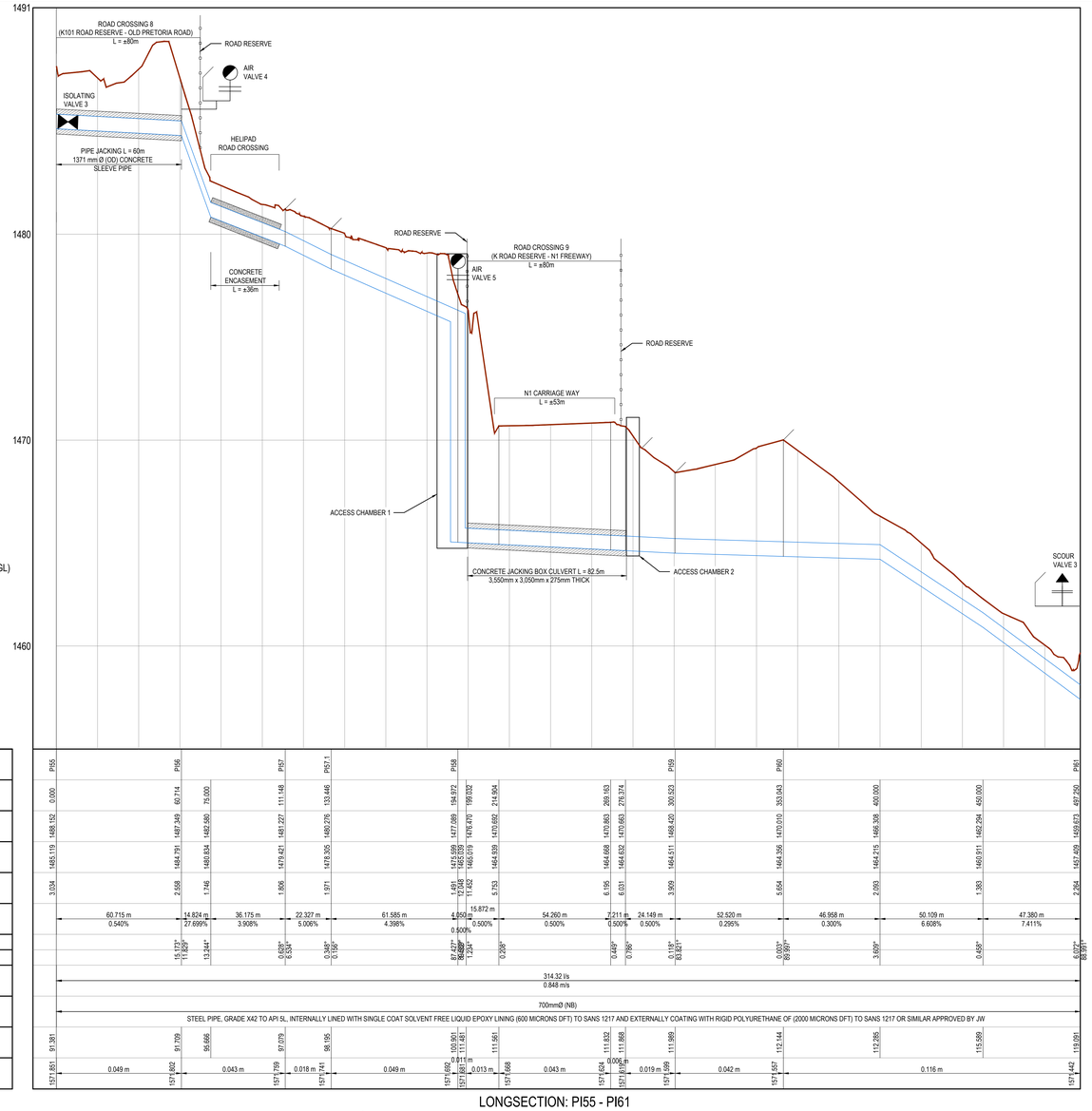
LEGEND

- 700mm Ø STEEL PIPELINE
- 800mm Ø EXISTING STEEL PIPELINE
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- OFFTAKE
- TEST PITS
- BOREHOLES
- IV — ISOLATING VALVE
- AV — AIR VALVE
- SV — SCOUR VALVE

COORDINATES LIST FOR BULK WATER SUPPLY PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI55	88792.161	2880084.893	1485.119
PI56	88842.349	2880050.726	1484.791
PI57	88888.971	2880031.493	1479.421
PI57.1	88908.483	2880020.699	1478.305
PI58	88962.401	2879991.063	1475.599
PI59	89054.771	2879939.991	1464.511
PI60	89034.278	2879891.628	1464.356
PI61	89167.058	2879835.365	1457.409





LEGEND

- NATURAL GROUND LEVEL (NGL)
- WATER PIPES
- PIPE JACKING / HORIZONTAL DRILLING
- PREFABRICATED BEND > 5°

SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1455

PI	PI55 · PI56 · PI57 · PI57.1 · PI58 · PI59 · PI60 · PI61
CHAINAGE (m)	0.000 · 60.714 · 75.000 · 111.148 · 133.446 · 194.572 · 199.002 · 214.904 · 299.183 · 276.374 · 300.923 · 353.043 · 400.000 · 450.000 · 497.200
GROUND LEVEL (m)	1488.152 · 1487.249 · 1482.589 · 1481.227 · 1480.276 · 1477.089 · 1476.470 · 1470.693 · 1470.663 · 1470.663 · 1468.420 · 1470.010 · 1468.309 · 1462.294 · 1459.873
PIPE INVERT (m)	1485.119 · 1484.791 · 1480.834 · 1479.421 · 1478.305 · 1475.599 · 1475.039 · 1465.019 · 1464.699 · 1470.693 · 1464.668 · 1464.632 · 1464.511 · 1464.356 · 1464.215 · 1460.911 · 1457.409
DEPTH TO INVERT (m)	3.034 · 2.598 · 1.746 · 1.806 · 1.971 · 1.491 · 12.048 · 11.402 · 6.753 · 6.195 · 6.031 · 3.909 · 5.654 · 2.053 · 1.383 · 2.264
PIPE LENGTH / SLOPE	60.715 m 0.540% · 14.824 m 27.699% · 36.175 m 3.908% · 22.327 m 5.006% · 61.585 m 4.398% · 15.872 m 4.650 m 0.500% · 54.260 m 0.500% · 7.211 m 0.500% · 24.149 m 0.500% · 52.520 m 0.295% · 46.958 m 0.300% · 50.109 m 6.608% · 47.380 m 7.411%
CHANGE IN DIRECTION — HORIZONTAL	15.177° · 13.244° · 0.628° · 0.348° · 87.427° · 1.234° · 0.208° · 0.449° · 0.786° · 0.134° · 0.003° · 3.676° · 0.458° · 6.072°
CHANGE IN DIRECTION — VERTICAL	13.699° · 6.534° · 0.199° · 84.288° · 89.990° · 0.041° · 89.990° · 88.991°
PEAK FLOW / VELOCITY	314.32 l/s 0.848 m/s
PIPE SIZE / PIPE TYPE	700mmØ (NB)
STATIC PRESSURE (m)	STEEL PIPE, GRADE X42 TO API 5L, INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217 AND EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW
HYDRAULIC GRADE (m) / HEAD LOSS	91.381 · 91.709 · 95.666 · 97.079 · 98.195 · 100.901 · 111.481 · 111.661 · 111.832 · 111.888 · 111.999 · 112.144 · 112.265 · 115.589 · 119.091
	0.049 m · 0.043 m · 0.018 m · 0.049 m · 0.011 m · 0.013 m · 0.043 m · 0.006 m · 0.019 m · 0.042 m · 0.116 m
	1571.851 · 1571.802 · 1571.759 · 1571.741 · 1571.692 · 1571.681 · 1571.668 · 1571.624 · 1571.618 · 1571.599 · 1571.557 · 1571.442

LONGSECTION: PI55 - PI61

NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L.
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
   LINING: INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217.
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5. REFER TO DWG NO. 111242-0000-DRG-WW-0502-0503 FOR TYPICAL SCOUR VALVE CHAMBER DETAIL.
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DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
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APPROVED BY:	C. KAN	OCTOBER 2024	
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ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 6 OF 10

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE

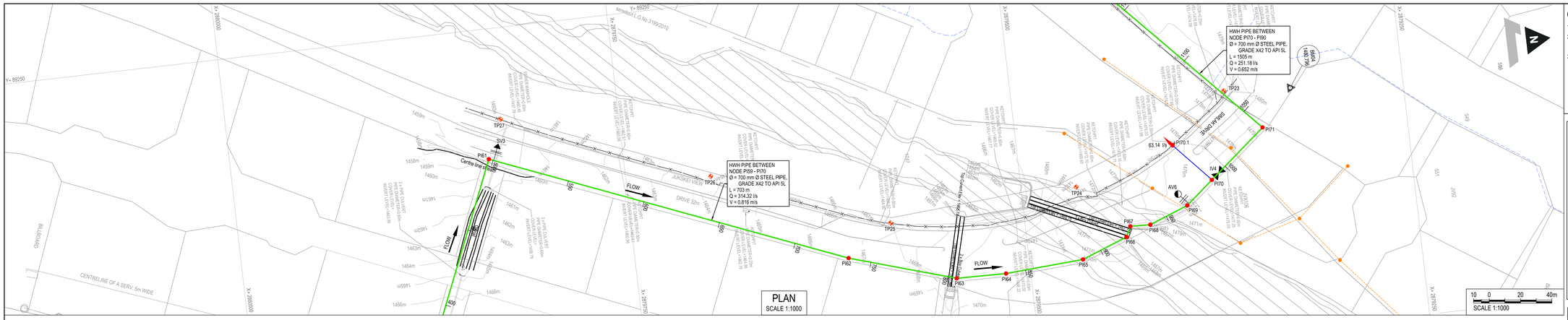
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0306 - T1
PROJECT No. · DRAWING No. · REV.

A0 ORIGINAL PAGE SIZE · SHEET 6 OF 10

FILE No.



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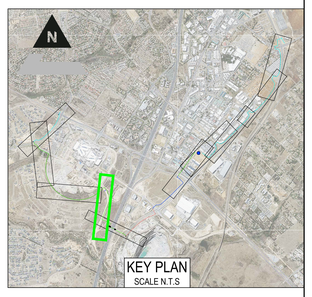
LEGEND

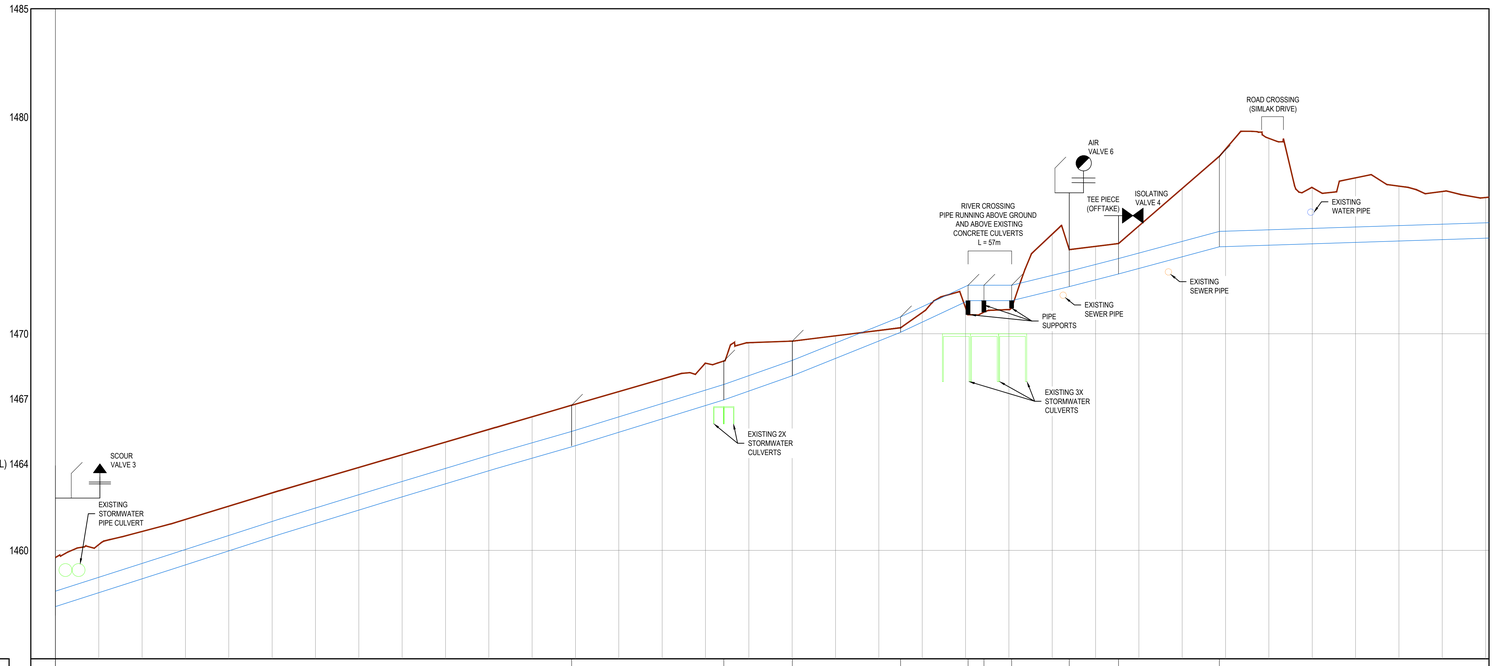
- 700mm Ø STEEL PIPELINE
- 315mm Ø mPVC PIPELINE
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- WETLAND AREA
- NODES
- TEST PITS
- BOREHOLES
- ISOLATING VALVE (IV)
- AIR VALVE (AV)
- SCOUR VALVE (SV)

10 0 20 40m
SCALE 1:1000

COORDINATES LIST FOR BULK WATER SUPPLY PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI61	89167.058	2879835.365	1457.409
PI62	89077.991	2879614.437	1466.701
PI63	89057.283	2879547.325	1466.946
PI64	88056.718	2879515.696	1468.061
PI65	89060.046	2879465.855	1470.068
PI66	89071.075	2879436.737	1471.527
PI67	89077.607	2879433.403	1471.526
PI68	89077.183	2879420.636	1471.527
PI69	89086.728	2879395.819	1472.176
PI70	89101.097	2879378.360	1472.761
PI70.1	89125.956	2879400.763	1474.008
PI71	89130.742	2879342.343	1474.013





LEGEND

- NATURAL GROUND LEVEL (NGL)
- WATER PIPES
- PIPE JACKING / HORIZONTAL DRILLING
- PREFABRICATED BEND > 5°

SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1455

PI	PI61 PI62 PI63 PI64 PI65 PI66 PI67 PI68 PI69 PI70 PI71 PI72
CHAINAGE (m)	497.250 550.000 600.000 650.000 700.000 735.456 805.690 837.324 887.276 918.413 925.747 938.521 965.109 987.848 1034.371 1158.840
GROUND LEVEL (m)	1459.673 1461.198 1462.738 1464.201 1465.664 1466.701 1468.741 1469.659 1470.275 1470.878 1471.393 1471.181 1473.884 1474.163 1474.188 1478.393
PIPE INVERT (m)	1457.469 1459.098 1460.716 1462.253 1463.757 1464.780 1466.946 1468.061 1470.068 1470.527 1471.526 1471.527 1472.176 1472.761 1474.013 1474.412
DEPTH TO INVERT (m)	2.264 2.178 2.023 1.948 1.906 1.921 1.795 1.598 0.207 -0.649 -0.133 -0.346 1.708 1.402 4.175 1.891
PIPE LENGTH / SLOPE	52.777 m 3.201% | 50.000 m 3.236% | 50.000 m 3.075% | 50.000 m 3.008% | 35.471 m 2.884% | 70.268 m 3.084% | 31.654 m 3.526% | 49.992 m 4.016% | 31.171 m 4.686% | 7.334 m 0.005% | 12.774 m 0.008% | 26.596 m 2.440% | 22.747 m 2.570% | 46.539 m 2.692% | 124.470 m 0.320%
CHANGE IN DIRECTION — HORIZONTAL	4.8° | 16.1° | 4.8° | 16.9° | 2.6° 42.2° | 64.8° | 1.2° 22.9° | 18.4° | 1.2° 93.6°
CHANGE IN DIRECTION — VERTICAL	
PEAK FLOW / VELOCITY	314.32 l/s 0.848 m/s | 251.18 l/s 0.678 m/s
PIPE SIZE / PIPE TYPE	700mmØ (NB) STEEL PIPE, GRADE X42 TO API 5L, INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217 AND EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW
STATIC PRESSURE (m)	119.991 117.388 115.770 114.233 112.729 111.673 109.564 108.439 106.432 104.873 104.574 104.573 104.524 103.739 102.467 102.083
HYDRAULIC GRADE (m) / HEAD LOSS	1571.441 0.191 m 1571.250 0.056 m 1571.194 0.025 m 1571.168 0.040 m 1571.128 0.025 m 1571.103 0.006 m 1571.097 0.010 m 1571.087 0.021 m 1571.066 0.018 m 1571.048 0.024 m 1571.023 0.065 m 1570.958

LONGSECTION: PI61 - PI72

NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L.
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
   LINING: INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217.
2. REFER TO GEOTECHNICAL INVESTIGATION REPORT FOR DETAILED GEOTECHNICAL INFORMATION ALONG THE PIPELINE ROUTE.
3. REFER TO DWG NO. 111242-0000-DRG-WW-0500 FOR TYPICAL AIR VALVE DETAIL.
4. REFER TO DWG NO. 111242-0000-DRG-WW-0501 FOR TYPICAL ISOLATING VALVE DETAIL.
5. REFER TO DWG NO. 111242-0000-DRG-WW-0502-0503 FOR TYPICAL SCOUR VALVE CHAMBER DETAIL.
6. REFER TO DWG NO. 111242-0000-DRG-WW-0504 FOR TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL.
7. REFER TO DWG NO. 111242-0000-DRG-WW-0506 FOR TYPICAL PIPE JACKING DETAIL.
8. EXISTING SERVICES LEVELS AND POSITIONS TO BE CONFIRMED ON SITE.

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JOHANNESBURG
2001

DESIGNED	T. SHABALALA		OCTOBER 2024
DRAWN	T. SHABALALA		OCTOBER 2024
CHECKED	K. BRINK		OCTOBER 2024
APPROVED BY:	C. KAN	SIGNATURE	DATE
ECSA REG. No.	980570		
CHECKED BY:		SIGNATURE	DATE
ECSA REG. No.			

Johannesburg Water

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2001
TEL: (011) 688-1400
FAX: (011) 688-1529

Joburg

HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 7 OF 10

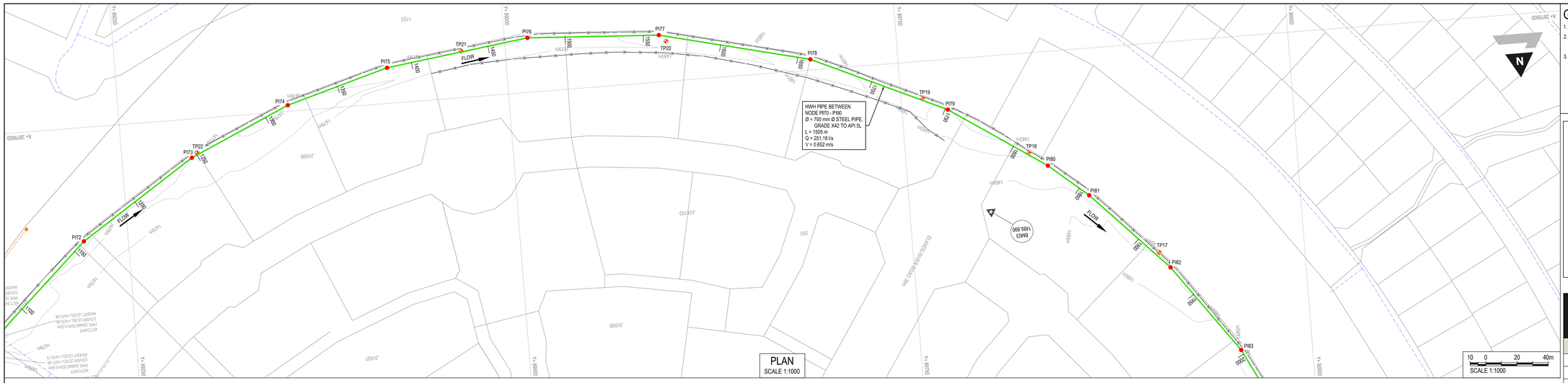
APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0307 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 7 OF 10
FILE No.


PI72
PI73
PI74
PI75
PI76
PI77
PI78
PI79
PI80
PI81
PI82
PI83
TP17
TP18
TP19
TP20
TP21
TP22
FLOW
HWH PIPE BETWEEN NODE PI70 - PI90
Ø = 700 mm Ø STEEL PIPE GRADE X42 TO API 5L
L = 1505 m
Q = 251.18 l/s
V = 0.652 m/s
BM03 1465.590
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000
2050
2100
2150
2200
2250
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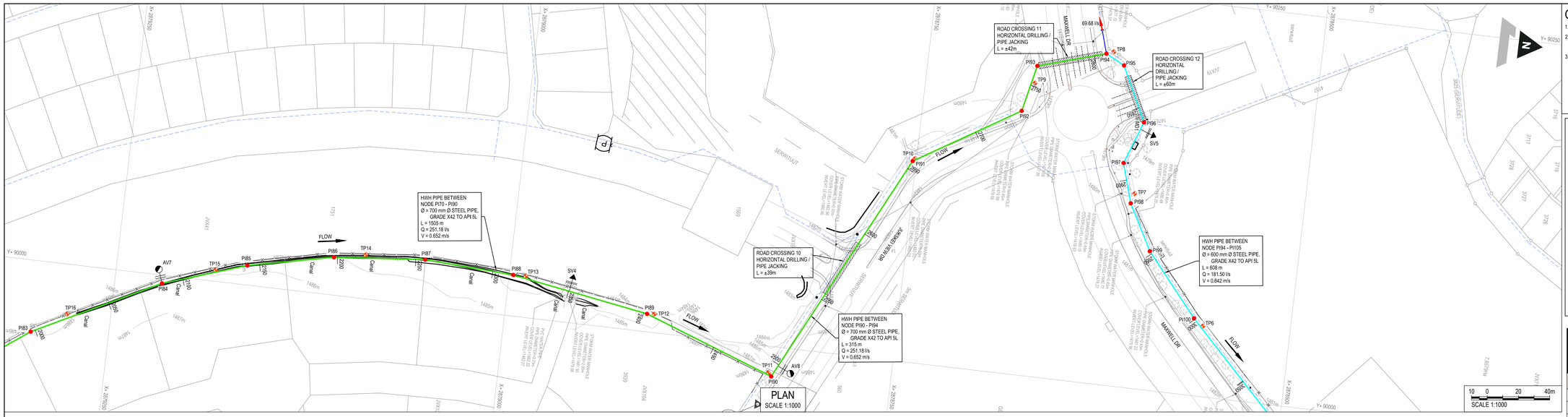

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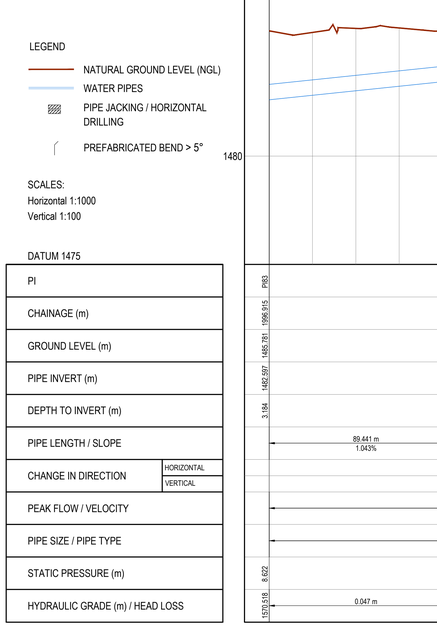
LEGEND

- 700mm Ø STEEL PIPELINE
- 600mm Ø STEEL PIPELINE
- 315mm Ø mPVC PIPELINE
- EXISTING WATER PIPELINE
- EXISTING SEWER PIPELINE
- EXISTING ESKOM OVERHEAD CABLES
- EXISTING DFA CABLES
- NODES
- OFFTAKE
- TEST PITS
- BOREHOLES
- ISOLATING VALVE (IV)
- AIR VALVE (AV)
- SCOUR VALVE (SV)

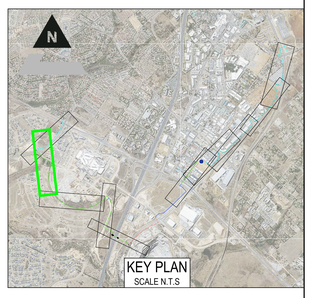
COORDINATES LIST FOR BULK WATER SUPPLY PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI83	89954.372	2879299.639	1482.597
PI84	89994.751	2879219.837	1483.530
PI85	90012.451	2879166.944	1482.994
PI86	90024.124	2879112.587	1482.333
PI87	90029.377	2879054.387	1481.576
PI88	90026.182	2878997.423	1480.867
PI89	90011.447	2878909.551	1481.690
PI90	89980.959	2878826.132	1484.048
PI91	90128.082	2878752.226	1478.849
PI92	90168.012	2878686.732	1476.855
PI93	90197.720	2878680.136	1475.989
PI94	90210.587	2878637.173	1475.775
PI95	90204.437	2878625.124	1475.737
PI96	90169.816	2878608.207	1475.608
PI97	90142.534	2878618.220	1476.100
PI98	90117.466	2878610.661	1476.653
PI99	90088.488	2878594.940	1477.276
PI100	90049.196	2878561.948	1478.149



	PI83	PI84	PI85	PI86	PI87	PI88	PI89	PI90	PI91	PI92	PI93	PI94
CHAINAGE (m)	1999.615	2089.351	2142.127	2197.724	2256.123	2313.214	2350.000	2402.313	2491.129	2554.109	2592.793	2807.769
GROUND LEVEL (m)	1485.781	1485.931	1485.136	1484.752	1483.559	1483.207	1484.107	1483.864	1486.445	1484.108	1482.994	1481.604
PIPE INVERT (m)	1482.597	1483.530	1482.994	1482.333	1481.576	1480.867	1480.395	1481.690	1484.048	1480.591	1480.392	1478.849
DEPTH TO INVERT (m)	3.184	2.401	2.143	2.419	1.983	2.339	3.711	2.183	2.397	3.517	2.603	2.754
PIPE LENGTH / SLOPE	89.441 m 1.043%	55.779 m 0.961%	55.600 m 1.188%	58.405 m 1.296%	57.095 m 1.242%	37.269 m 1.267%	51.849 m 2.499%	88.847 m 2.654%	63.075 m 5.488%	38.685 m 0.516%	62.998 m 2.449%	76.778 m 2.598%
CHANGE IN DIRECTION HORIZONTAL		1.1°	6.3°	6.9°	8.3°	6.3°	10.5°	4.6°	2.8°	1.1°	31.8°	46.1°
CHANGE IN DIRECTION VERTICAL		8.3°					2.1°	83.3°				
PEAK FLOW / VELOCITY	251.18 l/s 0.652 m/s											
PIPE SIZE / PIPE TYPE	700mmØ (NB)											
STATIC PRESSURE (m)	STEEL PIPE, GRADE X42 TO API 5L, INTERNALLY LINED WITH SINGLE COAT SOLVENT FREE LIQUID EPOXY LINING (600 MICRONS DFT) TO SANS 1217 AND EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW											
HYDRAULIC GRADE (m) / HEAD LOSS	8.622	8.526	8.376	8.938	8.709	8.775	8.820	8.690	8.454	8.760	8.808	8.956
	1570.519	0.047 m 1570.471	0.029 m 1570.442	0.029 m 1570.413	0.031 m 1570.382	0.030 m 1570.352	0.047 m 1570.305	0.047 m 1570.259	0.033 m 1570.226	0.020 m 1570.205	0.033 m 1570.172	0.040 m 1570.132
												9.147
												0.016 m 1570.116
												9.231
												0.024 m 1570.093
												9.249

LONGSECTION: PI83 - PI94



NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L,
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
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5. REFER TO DWG NO. 111242-0000-DRG-WW-0502-0503 FOR TYPICAL SCOUR VALVE CHAMBER DETAIL.
6. REFER TO DWG NO. 111242-0000-DRG-WW-0504 FOR TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL.
7. REFER TO DWG NO. 111242-0000-DRG-WW-0506 FOR TYPICAL PIPE JACKING DETAIL.
8. EXISTING SERVICES LEVELS AND POSITIONS TO BE CONFIRMED ON SITE.

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DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

Joburg

HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 9 OF 10

APPROVAL BY JW DEPOT			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

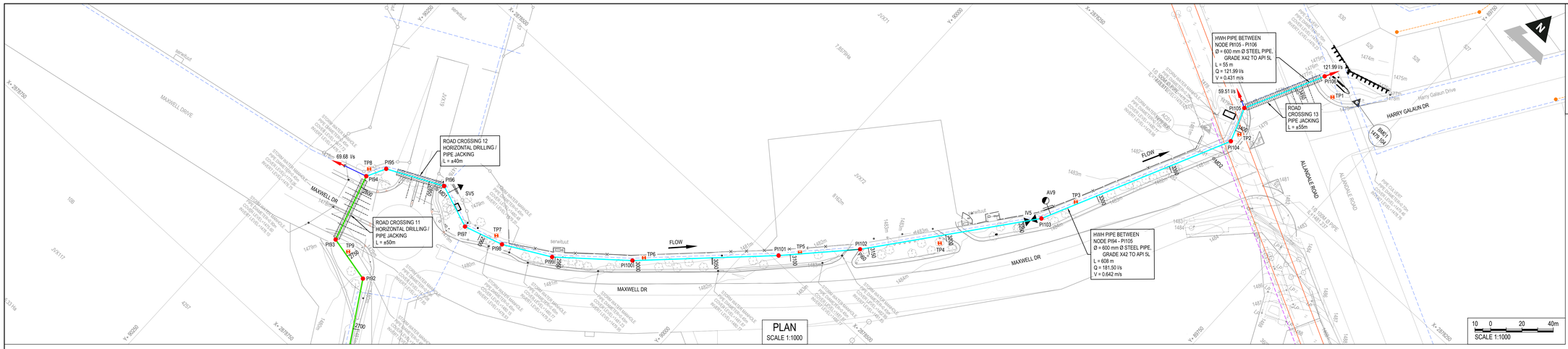
SCALE

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0309 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 9 OF 10
FILE No.



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LEGEND

- 700mm Ø STEEL PIPELINE
- 600mm Ø STEEL PIPELINE
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- EXISTING SEWER PIPELINE
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- ISOLATING VALVE (IV)
- AIR VALVE (AV)
- SCOUR VALVE (SV)

COORDINATES LIST FOR BULK WATER SUPPLY PIPELINE WGS-84 LO-29

POINT	Y-COORD	X-COORD	INVERT LEVEL
PI92	90168.012	2878686.732	1476.855
PI93	90197.720	2878680.136	1475.989
PI94	90210.587	2878637.173	1475.775
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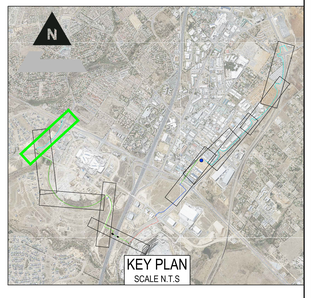
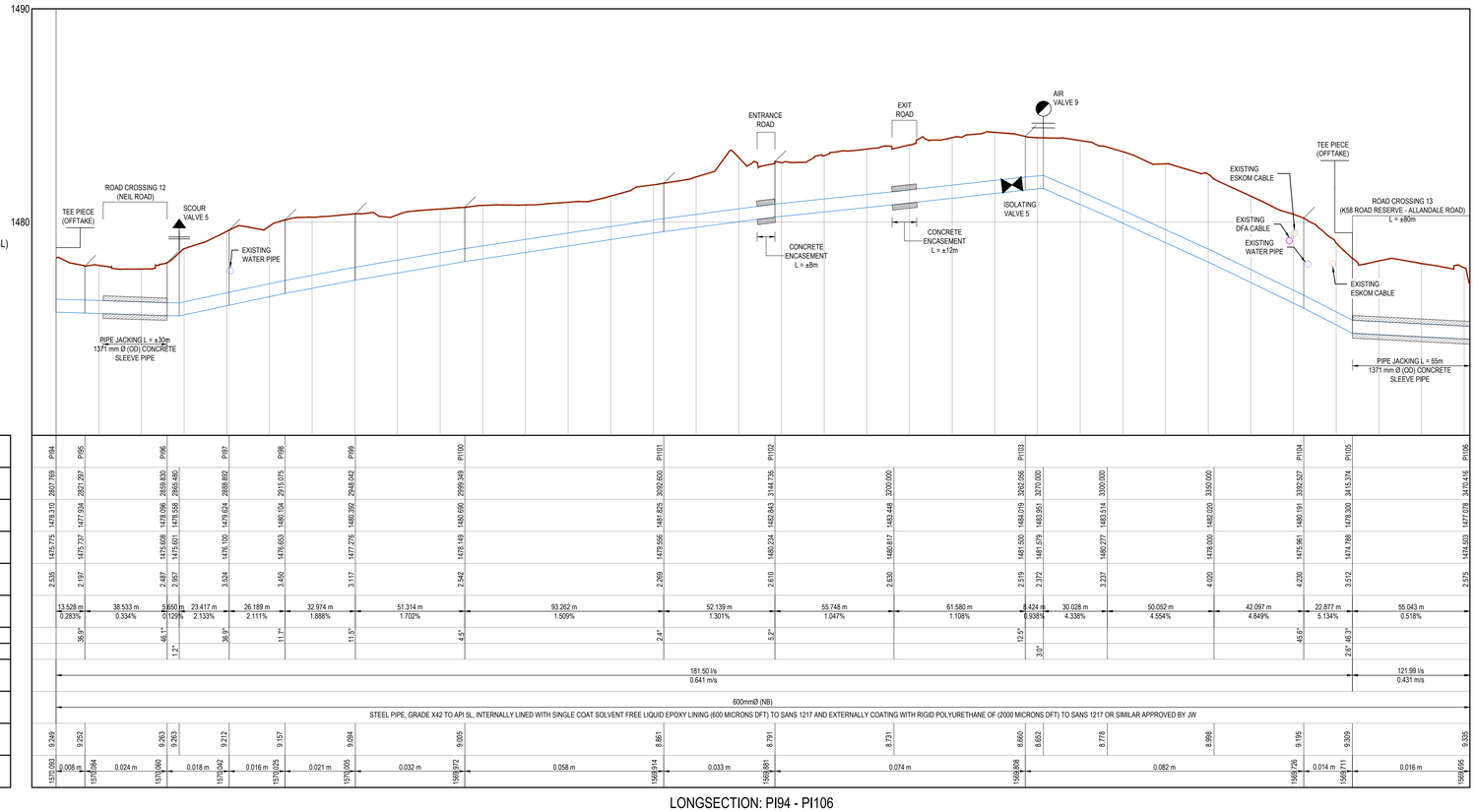
PI96	90169.816	2878608.207	1475.608
PI97	90142.534	2878618.220	1476.100
PI98	90117.466	2878610.661	1476.653
PI99	90088.488	2878594.940	1477.276
PI100	90049.196	2878561.948	1478.149
PI101	89982.724	2878496.547	1479.556
PI102	89947.134	2878458.450	1480.234
PI103	89875.213	2878365.759	1481.500
PI104	89819.544	2878247.760	1475.961
PI105	89827.521	2878226.351	1474.788
PI106	89803.463	2878176.845	1474.503





LONGSECTION: PI94 - PI106

NOTES:

1. PIPE DESCRIPTION: 600mm Ø (NB) STEEL PIPE, GRADE X42 TO API 5L,
   COATING: EXTERNALLY COATING WITH RIGID POLYURETHANE OF (2000 MICRONS DFT) TO SANS 1217 OR SIMILAR APPROVED BY JW.
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5. REFER TO DWG NO. 111242-0000-DRG-WW-0502-0503 FOR TYPICAL SCOUR VALVE CHAMBER DETAIL.
6. REFER TO DWG NO. 111242-0000-DRG-WW-0504 FOR TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL.
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HALFWAY HOUSE WATER UPGRADE

PLAN AND LONGSECTION:
SHEET 10 OF 10

APPROVAL BY JW DEPOT		
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APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE

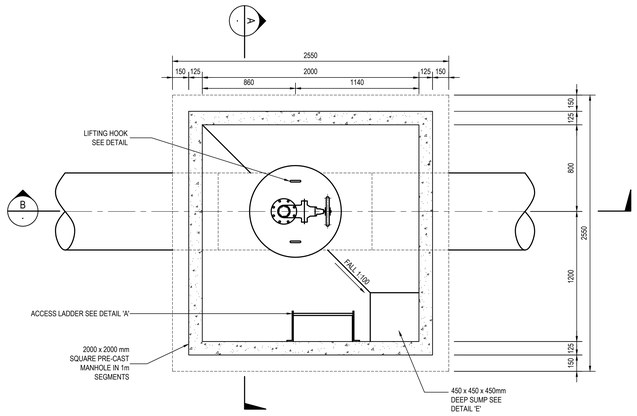
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

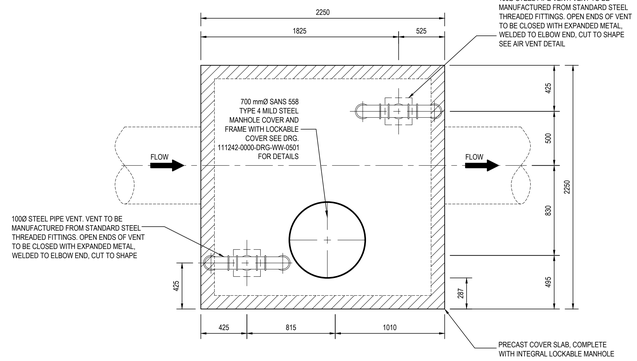
111242 - 0000-DRG-WW-0310 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 10 OF 10

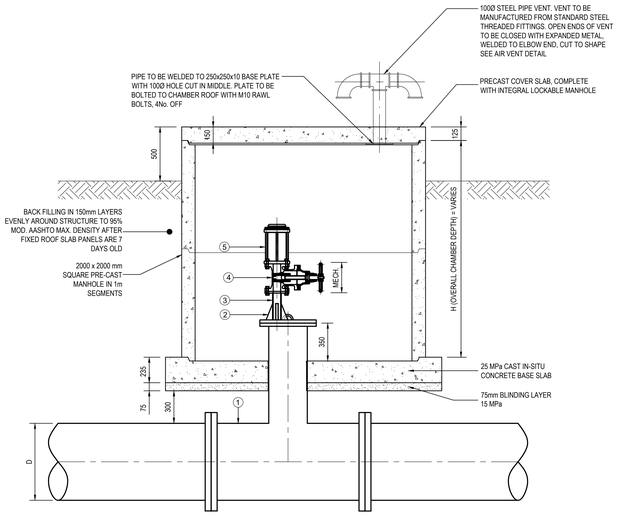
FILE No.



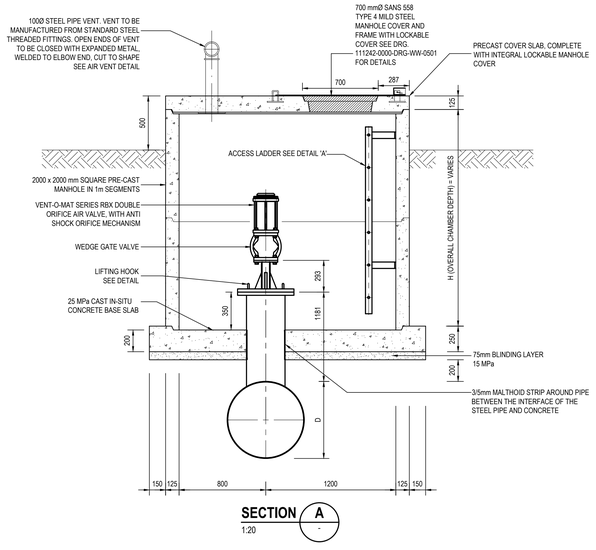
PLAN: AIR VALVE CHAMBER
SCALE 1:20



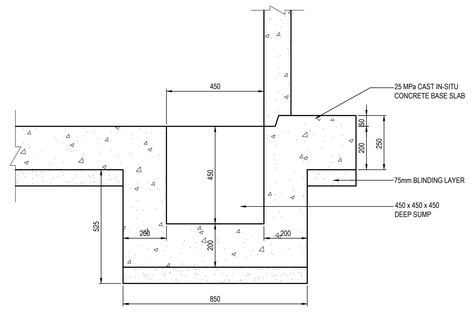
ROOF PLAN: AIR VALVE CHAMBER
SCALE 1:20



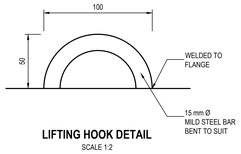
SECTION B
1:20



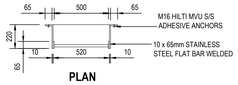
SECTION A
1:20



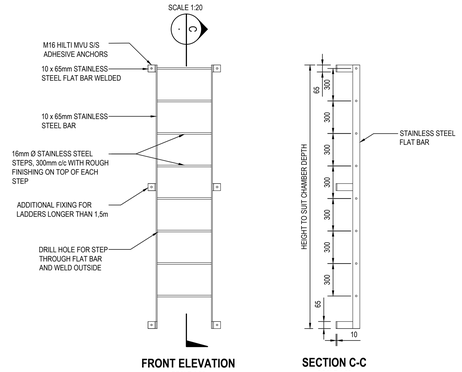
DETAL 'E': SUMP DETAIL
SCALE 1:10



LIFTING HOOK DETAIL
SCALE 1:2



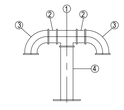
PLAN
SCALE 1:20



FRONT ELEVATION
SCALE 1:20

SECTION C-C
SCALE 1:20

DETAIL A: STAINLESS STEEL ACCESS LADDER
SCALE 1:20



AIR VENT DETAIL
SCALE 1:20

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NOTES :

1. RE-INFORCEMENT STEEL SHALL BE MINIMUM OF 50mm CLEAR OF PUDDLE PIPE AND FLANGES.
2. ALL FLANGES TO BE DRILLED OFF-CENTRE TO SANS 1123 TABLE 1600/3 OR 2500/3 AS SPECIFIED IN SCHEDULE OF FITTINGS. PUDDLE FLANGES SIMILAR TO SANS 1123 TABLE 1600/3 OR 2500/3, AS SPECIFIED, BUT UNDRILLED AND SHOP FITTED AND COATED. CONNECTING FLANGE HOLES IN OPPOSITE FLANGES MUST BE IN LINE.
3. ALL STEELWORK TO BE FINISHED ACCORDING TO PROJECT SPECIFICATIONS.
4. ALL VALVES ACCORDING TO PROJECT SPECIFICATIONS.
5. ALL SPECIALS ACCORDING TO PROJECT SPECIFICATIONS.
6. ALL JOINTING BOLTS AND NUTS TO BE HOT-DIP GALVANISED.
7. THE QUANTITIES IN THE PIPE SPECIAL SCHEDULE ARE FOR ONE CHAMBER ONLY.
8. A COMPLETE SET OF DETAILED SHOP DRAWINGS OF ALL FITTINGS MUST BE SUBMITTED FOR THE ENGINEER'S APPROVAL, PRIOR TO FABRICATION.

PIPE SCHEDULE FOR AIR VALVE

ITEM No.	QTY	DESCRIPTION	PRESSURE RATING	WALL THICKNESS	PROTECTION		FLANGE DRILLING	DIMENSIONS (mm)
					LINING	COATING		
①	1	700 x 3500mm UNEQUAL STEEL TEE, FLANGED BOTH ENDS	16 BAR	8.0mm	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	1520, 324
		600 x 3500mm UNEQUAL STEEL TEE, FLANGED BOTH ENDS						
②	4	150 x 60 x 25 mm SUPPORTING BRACKET	-	-	AS SPECIFIED	AS SPECIFIED	-	60, 324, 25
③	1	100mmØ STEEL PIPE WITH 520mmØ STEEL FLANGE FITTED ON ONE END AND 220mmØ STEEL FLANGE FITTED ON ONE END WITH LIFTING HOOKS	-	SANS 62 HEAVY DUTY	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	320, 250
		200mmØ STEEL PIPE WITH 520mmØ STEEL FLANGE FITTED ON ONE END AND 340mmØ STEEL FLANGE FITTED ON ONE END WITH LIFTING HOOKS						
④	1	100 mm Ø NON-RISING SPINDLE RESILIENT SEAL GATE VALVE	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SANS 1123 T1600/3	254
		200 mm Ø VOSA NON-RISING SPINDLE WEDGE GATE VALVE OR SIMILAR APPROVED						311
⑤	1	100 mm Ø VENT-O-MAT SERIES RBX DOUBLE ORIFICE AIR VALVE, WITH ANTI SHOCK ORIFICE MECHANISM	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SANS 1123 T1600/3	369
		200 mm Ø VENT-O-MAT SERIES RBX DOUBLE ORIFICE AIR VALVE, WITH ANTI SHOCK ORIFICE MECHANISM						672

STEEL FLANGES TO: SANS 1123

PIPE SIZE	ITEM DESCRIPTION	PRESSURE RATING	FLANGE DIAMETER	THICKNESS	PCD	No. OF BOLTS.
100mmØ	FLANGE	16 BAR	220mm	14mm	180mm	8 x M16
200mmØ	FLANGE	16 BAR	340mm	22mm	295mm	12 x M20
350mmØ	FLANGE	16 BAR	520mm	30mm	470mm	16 x M24
600mmØ	FLANGE	16 BAR	840mm	50mm	770mm	20 x M30
700mmØ	FLANGE	16 BAR	910mm	55mm	840mm	24 x M30

AIR VENT INSTALLATION ON SINGLE PIPE AND DOUBLE PIPE AIR VALVE CHAMBER

ITEM No.	DIA	No. OFF	DESCRIPTION
1	100	1	STEEL EQUAL TEE PIECE, FEMALE THREADED BOTH ENDS, 96mm CENTER TO END
2	100	2	STRAIGHT STEEL PIPE, MALE THREADED BOTH ENDS, 89mm LONG
3	100	2	90° STEEL ELBOW, FEMALE THREADED BOTH ENDS, 165mm CENTER TO END
4	100	1	STRAIGHT STEEL PIPE, MALE THREADED ONE END AND 250x250x10mm BASE PLATE WELDED WITH 100mmØ HOLE CUT IN ONE END, 506mm LONG

DISCLAIMER

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CLIENT

65 NTEMI PILISO STREET
NEWTOWN
JOHANNESBURG
2001

DESIGNED	T. SHABALALA		OCTOBER 2024
DRAWN	T. SHABALALA		OCTOBER 2024
CHECKED	K. BRINK		OCTOBER 2024
APPROVED BY:	C. KAN		OCTOBER 2024
	SIGNATURE		DATE
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE		DATE
ECSA REG. No.			

Johannesburg Water

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FAX: (011) 688-1529

Joburg

HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS OF AIR VALVE CHAMBER

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

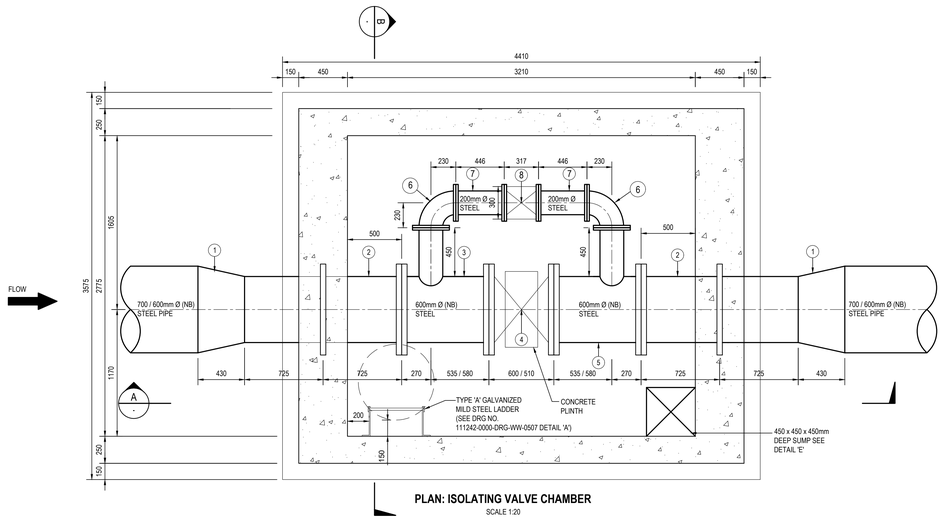
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

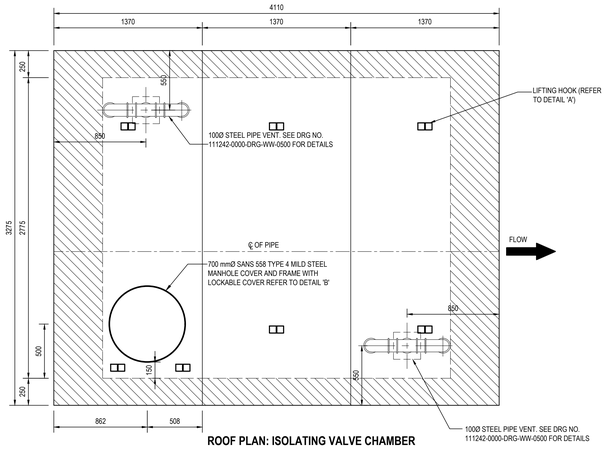
111242 - 0000-DRG-WW-0500 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 1 OF 1

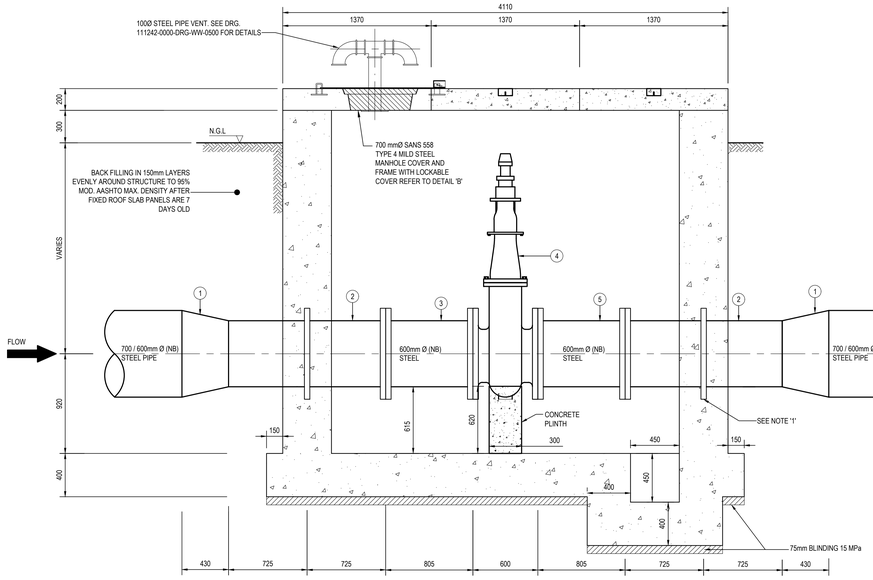
FILE No.



PLAN: ISOLATING VALVE CHAMBER
SCALE 1:20



ROOF PLAN: ISOLATING VALVE CHAMBER
SCALE 1:20



SECTION A
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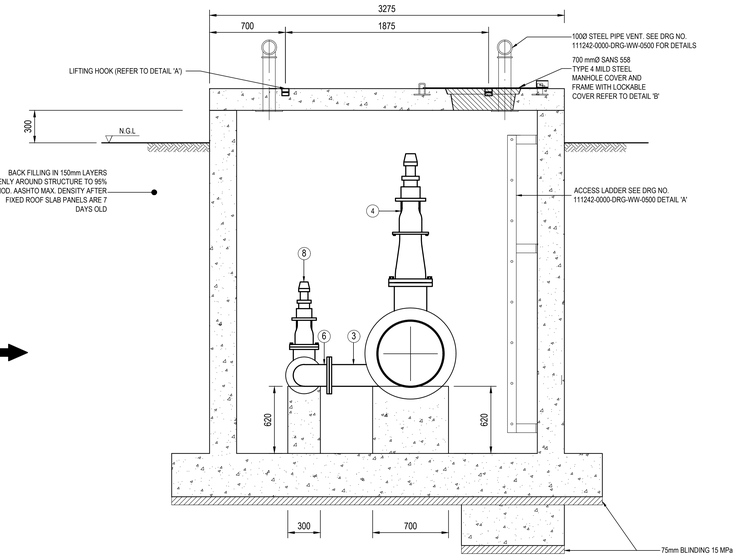

SECTION B
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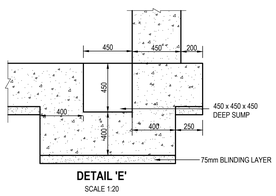
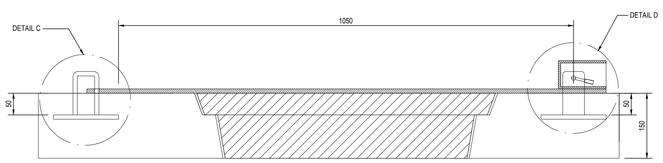
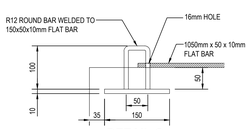


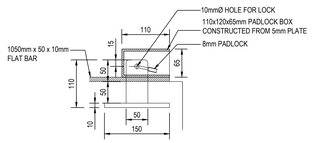
DETAIL 'E'
SCALE 1:20



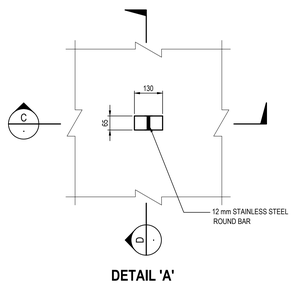
DETAIL B: MANHOLE LOCKING DEVICE
SCALE 1:5



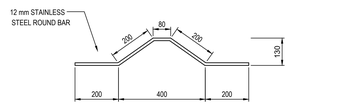
DETAIL C
SCALE 1:5



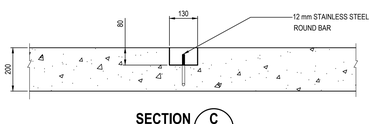
DETAIL D
SCALE 1:5



DETAIL 'A'
SCALE 1:10



LIFTING HOOK
SCALE 1:10



SECTION C
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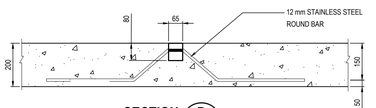

SECTION D
1:10

NOTES:

1. RE-INFORCEMENT STEEL SHALL BE MINIMUM OF 50mm CLEAR OF PUDDLE PIPE AND FLANGES
2. ALL FLANGES TO BE DRILLED OFF-CENTRE TO SANS 1123 TABLE 1600/3 OR 2500/3 AS SPECIFIED IN SCHEDULE OF FITTINGS. PUDDLE FLANGES SIMILAR TO SANS 1123 TABLE 1600/3 OR 2500/3, AS SPECIFIED, BUT UNDRILLED AND SHOP FITTED AND COATED. CONNECTING FLANGE HOLES IN OPPOSITE FLANGES MUST BE IN LINE.
3. ALL STEELWORK TO BE FINISHED ACCORDING TO PROJECT SPECIFICATIONS.
4. ALL VALVES ACCORDING TO PROJECT SPECIFICATIONS.
5. ALL SPECIALS ACCORDING TO PROJECT SPECIFICATIONS.
6. ALL JOINTING BOLTS AND NUTS TO BE HOT-DIP GALVANISED.
7. THE QUANTITIES IN THE PIPE SPECIAL SCHEDULE ARE FOR ONE CHAMBER ONLY.
8. A COMPLETE SET OF DETAILED SHOP DRAWINGS OF ALL FITTINGS MUST BE SUBMITTED FOR THE ENGINEER'S APPROVAL, PRIOR TO FABRICATION
9. MILD STEEL PIPES 8mm "TYPE B" WALL THICKNESS CLASS 300WA/ CLASS 16.
10. ALL JOINTS MUST BE EXTERNALLY E128 CORROSION PROTECTED.
11. ALL JOINTS MUST BE DONE BY APPROVED AND CERTIFIED SUBCONTRACTOR A CERTIFICATE OF COMPLIANCE SHALL BE REQUIRED.
12. ALL PIPES TO BE DISINFECTED BEFORE COMMISSIONING.
13. ALL STEEL PIPES MUST BE CATHODIC PROTECTED AS PER SABS 10121 AND IN LINE WITH THE JOHANNESBURG WATER SPECIFICATIONS.
14. ALL CHAMBERS TO BE REINFORCED WITH CONCRETE OF GRADE 25MPa.
15. ALL CHAMBERS TO HAVE ADEQUATE ACCESS POINTS AND APPROPRIATE STEPS.
16. CONCRETE COVERS SHALL BE USED INSTEAD OF STEEL COVERS.
17. ALL CHAMBERS TO BE CONSTRUCTED STRICTLY AS PER THE ENGINEERS DRAWINGS.
18. ALL VALVES, 300mm DIAMETER AND UPWARDS, MUST BE MULTI STAGE OPEN SPUR GEAR DRIVEN WITH 6:1 MINIMUM GEAR RATIO, HAVING OPERATING SPINDLES ON THE INPUT SPINDLES AND AT A STAGE WHERE THE VALVE CAN BE STROKED WITHOUT EXCEEDING THE MAXIMUM INPUT TORQUE IF NO DIFFERENTIAL PRESSURE IS APPLIED TO THE VALVE.

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FITTING SCHEDULE

ITEM No.	QTY	DESCRIPTION	PRESSURE RATING	WALL THICKNESS	PROTECTION		FLANGE DRILLING	DIMENSIONS (mm)
					LINING	COATING		
1	2	700mm Ø x 600mm Ø x 430mm STEEL REDUCER WITH 1500mm INTEGRAL STRAIGHT PIPE	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	700Ø 600Ø 1500 430
	2	600mm Ø INTEGRAL STRAIGHT PIPE L = 1500 mm						600Ø 600Ø 1500
2	2	600mm x 1450mm STEEL PUDDLE PIPE, FLANGED ONE END	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	725 725
3	1	600mm x 200mm Ø STEEL TEE	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	610 270 535
4	1	600mm Ø VOSA, NON-RISING SPINDLE WEDGE GATE OR APPROVED EQUIVALENT (MECH)	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SANS 1123 T1600/3	770 600
5	1	600mm x 200mm Ø STEEL TEE	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	600Ø 535 270
6	2	200mm x 90° STEEL BEND	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	230 230
7	2	200mm Ø X 446 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	200Ø 446
8	1	200mmØ VOSA NON-RISING WEDGE GATE OR APPROVED EQUIVALENT (MECH)	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SANS 1123 T1600/3	340 317

STEEL FLANGES TO: SANS 1123

PIPE SIZE	ITEM DESCRIPTION	PRESSURE RATING	FLANGE DIAMETER	THICKNESS	PCD	No. OF BOLTS.
200mmØ	FLANGE	16 BAR	340mm	22mm	295mm	12 x M20
500mmØ	FLANGE	16 BAR	715mm	40mm	650mm	16 x M30
600mmØ	FLANGE	16 BAR	840mm	50mm	770mm	20 x M30
700mmØ	FLANGE	16 BAR	910mm	55mm	840mm	24 x M30

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NEWTOWN
JOHANNESBURG
2001

DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS OF ISOLATING VALVE CHAMBER

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0501 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 1 OF 1

FILE No.

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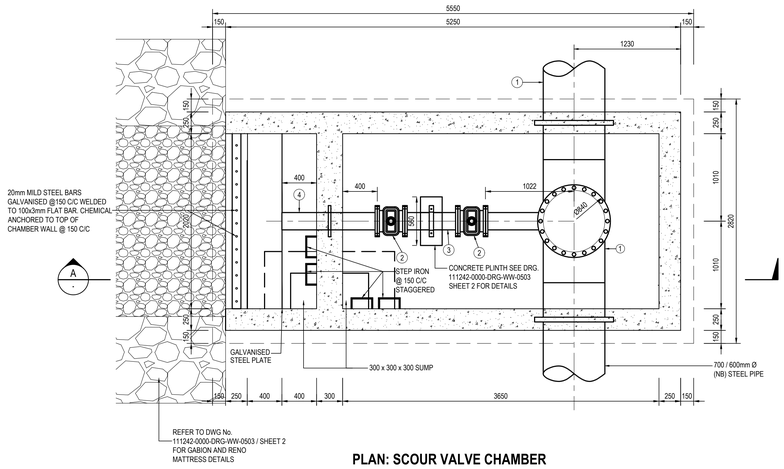
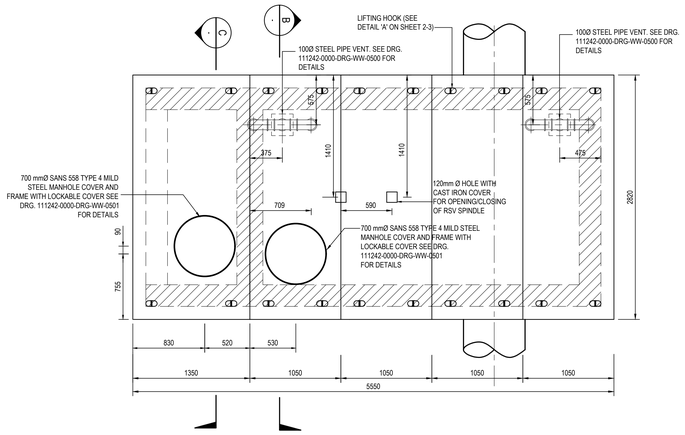


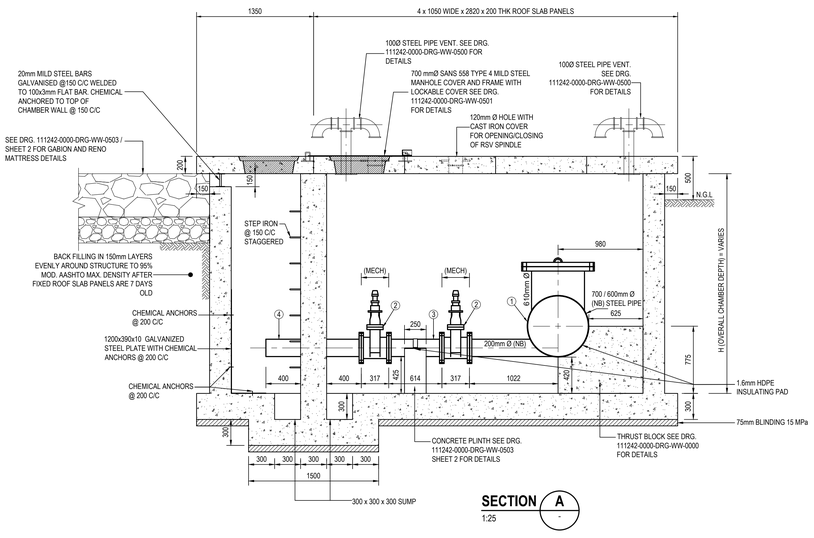
PLAN: SCOUR VALVE CHAMBER

SCALE 1:25



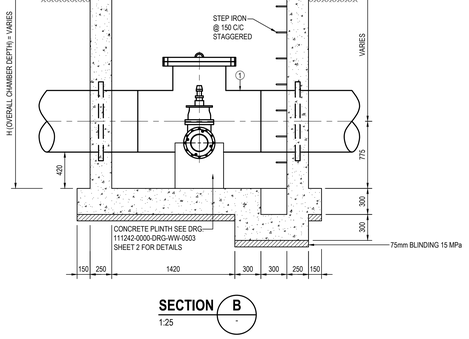
ROOF PLAN: SCOUR VALVE CHAMBER

SCALE 1:25



SECTION A

1:25



SECTION B

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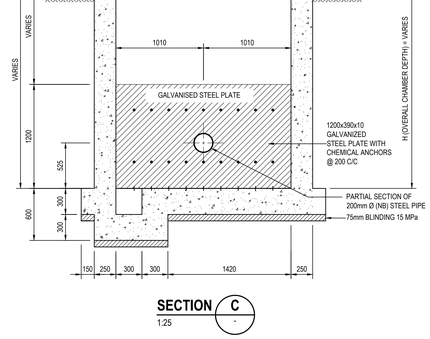


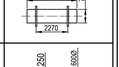
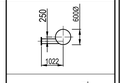
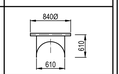
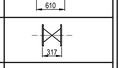
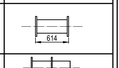
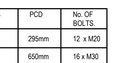
SECTION C

1:25

NOTES:

1. RE-INFORCEMENT STEEL SHALL BE MINIMUM OF 50mm CLEAR OF PUDDLE PIPE AND FLANGES
2. ALL FLANGES TO BE DRILLED OFF-CENTRE TO SANS 1123 TABLE 1600/3 OR 2500/3 AS SPECIFIED IN SCHEDULE OF FITTINGS. PUDDLE FLANGES SIMILAR TO SANS 1123 TABLE 1600/3 OR 2500/3, AS SPECIFIED, BUT UNDRILLED AND SHOP FITTED AND COATED. CONNECTING FLANGE HOLES IN OPPOSITE FLANGES MUST BE IN LINE.
3. ALL STEELWORK TO BE FINISHED ACCORDING TO PROJECT SPECIFICATIONS.
4. ALL VALVES ACCORDING TO PROJECT SPECIFICATIONS.
5. ALL SPECIALS ACCORDING TO PROJECT SPECIFICATIONS.
6. ALL JOINTING BOLTS AND NUTS TO BE HOT-DIP GALVANISED.
7. THE QUANTITIES IN THE PIPE SPECIAL SCHEDULE ARE FOR ONE CHAMBER ONLY.
8. A COMPLETE SET OF DETAILED SHOP DRAWINGS OF ALL FITTINGS MUST BE SUBMITTED FOR THE ENGINEER'S APPROVAL, PRIOR TO FABRICATION.
9. ALL JOINTS MUST BE EXTERNALLY E128 CORROSION PROTECTED.
10. ALL JOINTS MUST BE DONE BY APPROVED AND CERTIFIED SUBCONTRACTOR A CERTIFICATE OF COMPLIANCE SHALL BE REQUIRED.
11. ALL PIPES TO BE DISINFECTED BEFORE COMMISSIONING.
12. ALL STEEL PIPES MUST BE CATHODIC PROTECTED AND IN LINE WITH THE JOHANNESBURG WATER SPECIFICATIONS.
13. ALL CHAMBERS TO BE REINFORCED WITH CONCRETE OF GRADE 25MPa.
14. ALL CHAMBERS TO HAVE ADEQUATE ACCESS POINTS AND APPROPRIATE STEPS.
15. CONCRETE COVERS SHALL BE USED INSTEAD OF STEEL COVERS.
16. ALL CHAMBERS TO BE CONSTRUCTED STRICTLY AS PER THE ENGINEERS DRAWINGS.
17. ALL ISOLATION VALVES SHALL COMPLY WITH THE FOLLOWING SPECIFICATIONS:
    - WEDGE GATE VALVES (VOSA)
    - DUCTILE BODY AND COVER
    - GUN-METAL TRIMMED
    - GEARBOX OPERATED
    - NON-RISING SPINDLE
    - ANTICLOCKWISE CLOSING
    - MANUFACTURED TO SANS 664 WATER WORKS SPECIFICATIONS
18. * ALL VALVES, 300mm DIAMETER AND UPWARDS, MUST BE MULTI STAGE OPEN SPUR GEAR DRIVEN WITH 6:1 MINIMUM GEAR RATIO, HAVING OPERATING SPINDLES ON THE INPUT SPINDLES AND AT A STAGE WHERE THE VALVE CAN BE STROKED WITHOUT EXCEEDING THE MAXIMUM INPUT TORQUE IF NO DIFFERENTIAL PRESSURE IS APPLIED TO THE VALVE.

PIPE SCHEDULE OF SCOUR VALVE ON STEEL PIPELINE

ITEM No.	QTY	DESCRIPTION	PRESSURE RATING	WALL THICKNESS	PROTECTION		FLANGE DRILLING	DIMENSIONS (mm)
					LINING	COATING		
①	1	700mm Ø x 200mm Ø (NB) FLANGED SCOUR TEE	16 BAR	8.0mm	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	
		700 mm Ø (NB) x 4800mm DOUBLE PUDDLE PIPE WITH CP CONNECTION POINT						
		600mm Ø x 200mm Ø (NB) FLANGED SCOUR TEE	16 BAR	8.0mm	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	
		600 mm Ø (NB) x 4800mm DOUBLE PUDDLE PIPE WITH CP CONNECTION POINT						
		610 mm Ø x 610 mm Ø ACCESS PIPE	16 BAR	8.0mm	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	
②	2	200 mm Ø WEDGE GATE VALVE (MECH)	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SANS 1123 T1600/3	
③	1	200mmØ (NB) SPOOL PIPE FLANGED BOTH ENDS, 614mm LONG	16 BAR	8.0mm	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	
④	1	200mmØ (NB) STEEL PUDDLE PIPE, 1100mm LONG WITH CP CONNECTION POINT	16 BAR	8.0mm	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	

STEEL FLANGES TO: SANS 1123

PIPE SIZE	ITEM DESCRIPTION	PRESSURE RATING	FLANGE DIAMETER	THICKNESS	PCD	No. OF BOLTS.
200mmØ	FLANGE	16 BAR	340mm	22mm	295mm	12 x M20
500mmØ	FLANGE	16 BAR	715mm	40mm	650mm	16 x M30
600mmØ	FLANGE	16 BAR	840mm	50mm	770mm	20 x M30
700mmØ	FLANGE	16 BAR	910mm	55mm	840mm	24 x M30

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HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS OF SCOUR VALVE CHAMBER
SHEET 1 OF 2

APPROVAL BY JW DEPOT			SCALE
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APPROVED BY:			
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AMENDMENTS		
REV:	DESCRIPTION	DATE:
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DRAWING No.

111242 - 0000-DRG-WW-0502 - T1

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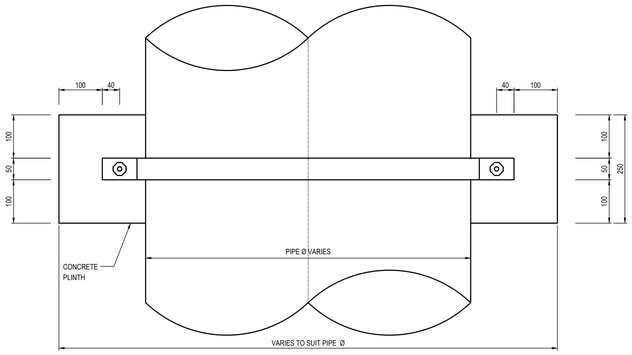
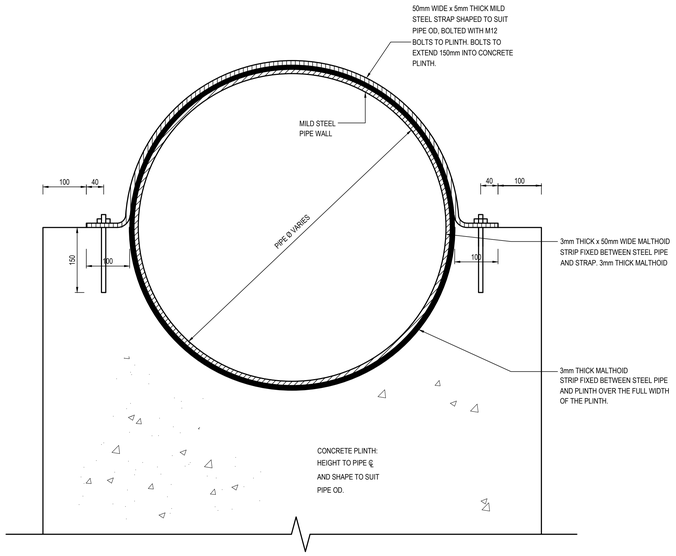
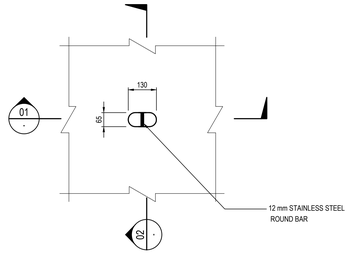


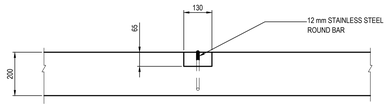
TYPICAL PIPE PLINTH: TOP VIEW
SCALE 1:5



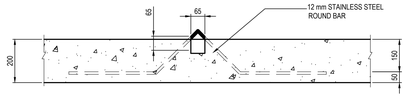
TYPICAL PIPE PLINTH: SECTIONAL VIEW
SCALE 1:5



PLAN
SCALE 1:10



SECTION 01
1:10



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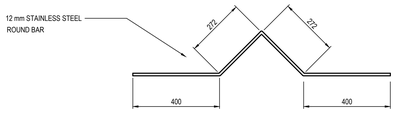
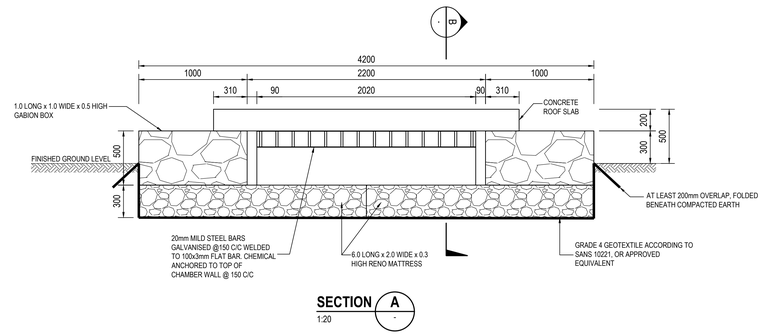


LIFTING HOOK
SCALE 1:10

DETAIL 'A'
SCALE 1:10



SECTION A
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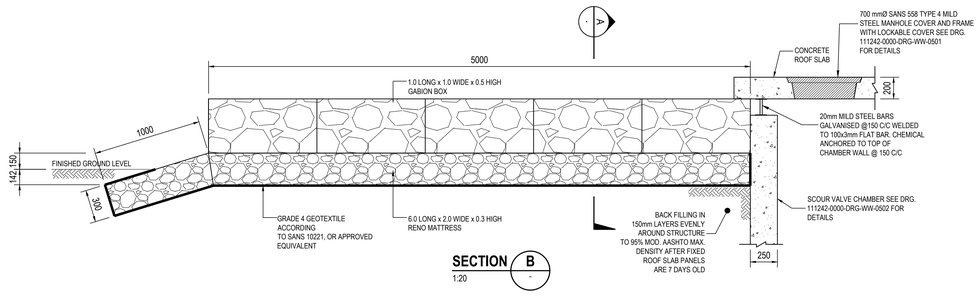

SECTION B
1:20

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HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS OF SCOUR VALVE CHAMBER
SHEET 2 OF 2

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DRAWING No.

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PROJECT No. | DRAWING No. | REV.

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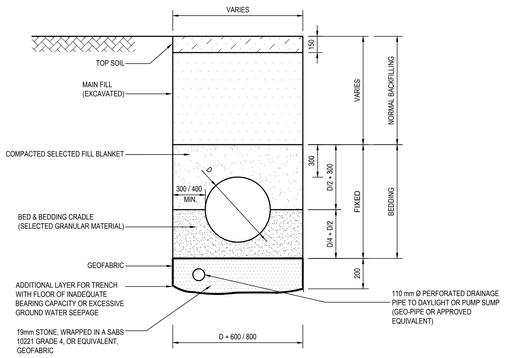
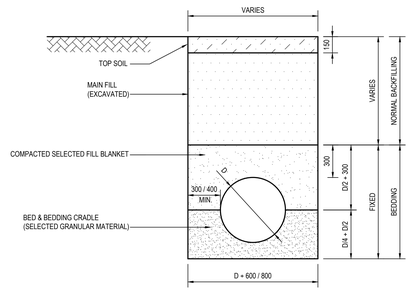


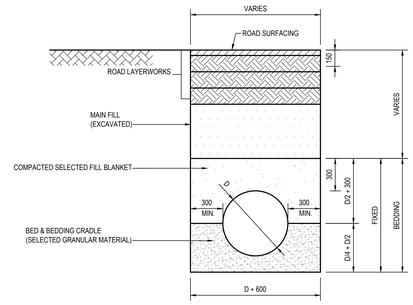
TYPICAL TRENCH GEOMETRY FOR PAYMENT PURPOSES IN AREAS WITH EXCESSIVE GROUND WATER FOR PIPES < 600Ø AND ABOVE IN CLASS B BEDDING (STEEL PIPES)

SCALE 1:20



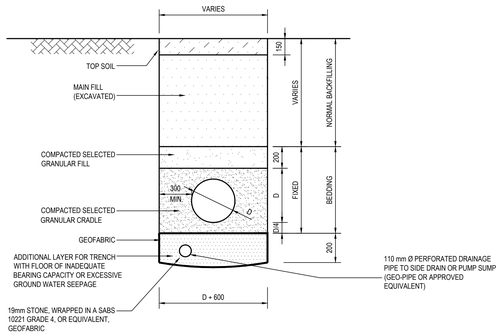
TYPICAL TRENCH GEOMETRY FOR PAYMENT PURPOSES FOR PIPES < 600Ø AND ABOVE IN CLASS B BEDDING (STEEL PIPES)

SCALE 1:20



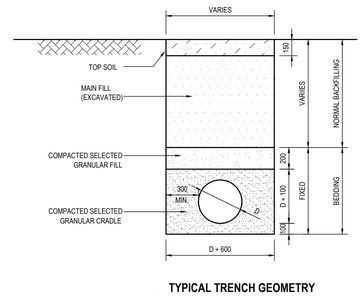
TYPICAL TRENCH GEOMETRY FOR PAYMENT PURPOSES FOR PIPES < 600Ø AND BELOW IN CLASS B BEDDING (STEEL PIPES)

SCALE 1:20



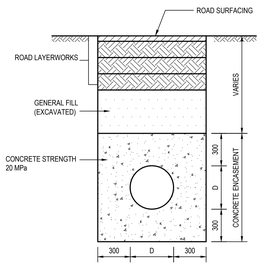
TYPICAL TRENCH GEOMETRY FOR PAYMENT PURPOSES IN AREAS WITH EXCESSIVE GROUND WATER IN FLEXIBLE BEDDING (mPVC PIPES)

SCALE 1:20



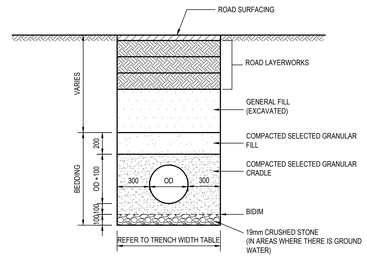
TYPICAL TRENCH GEOMETRY FOR PAYMENT PURPOSES IN AREAS IN FLEXIBLE BEDDING (mPVC PIPES)

SCALE 1:20



CONCRETE ENCASEMENT DETAIL & UNDER ROAD OR SHALLOW COVER

SCALE 1:20



TYPICAL FLEXIBLE PIPE TRENCH AND BEDDING DETAIL (UNDER ROADS)

SCALE 1:20

NOMINAL PIPE DIA (mm)	TRENCH BASE WIDTH, W(mm)
100mm	700
150mm	750
200mm	800
250mm	850
300mm	900
400mm	1000
500mm	1100
600mm	1200
700mm	1500

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HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS FOR TRENCH EXCAVATION AND BACKFILL

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SCALE

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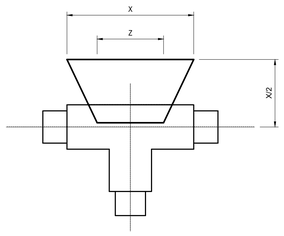
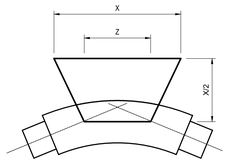
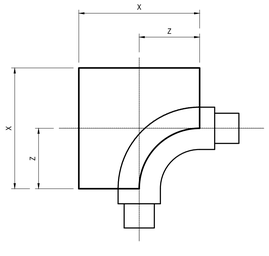


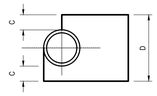
T - PIECE AND END CAP



22.5° AND 45° BENDS



90° BEND



TYPICAL CROSS-SECTION

NOTES:

1. THRUST BLOCKS TO BE SYMMETRICAL TO THE CENTRELINES OF THE PIPES AND FITTINGS.
2. ALL ADDITIONAL EXCAVATION REQUIRED FOR THE CASTING OF THRUST BLOCKS IS REGARDED AS TRENCH EXCAVATION. THE RATES SHOULD INCLUDE THESE COSTS.
3. THRUST BLOCKS TO BE CAST AGAINST UNDISTURBED EARTH.
4. ALL THRUST BLOCKS CONCRETE TO BE CLASS 25MPa/19mm.

DIMENSIONS OF THRUST BLOCKS IN SOIL WITH MAX.HOR. BEARING CAPACITY OF 55 kPa (SOFT CLAYS)

PIPE DIA	X	D	Z	C
		T-PIECE AND END CAP		
350	2400	1500	800	550
400	2700	1700	900	650
450	2900	2000	1000	750
500	3200	2200	1100	850
600	4000	2500	1300	950
700	4900	2800	1600	1050
800	5800	3100	1900	1150
900	6700	3400	2200	1250
1000	7600	3700	2500	1350
		22.5° BEND		
350	1200	1200	400	400
400	1300	1300	400	450
450	1500	1500	500	500
500	1700	1600	600	550
600	2200	1800	700	600
700	2700	2000	900	650
800	3200	2200	1100	700
900	3700	2400	1200	750
1000	4200	2600	1400	800
		45° BEND		
350	1900	1400	600	500
400	2300	1500	800	550
450	2600	1700	900	600
500	3000	1800	1000	650
600	3800	2000	1300	700
700	4800	2200	1600	750
800	5700	2400	1900	800
900	6600	2600	2200	850
1000	7600	2800	2500	900
		90 ° BEND		
350	2400	1500	800	550
400	2700	1700	900	650
450	2900	2000	1000	750
500	3200	2200	1100	850
600	4000	2500	1300	950
700	4900	2800	1600	1050
800	5800	3100	1900	1150
900	6700	3400	2200	1250
1000	7600	3700	2500	1350

DIMENSIONS OF THRUST BLOCKS IN SOIL WITH MAX.HOR. BEARING CAPACITY OF 150 kPa

PIPE DIA	X	D	Z	C
		T-PIECE AND END CAP		
350	1000	1300	500	450
400	1100	1500	600	550
450	1200	1800	600	650
500	1300	2000	700	750
600	1600	2300	800	850
700	2000	2600	1000	950
800	2300	2900	1200	1050
900	2600	3200	1300	1150
1000	3000	3500	1500	1250
		22.5° BEND		
350	700	800	400	200
400	700	900	400	250
450	800	1100	400	300
500	800	1200	400	350
600	1000	1400	500	400
700	1200	1600	600	450
800	1400	1800	700	500
900	1600	2000	800	550
1000	1800	2200	900	600
		45° BEND		
350	1000	1000	500	300
400	1100	1100	600	350
450	1300	1300	700	400
500	1400	1400	700	450
600	1800	1600	900	500
700	2100	1800	1100	550
800	2500	2000	1300	600
900	2900	2200	1500	650
1000	3300	2400	1700	700
		90° BEND		
350	900	1400	500	500
400	1000	1600	500	600
450	1100	1900	600	700
500	1200	2100	600	800
600	1600	2400	800	900
700	1900	2700	1000	1000
800	2200	3000	1100	1100
900	2500	3300	1300	1200
1000	2900	3600	1500	1300

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DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

THRUST BLOCK DETAILS

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APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0505 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
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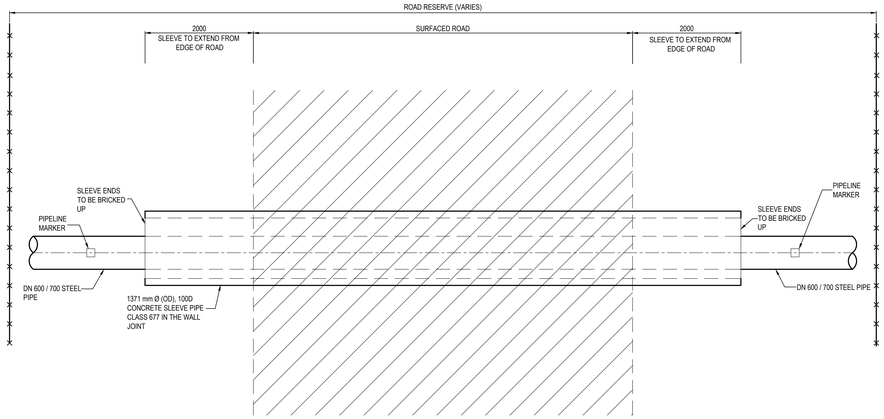
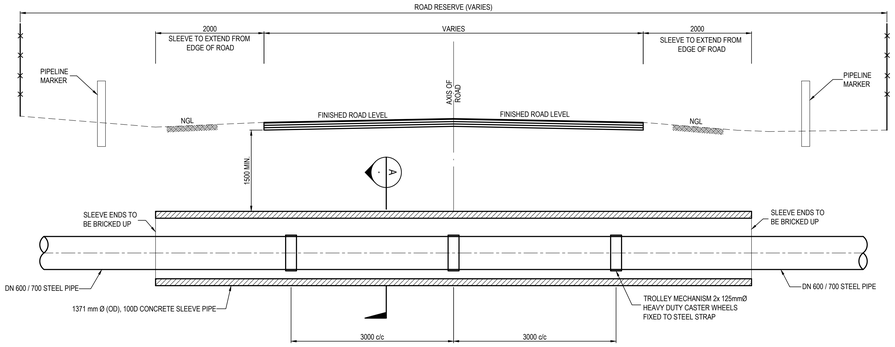
FILE No.



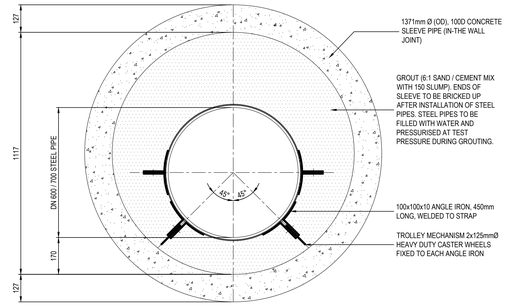
TYPICAL PLAN OF ROAD CROSSING

SCALE 1:40



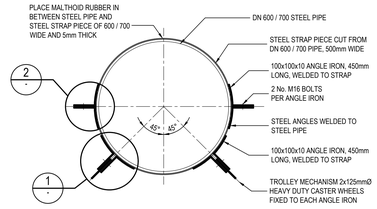
TYPICAL LONGITUDINAL SECTION OF ROAD CROSSING

SCALE 1:40



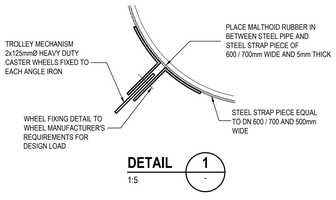
SECTION A 1:10

CROSS SECTION THROUGH SLEEVE PIPE

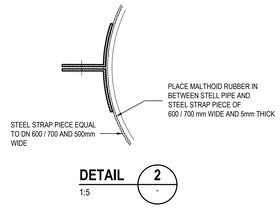


TROLLEY MECHANISM DETAILS

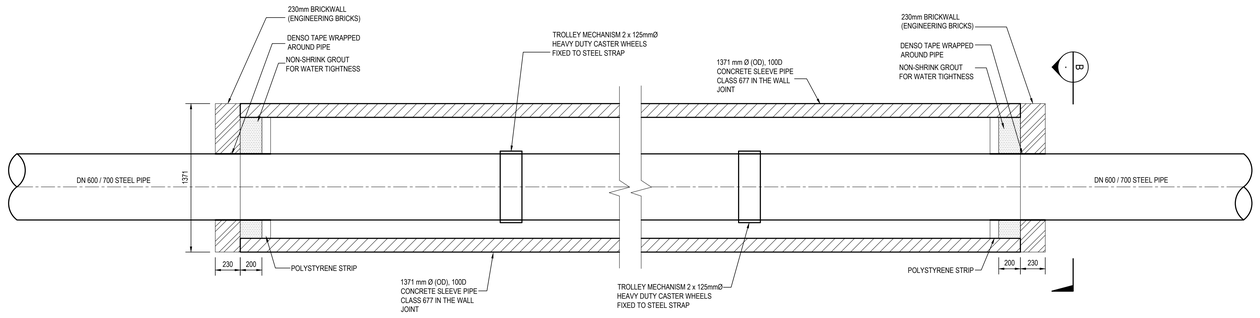
SCALE 1:10



DETAIL 1 1:5

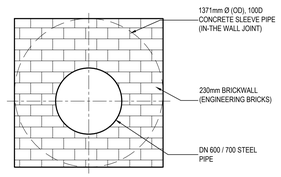


DETAIL 2 1:5



END OF SLEEVE PIPE

SCALE 1:20



SECTION B 1:20

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NOTES:

1. PIPE JACKING METHOD WILL BE USED TO INSTALL CONCRETE SLEEVE PIPES UNDER ROAD CROSSINGS WERE POSSIBLE.
2. THE POSITION AND DEPTH OF ALL EXISTING SERVICES ON THE SITE AND OFF SITE, WHERE AFFECTED BY WORKS, SHALL BE CONFIRMED PRIOR TO ANY CONSTRUCTION.
3. ALL PIPE JACKING AND OTHER CONCRETE SLEEVE PIPES TO BE OF CLASS 100D AND MANUFACTURED TO SANS 677 TYPE SC.
4. THE CONTRACTOR SHALL SUBMIT A METHOD STATEMENT FOR ROAD CROSSINGS FOR ENGINEERS APPROVAL.
5. REFER TO LONGSECTIONS FOR WALL THICKNESS OF STEEL PIPE BENEATH ROAD.

INSTALLATION AND SUPPORTING STEEL PIPE JACKING SECTIONS:

1. STEEL PIPE SHALL BE INSTALLED IN ALL JACKING SECTIONS BY USING TWO WHEEL TROLLEY MECHANISM OR SIMILAR APPROVED SYSTEM.
2. THESE TROLLEY MECHANISM WILL BE PLACED AT 3.0m APART.
3. THE CONTRACTOR SHALL SUPPLY AND USE A SUITABLE TEMPORARY LAUNCHING FRAME OUTSIDE THE JACKING SECTIONS TO PREVENT DAMAGE TO THE PIPE COATING DURING INSTALLATION OF THE PIPE.
4. ONCE THE STEEL PIPE HAS BEEN INSTALLED IN THE JACKING SECTION, THE SPACE BETWEEN THE CONCRETE SLEEVE AND STEEL PIPE SHALL BE FILLED WITH GROUT TO THE LEVEL INDICATED ON THE DRAWING. GROUTING TO BE DONE IN STAGES TO PREVENT PIPE FROM FLOATING.
5. ALL STEEL PIPE JOINTS SHALL BE INSPECTED AND TESTED AS PER THE SPECIFICATIONS AND APPROVED BY THE ENGINEER BEFORE IT IS INSERTED INTO THE CONCRETE SLEEVE.
6. THE ENTIRE LENGTH OF STEEL PIPE IN THE ROAD RESERVE SHALL BE TESTED AND APPROVED BEFORE IT IS INSTALLED IN THE CONCRETE SLEEVE.

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HALFWAY HOUSE WATER UPGRADE

TYPICAL PIPE JACKING DETAIL

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AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
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PROJECT No. | DRAWING No. | REV.

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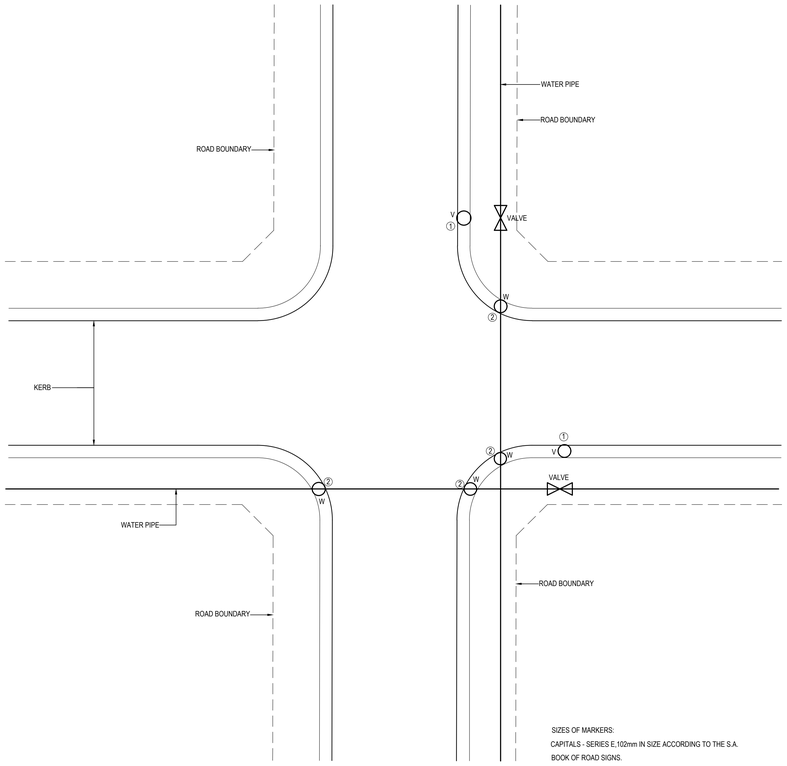


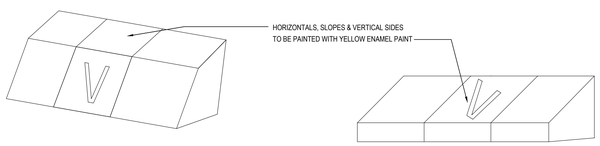
SIZES OF MARKERS:
CAPITALS - SERIES E,102mm IN SIZE ACCORDING TO THE S.A. BOOK OF ROAD SIGNS.

PLAN: ROAD CROSSING

SCALE N.T.S

① VALVE MARKER-"V" MUST BE PAINTED

② WATER PIPE MARKER-"W"



BARRIER KERB

SCALE N.T.S

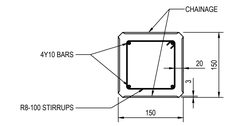
MOUNTABLE KERB

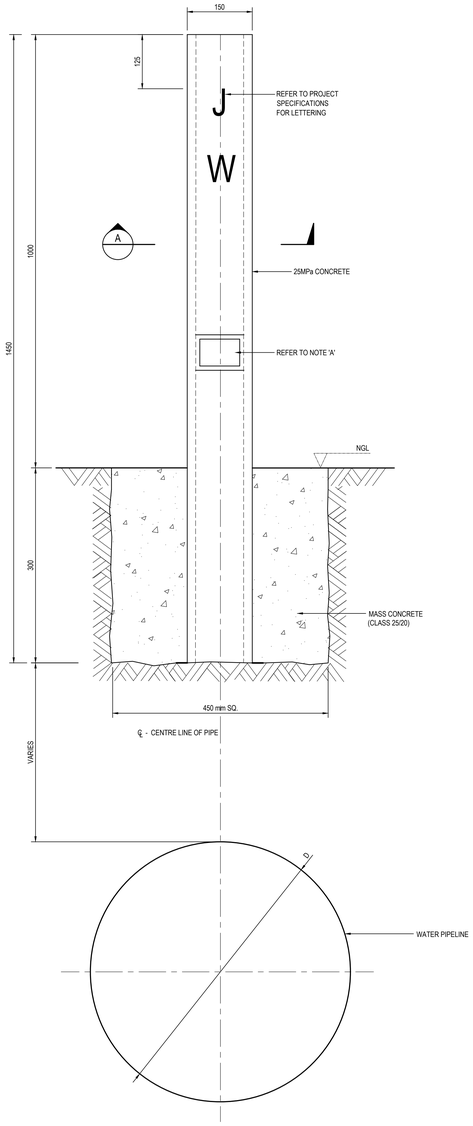
SCALE N.T.S

DETAILS OF SERVICE MARKERS

NOTE

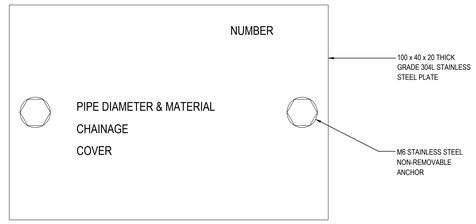
1. TOP SURFACE OF VALVE COVERS TO BE PAINTED AS FOLLOWS:
   - VALVES NORMALLY OPEN : BLUE
   - VALVES NORMALLY CLOSED : SIGNAL RED
   - SCOUR VALVES : GREEN
   - AIR VALVES : BROWN





PIPELINE PRECAST CONCRETE MARKER POST

SCALE 1:5



NOTE 'A'

SCALE 1:5

NOTES
* REFER TO PROJECT SPECIFICATIONS FOR MARKER PLATE DETAILS

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HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS OF MARKER BLOCK

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	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
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PROJECT No. DRAWING No. REV.

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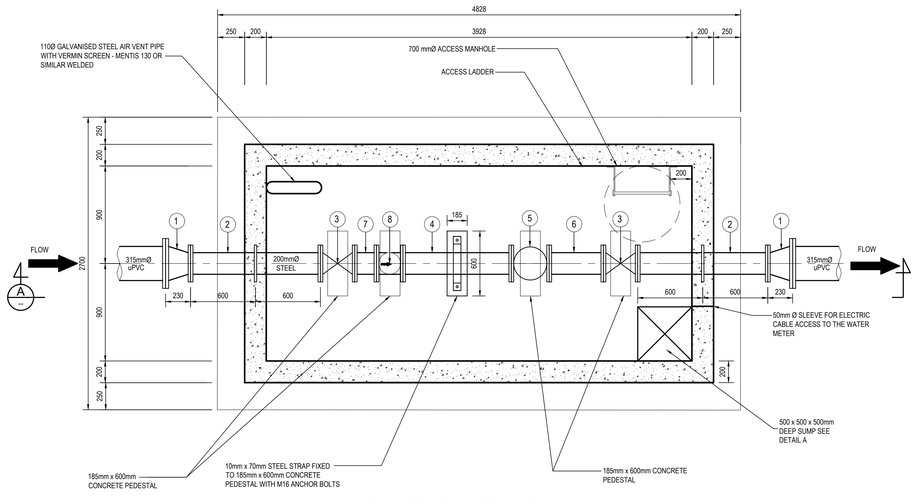
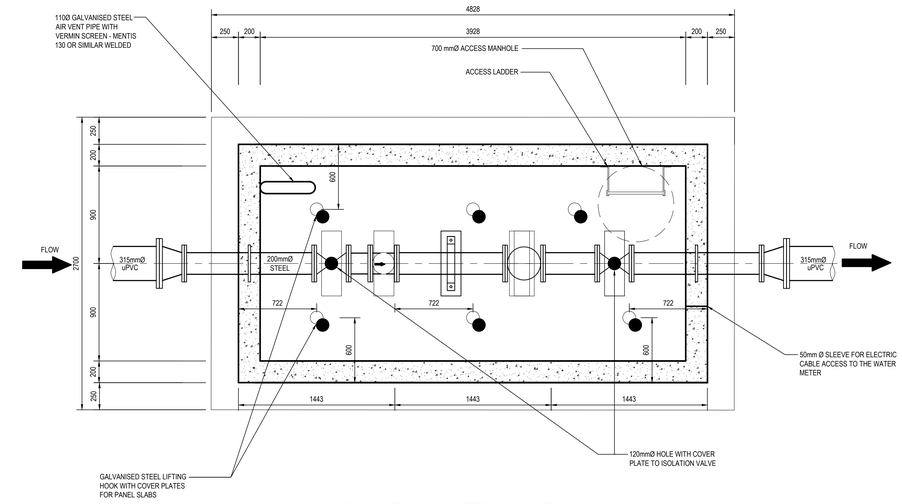
SHEET 1 OF 1
FILE No.



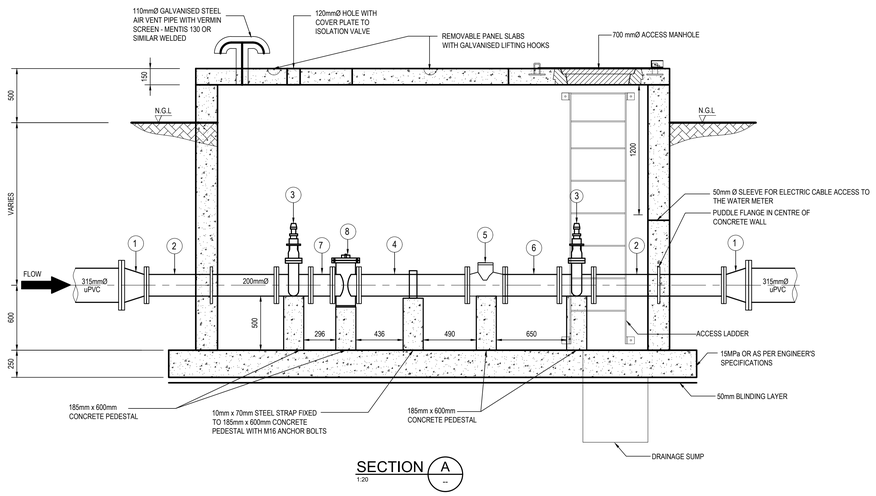
PLAN VIEW (ROOF REMOVED)

SCALE 1:20



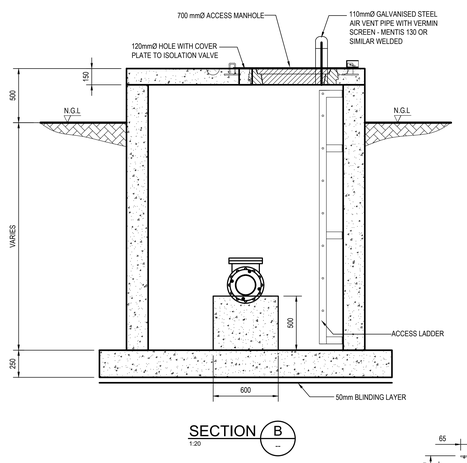
PLAN VIEW: CONCRETE ROOF DETAIL

SCALE 1:20



SECTION A

1:20

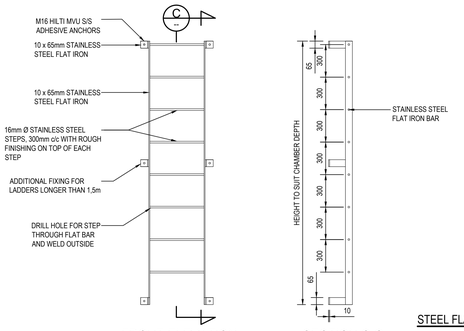


SECTION B

1:20

PLAN

SCALE 1:20

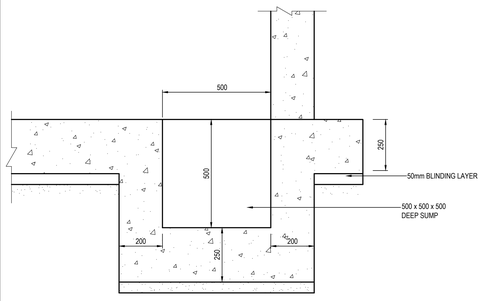


FRONT ELEVATION

SCALE 1:20

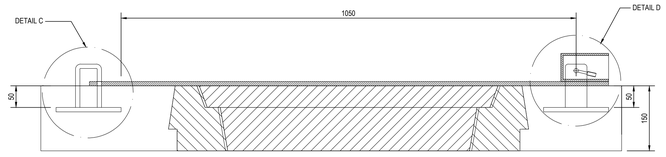
SECTION C-C

SCALE 1:20



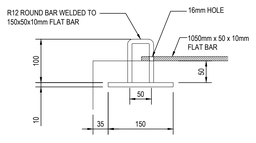
DETAIL A: DRAINAGE SUMP'

SCALE 1:10



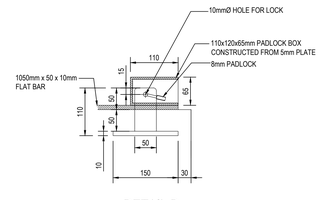
DETAIL B: MANHOLE LOCKING DEVICE

SCALE 1:5



DETAIL C

SCALE 1:5



DETAIL D

SCALE 1:5

DETAIL E: STAINLESS STEEL ACCESS LADDER

SCALE 1:20

NOTES:

1. RE-INFORCEMENT STEEL SHALL BE MINIMUM OF 50mm CLEAR OF PUDDLE PIPE AND FLANGES.
2. ALL FLANGES TO BE DRILLED OFF-CENTRE TO SANS 1123 TABLE 1600/3 OR 2500/3 AS SPECIFIED IN SCHEDULE OF FITTINGS. PUDDLE FLANGES SIMILAR TO SANS 1123 TABLE 1600/3 OR 2500/3, AS SPECIFIED, BUT UNDRILLED AND SHOP FITTED AND COATED. CONNECTING FLANGE HOLES IN OPPOSITE FLANGES MUST BE IN LINE.
3. ALL STEELWORK TO BE FINISHED ACCORDING TO PROJECT SPECIFICATIONS.
4. ALL VALVES ACCORDING TO PROJECT SPECIFICATIONS.
5. ALL SPECIALS ACCORDING TO PROJECT SPECIFICATIONS.
6. ALL JOINTING BOLTS AND NUTS TO BE HOT-DIP GALVANISED.
7. THE QUANTITIES IN THE PIPE SPECIAL SCHEDULE ARE FOR ONE CHAMBER ONLY.
8. A COMPLETE SET OF DETAILED SHOP DRAWINGS OF ALL FITTINGS MUST BE SUBMITTED FOR THE ENGINEER'S APPROVAL, PRIOR TO FABRICATION.
9. ALL HDPE FLANGES ARE TO BE MADE OF STUB AND BACKING RING.
10. STUB ARE TO BE WELDED TO THE HDPE PIPE.
11. MILD STEEL PIPES 8mm "TYPE B" WALL THICKNESS CLASS 300WA/ CLASS 16.
12. ALL JOINTS TO BE WELDED WITH SPIGOT AND SOCKET.
13. ALL JOINTS MUST BE EXTERNALLY E128 CORROSION PROTECTED.
14. ALL JOINTS MUST BE DONE BY APPROVED AND CERTIFIED SUBCONTRACTOR. A CERTIFICATE OF COMPLIANCE SHALL BE REQUIRED.
15. ALL PIPES TO BE DISINFECTED BEFORE COMMISSIONING.
16. ALL STEEL PIPES MUST BE CATHODIC PROTECTED AS PER SABS 10121 AND IN LINE WITH THE JOHANNESBURG WATER SPECIFICATIONS.
17. ALL CHAMBERS TO BE REINFORCED WITH CONCRETE OF GRADE 25MPa.
18. ALL CHAMBERS TO HAVE ADEQUATE ACCESS POINTS AND APPROPRIATE STEPS.
19. CONCRETE COVERS SHALL BE USED INSTEAD OF STEEL COVERS.
20. ALL CHAMBERS TO BE CONSTRUCTED STRICTLY AS PER THE ENGINEERS DRAWINGS.

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APPROVED METER TYPE

Sizes (Nom Dia)	Customer Type / End Use	Approve Meter Type	Class	Strainer Required
15 - 20	Domestic	Volumetric (Brass Bodied)	C	No
15 - 20	Domestic	Volumetric (Plastic Bodied)	C	No
20	Stand pipe	Multi-jet	B	No
25	Industrial / Commercial / Domestic	Single-Jet (or Volumetric) (or Volumetric)	C (C)	Yes (No)
50	Stand pipe	Woltmann WP-Type	B	No
40 - 100	Industrial / Commercial / Townhouse Complex	Single-Jet (preferred)	C	Yes
50 - 100	Industrial / Commercial / Townhouse Complex	Woltmann WP-Type (By authority of Reg. Manager)	B	Yes
150 & Up	Industrial / Commercial Townhouse Complex	Woltmann WP-Type	B	Yes
50 - 300	Bulk Metering / Water Manangement	Woltmann WP-Type	B	No
350 & Up	Bulk Metering / Water Management	Woltmann WP-Type (or Electro-Magnetic Force where security ensured)	B (-)	No (No)
100 (Min)	Fire Service - Type A	Woltmann WP-Type	B	No
80, 100	Fire Service - Type B	Single-Jet	B	Yes
25,40,50, 80 & 100	Fire Service - Type C	Single-Jet	B	Yes

METER INSTALLATION CRITERIA

UPSTREAM REQUIREMENTS 5 * METER DIAMETER OF STRAIGHT PIPE
DOWNSTREAM REQUIREMENTS 3 * METER DIAMETER OF STRAIGHT PIPE

1. THIS DRAWING AND TABLES SERVE AS GUIDELINE FOR THE DETERMINATION OF CHAMBER. DIMENSIONS THAT ARE BASED ON THE SELECTED METER DIAMETER.
2. THE REQUIRED LENGTH OF STRAIGHT PIPEWORK UPSTREAM AND DOWNSTREAM LENGTHS OF THE METER ARE BASED ON THE METER DIAMETER.
3. ALL FLANGED VALVE, STRAINER AND METER DIMENSIONS MUST BE VERIFIED BEFORE THE CHAMBER DIMENSION ARE FINALISED.

FITTING SCHEDULE

ITEM No.	QTY	DESCRIPTION	PRESSURE RATING	WALL THICKNESS	PROTECTION LINING	PROTECTION COATING	FLANGE DRILLING	DIMENSIONS (mm)
1	2	315mm Ø x 219mm Ø STEEL REDUCER FLANGED BOTH SIDES WITH 315mm Ø INTEGRAL STRAIGHT uPVC PIPE FLANGED ONE END	16 BAR	8.0	EPOXY	SINTAKOTE II	SABS 1123 T1600/3	3150, 218, 1500, 230
2	2	219mm x 1200mm STEEL STRAIGHT PIPE FLANGED BOTH ENDS, WITH PUDDLE FLANGE	16 BAR	8.0	EPOXY	SINTAKOTE II	SABS 1123 T1600/3	600, 600
3	2	200mmØ VOGA NON-RISING WEDGE GATE OR APPROVED EQUIVALENT (MECH)	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SABS 1123 T1600/3	340, 317
4	1	219mm Ø X 1000 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8.0	EPOXY	SINTAKOTE II	SABS 1123 T1600/3	219, 1000
5	1	WOLTMAN WP-TYPE METER OR APPROVED EQUIVALENT	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SABS 1123 T1600/3	350
6	1	219mm Ø X 582 mm STEEL STRAIGHT PIPE, FLANGED ONE END	16 BAR	8.0	EPOXY	SINTAKOTE II	SABS 1123 T1600/3	219, 582
7	1	200mm Ø X 200mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8.0	EPOXY	SINTAKOTE II	SABS 1123 T1600/3	200, 200
8	1	SENSUS DN200 WATER STRAINER, OR APPROVED EQUIVALENT	16 BAR	-	AS SPECIFIED	AS SPECIFIED	SABS 1123 T1600/3	200

STEEL FLANGES TO: SANS 1123

PIPE SIZE	ITEM DISCRIPTION	PRESSURE RATING	FLANGE DIAMETER	THICKNESS	PCD	No. OF BOLTS.
200mmØ	FLANGE	16 BAR	340mm	22mm	295mm	12 x M20
300mmØ	FLANGE	16 BAR	460mm	28mm	410mm	12 x M24

DISCLAIMER

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2001

DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

TYPICAL WATER METER CHAMBER DETAIL

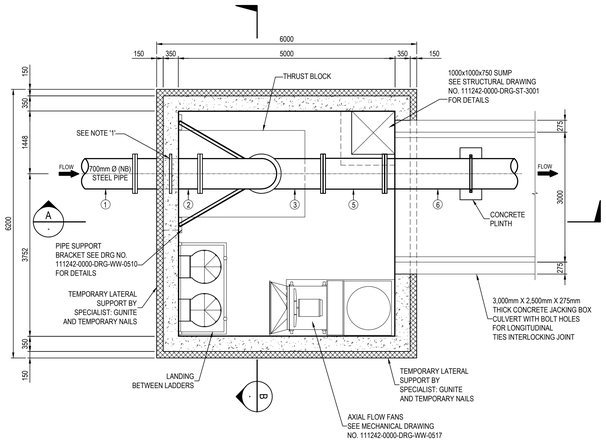
APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	12/2020
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0508 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 1 OF 1
FILE No.



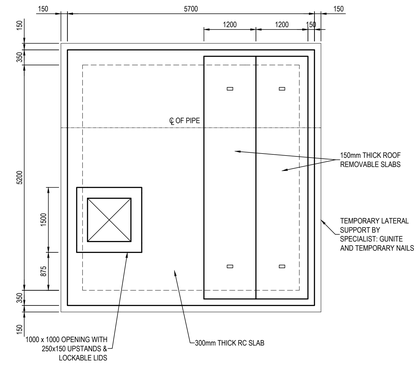
PLAN: ACCESS CHAMBER

SCALE 1:50

***NOTE**

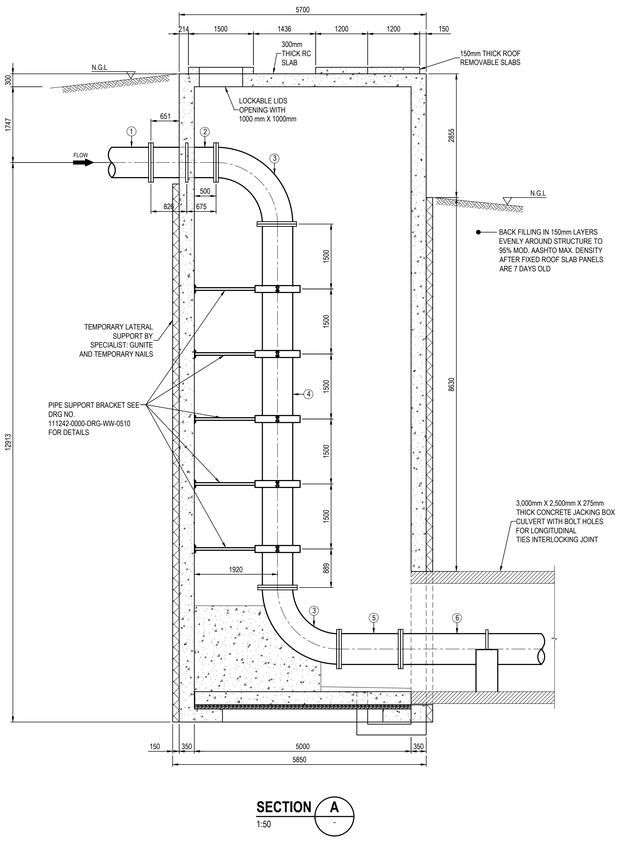
THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:

- REFER TO DWG NO. 111242-0000-DRG-SS-3000 - 3001 FOR STRUCTURAL DETAILS.
- REFER TO DWG NO. 111242-0000-DRG-WW-0516 - 0518 FOR VENTILATION DETAILS.
- REFER TO DWG NO. 111242-0000-DRG-WW-0519 FOR HYDROMECHANICAL DETAILS.



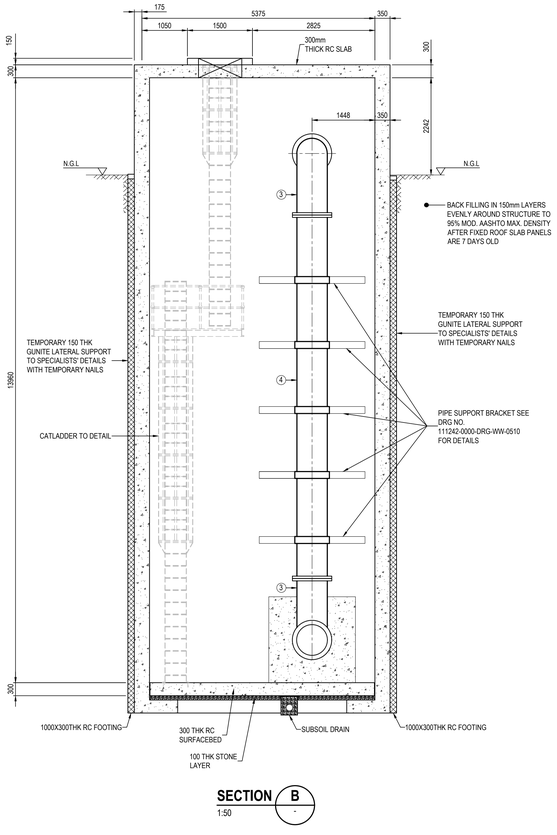
ROOF PLAN: ACCESS CHAMBER

SCALE 1:50



SECTION A

1:50



SECTION B

1:50

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NOTES:

1. REINFORCEMENT STEEL SHALL BE MINIMUM OF 50mm CLEAR OF PUDDLE PIPE AND FLANGES.
2. ALL FLANGES TO BE DRILLED OFF-CENTRE TO SANS 1123 TABLE 1600/3 OR 2500/3 AS SPECIFIED IN SCHEDULE OF FITTINGS. PUDDLE FLANGES SIMILAR TO SANS 1123 TABLE 1600/3 OR 2500/3, AS SPECIFIED, BUT UNDRILLED AND SHOP FITTED AND COATED. CONNECTING FLANGE HOLES IN OPPOSITE FLANGES MUST BE IN LINE.
3. ALL STEELWORK TO BE FINISHED ACCORDING TO PROJECT SPECIFICATIONS.
4. ALL VALVES ACCORDING TO PROJECT SPECIFICATIONS.
5. ALL SPECIALS ACCORDING TO PROJECT SPECIFICATIONS.
6. ALL JOINTING BOLTS AND NUTS TO BE HOT-DIP GALVANISED.
7. THE QUANTITIES IN THE PIPE SPECIAL SCHEDULE ARE FOR ONE CHAMBER ONLY.
8. A COMPLETE SET OF DETAILED SHOP DRAWINGS OF ALL FITTINGS MUST BE SUBMITTED FOR THE ENGINEER'S APPROVAL, PRIOR TO FABRICATION.
9. ALL JOINTS MUST BE EXTERNALLY E128 CORROSION PROTECTED.
10. ALL JOINTS MUST BE DONE BY APPROVED AND CERTIFIED SUBCONTRACTOR AND A CERTIFICATE OF COMPLIANCE SHALL BE REQUIRED.
11. ALL PIPES TO BE DISINFECTED BEFORE COMMISSIONING.
12. ALL STEEL PIPES MUST BE CATHODIC PROTECTED AND IN LINE WITH THE JOHANNESBURG WATER SPECIFICATIONS.
13. ALL CHAMBERS TO BE REINFORCED WITH CONCRETE OF GRADE 25MPa.
14. ALL CHAMBERS TO HAVE ADEQUATE ACCESS POINTS AND APPROPRIATE STEPS.
15. ALL CHAMBERS TO BE CONSTRUCTED STRICTLY AS PER THE ENGINEERS DRAWINGS.
16. LIGHTING AND ILLUMINATED PAINT DIRECTIONS TO BE ON THE WALLS IN CASE OF POWER OUTAGES.
17. PROVISION TO BE MADE FOR HYDROPOWER FACILITY. CONFIGURATION OF FACILITY WITHIN CHAMBER STILL TO BE FINALISED WITH HYDROPOWER SPECIALIST.

STEEL FLANGES TO: SANS 1123

PIPE SIZE	ITEM DESCRIPTION	PRESSURE RATING	FLANGE DIAMETER	THICKNESS	PCD	No. OF BOLTS
700mmØ	FLANGE	16 BAR	910mm	55mm	840mm	24 x M30

FITTING SCHEDULE

ITEM No.	QTY	DESCRIPTION	PRESSURE RATING	WALL THICKNESS	PROTECTION		FLANGE DRILLING	DIMENSIONS (mm)
					LINING	COATING		
1	1	711mm Ø INTEGRAL STRAIGHT PIPE L = 1500 mm; FLANGED ONE SIDE	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	1500, 700Ø
2	1	711mm Ø x 1550mm STEEL PUDDLE PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	826, 675
3	2	700mm Ø x 90° STEEL BEND	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	1420, 1420
4	1	700mm Ø x 8389 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES (LENGTH TO BE CONFIRMED ON SITE)	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	8389, 700Ø
5	1	700mm Ø x 1420 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	1420, 700Ø
6	1	700mm Ø x 4000 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	4000, 700Ø

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DRAWN	T. SHABALALA	OCTOBER 2024	
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ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

DETAILS OF ACCESS CHAMBER 1

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0509 - T1

PROJECT No. | DRAWING No. | REV.

A0 (ORIGINAL PAGE SIZE) | SHEET 1 OF 1

FILE No.

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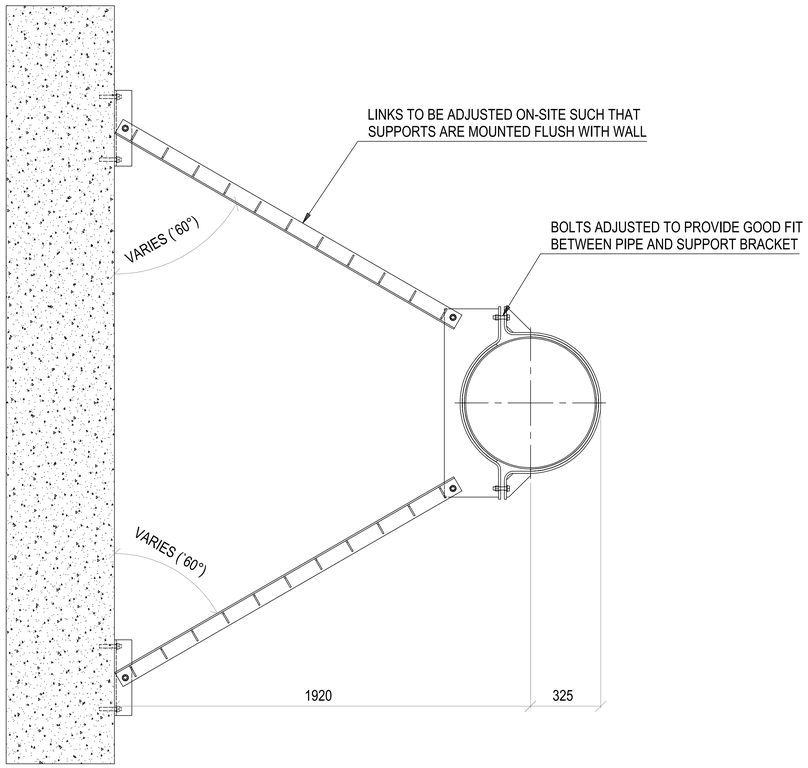
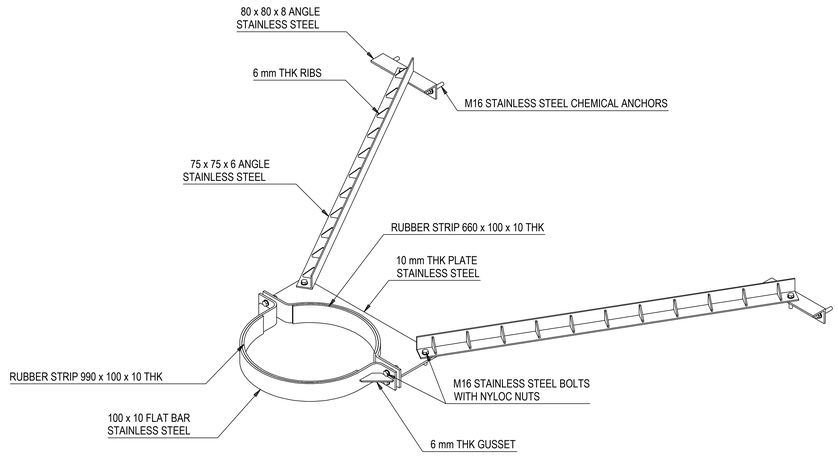


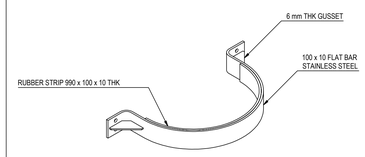
PIPE SUPPORT LAYOUT
SCALE 1:20



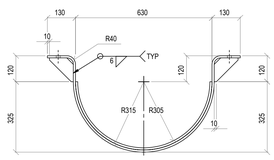
ISOMETRIC VIEW - PIPE SUPPORT BRACKET
SCALE 1:15

NOTES

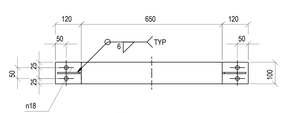
1. DRAWINGS ARE INDICATIVE ONLY - CONTRACTOR TO SUBMIT FINAL SHOP DRAWINGS TO ENGINEER FOR APPROVAL PRIOR TO MANUFACTURING.
2. CONTRACTOR TO VERIFY STRUCTURAL DIMENSIONS ON SITE AND ENSURE THAT THE DIMENSIONS OF THE SUPPORT ARE CORRECT BEFORE MANUFACTURING.
3. STEEL TO BE STAINLESS STEEL GRADE 304L MINIMUM.
4. ALL WELDS SHALL BE CONTINUOUS AND EVEN, WITH NO GAPS OR CREVICES. WELDS SHALL BE FREE OF SURFACE CAVITIES, SLAG INCLUSIONS, CRACKS, PINHOLES AND UNDERCUTS. ALL SHARP EDGES, BURRS AND WELD SPATTER TO BE REMOVED.
5. WELDING FILLER MATERIAL USED TO BE OF SIMILAR STRENGTH AS PARENT MATERIAL.
6. FATSENER THREADS TO BE COATED WITH MOLYBDENUM DISULPHIDE LUBRICANT OR NICKEL ANTI-SEIZE COMPOUND.
7. COMPLETE ASSEMBLY TO BE PICKLED AND PASSIVATED.



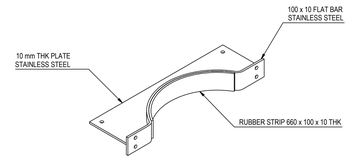
ISOMETRIC VIEW - TOP SUPPORT
SCALE 1:10



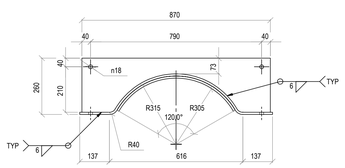
PLAN VIEW
SCALE 1:10



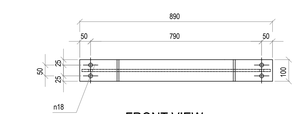
FRONT VIEW
SCALE 1:10



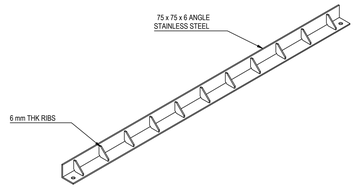
ISOMETRIC VIEW - BOTTOM SUPPORT
SCALE 1:10



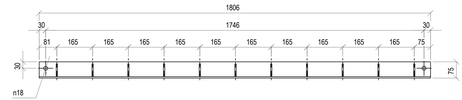
PLAN VIEW
SCALE 1:10



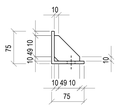
FRONT VIEW
SCALE 1:10



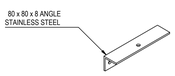
ISOMETRIC VIEW - CONNECTING ANGLE
SCALE 1:10



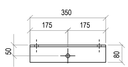
PLAN VIEW
SCALE 1:10



SIDE VIEW
SCALE 1:5



ISOMETRIC VIEW - ANCHOR ANGLE
SCALE 1:10



PLAN VIEW
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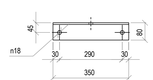

FRONT VIEW
SCALE 1 : 10

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DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
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ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAIL - DN 700 SUPPORT BRACKET DETAILS

APPROVAL BY JW DEPOT		
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APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	01/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0510 - T1
PROJECT No. DRAWING No. REV.

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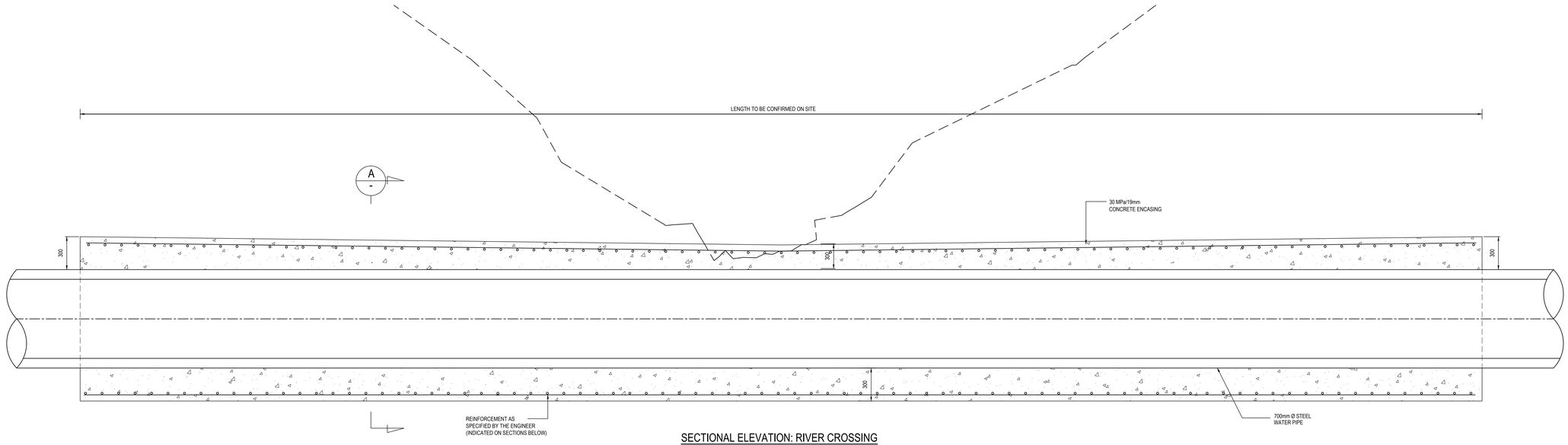
RIVER CROSSING:

1. PRIOR TO THE CONCRETE ENCASEMENT, THE CONCRETE PIPELINE SHALL BE SEALED WITH DENSOSTRIP 12mm X 25mm OR SIMILARLY APPROVED BITUMEN SEALANT TO ENSURE THAT IT IS WATERTIGHT.
2. BY USING A REINFORCED CONCRETE PIPE AND CONCRETE ENCASEMENT, THE WEIGHT OF SEWER PIPELINE INCLUDING THE ENCASEMENT IS GREATER THAN THE DISPLACED WATER WEIGHT. THEREFORE, BASED ON THE FLOATATION OF A CIRCULAR PIPE CALCULATION, BUOYANCY WILL NOT BE AN ISSUE.
3. DURING CONSTRUCTION, IT IS IMPERATIVE THAT THE PIPELINE IS CONSTRUCTED ACCORDING TO THE RELEVANT STANDARDS AND SPECIFICATIONS. IN ADDITION, THERE WILL BE SITE SUPERVISION BY THE ENGINEER AND INSPECTIONS WILL OCCUR AT THE VARIOUS CONSTRUCTION STAGES TO ENSURE QUALITY.



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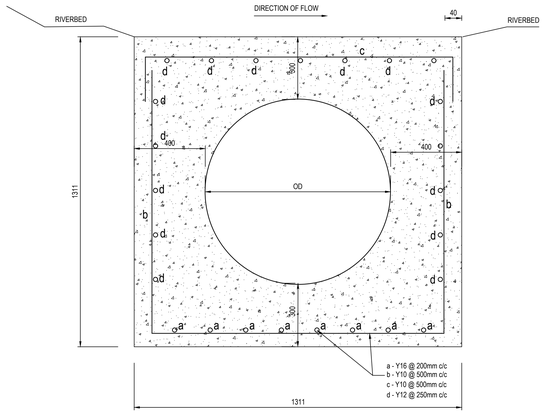
N.T.S.



SECTION A -

ENCASEMENT PROTECTION BELOW RIVER BED

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CONSULTING ENGINEERS

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HALFWAY HOUSE WATER UPGRADE

TYPICAL RIVER CROSSING DETAIL

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE

REV:	DESCRIPTION	DATE:
A	ISSUED FOR APPROVAL	07/2020
T1	ISSUED FOR RE-TENDER	10/2024

AMENDMENTS

DRAWING No.

111242 - 0000-DRG-WW-0511 - T1

PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE

SHEET 1 OF 1

FILE No.

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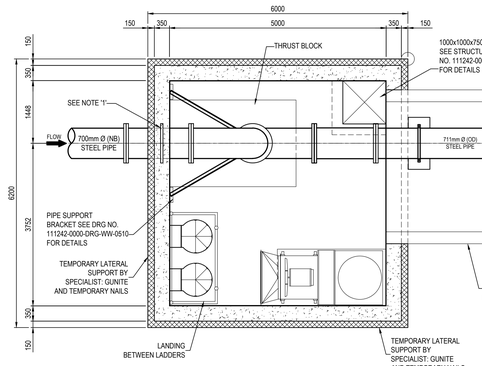
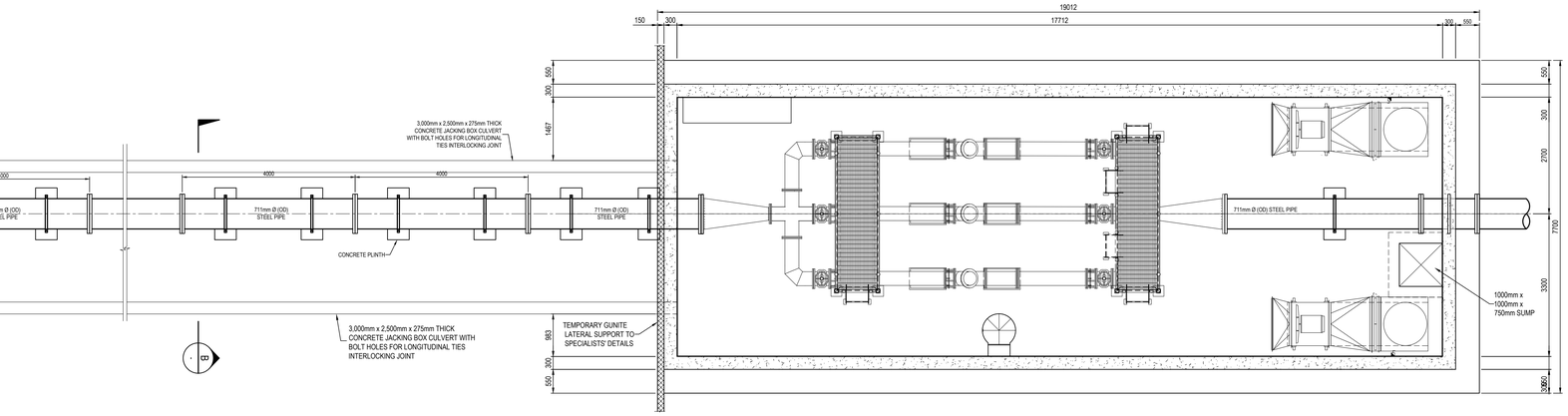
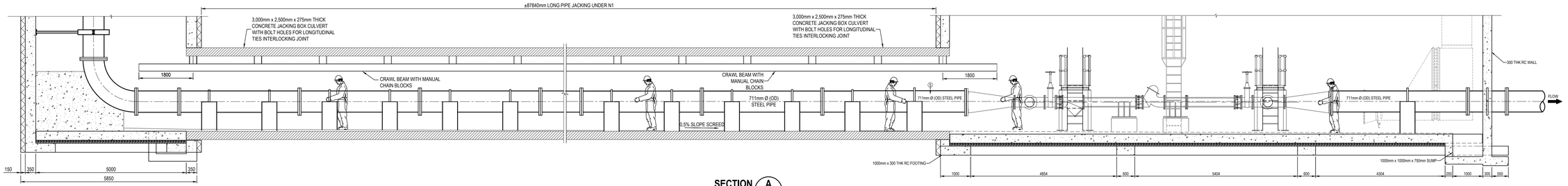


ACCESS CHAMBER 1
SCALE 1:50



PLAN: N1 CROSSING
SCALE 1:50

ACCESS CHAMBER 2
SCALE 1:50



SECTION A
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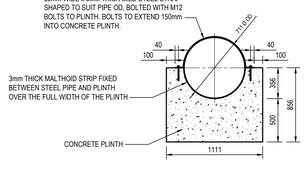
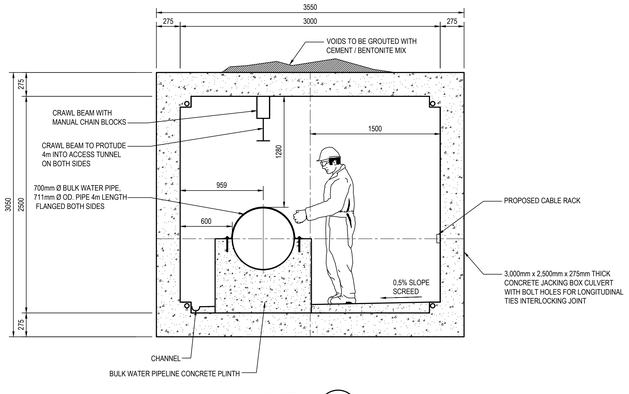


TYPICAL PIPE PLINTH
SCALE 1:25



SECTION B
1:25

NOTES:

1. LIGHTING AND ILLUMINATED PAINT DIRECTIONS TO BE ON THE WALLS IN CASE OF POWER OUTAGES.
2. PROVISION TO BE MADE FOR HYDROPOWER FACILITY. CONFIGURATION OF FACILITY WITHIN CHAMBER STILL TO BE FINALISED WITH HYDROPOWER SPECIALIST.
3. SUMP WITH SUBMERSIBLE PUMP TO BE PROVIDED.

DISCLAIMER

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DRAWN	T. SHABALALA	OCTOBER 2024
CHECKED	T. SIBAMBATO	OCTOBER 2024
APPROVED BY:	C. KAN	OCTOBER 2024
	SIGNATURE	DATE
ECSA REG. No.	980570	
CHECKED BY:		
	SIGNATURE	DATE
ECSA REG. No.		

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Joburg

HALFWAY HOUSE WATER UPGRADE

TYPICAL DETAILS FOR N1 CROSSING

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

SCALE

REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0512 - T1
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
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FILE No.

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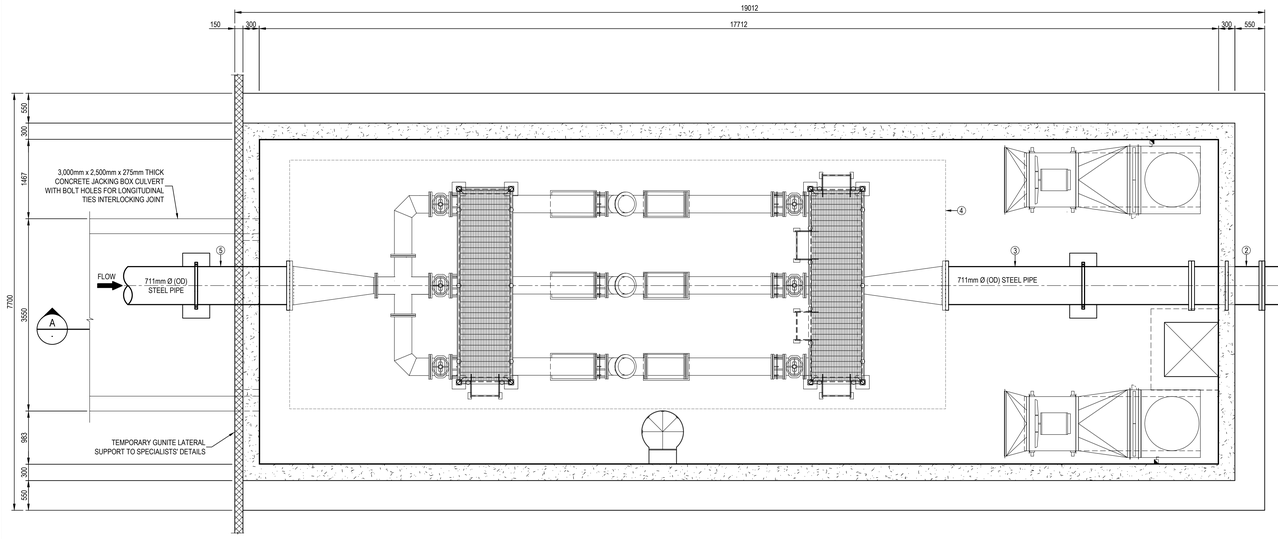
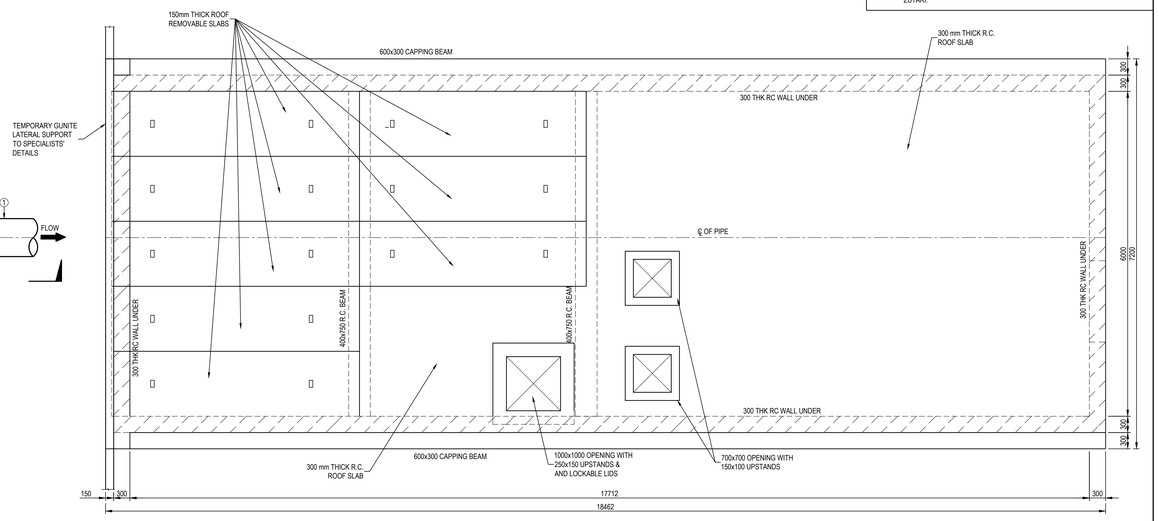
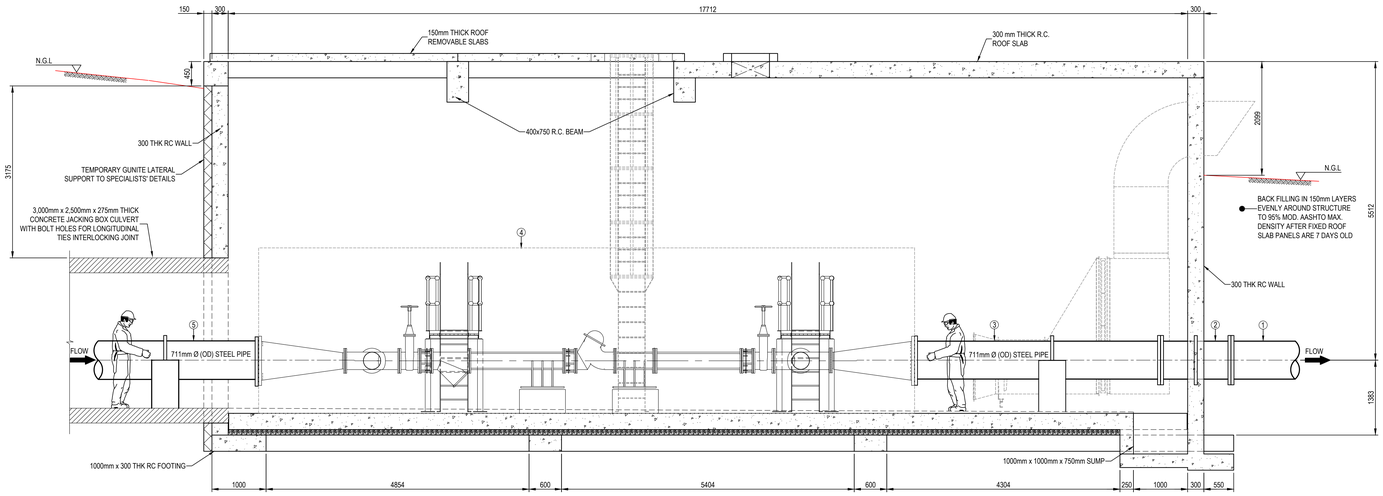


PLAN: ACCESS CHAMBER 2
SCALE 1:40



ROOF PLAN: ACCESS CHAMBER 2
SCALE 1:40



SECTION A
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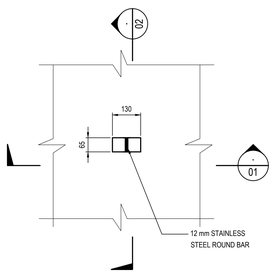

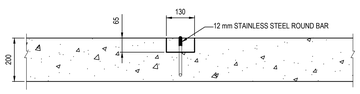

SECTION 01
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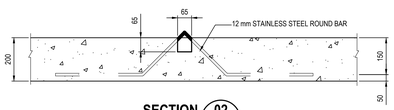

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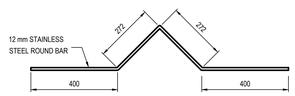

LIFTING HOOK
SCALE 1:10

***NOTE**
THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:
- REFER TO DWG NO. 111242-0000-DRG-SS-3000 - 3001 FOR STRUCTURAL DETAILS.
- REFER TO DWG NO. 111242-0000-DRG-WW-0516 - 0518 FOR VENTILATION DETAILS.
- REFER TO DWG NO. 111242-0000-DRG-WW-0519 FOR HYDROMECHANICAL DETAILS.

FITTING SCHEDULE

ITEM No.	QTY	DESCRIPTION	PRESSURE RATING	WALL THICKNESS	PROTECTION		FLANGE DRILLING	DIMENSIONS (mm)
					LINING	COATING		
1	1	700mm Ø x 1000 mm STEEL STRAIGHT PIPE, FLANGED ONE SIDE	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	700 1000
2	1	711mm Ø x 2795mm STEEL PUDDLE PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	690 690
3	1	700mm Ø x 4540 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	700 4540
4	1	PRV CONFIGURATION FACILITY						
5	1	700mm Ø x 4000 mm STEEL STRAIGHT PIPE, FLANGED BOTH SIDES	16 BAR	8,0	SINGLE COAT SOLVENT FREE LIQUID EPOXY	RIGID POLYURETHANE	SANS 1123 T1600/3	700 4000

NOTES:

1. RE-INFORCEMENT STEEL SHALL BE MINIMUM OF 50mm CLEAR OF PUDDLE PIPE AND FLANGES
2. ALL FLANGES TO BE DRILLED OFF-CENTRE TO SANS 1123 TABLE 1600/3 OR 2500/3 AS SPECIFIED IN SCHEDULE OF FITTINGS. PUDDLE FLANGES SIMILAR TO SANS 1123 TABLE 1600/3 OR 2500/3, AS SPECIFIED, BUT UNDRILLED AND SHOP FITTED AND COATED. CONNECTING FLANGE HOLES IN OPPOSITE FLANGES MUST BE IN LINE.
3. ALL STEELWORK TO BE FINISHED ACCORDING TO PROJECT SPECIFICATIONS.
4. ALL VALVES ACCORDING TO PROJECT SPECIFICATIONS.
5. ALL SPECIALS ACCORDING TO PROJECT SPECIFICATIONS.
6. ALL JOINTING BOLTS AND NUTS TO BE HOT-DIP GALVANISED.
7. THE QUANTITIES IN THE PIPE SPECIAL SCHEDULE ARE FOR ONE CHAMBER ONLY.
8. A COMPLETE SET OF DETAILED SHOP DRAWINGS OF ALL FITTINGS MUST BE SUBMITTED FOR THE ENGINEER'S APPROVAL, PRIOR TO FABRICATION.
9. ALL JOINTS MUST BE EXTERNALLY E128 CORROSION PROTECTED.
10. ALL JOINTS MUST BE DONE BY APPROVED AND CERTIFIED SUBCONTRACTOR A CERTIFICATE OF COMPLIANCE SHALL BE REQUIRED.
11. ALL PIPES TO BE DISINFECTED BEFORE COMMISSIONING.
12. ALL STEEL PIPES MUST BE CATHODIC PROTECTED AND IN LINE WITH THE JOHANNESBURG WATER SPECIFICATIONS.
13. ALL CHAMBERS TO BE REINFORCED WITH CONCRETE OF GRADE 25MPa.
14. ALL CHAMBERS TO HAVE ADEQUATE ACCESS POINTS AND APPROPRIATE STEPS.
15. CONCRETE COVERS SHALL BE USED INSTEAD OF STEEL COVERS.
16. ALL CHAMBERS TO BE CONSTRUCTED STRICTLY AS PER THE ENGINEERS DRAWINGS.

STEEL FLANGES TO: SANS 1123

PIPE SIZE	ITEM DESCRIPTION	PRESSURE RATING	FLANGE DIAMETER	THICKNESS	PCD	No. OF BOLTS.
700mmØ	FLANGE	16 BAR	910mm	55mm	840mm	24 x M30

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DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
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	SIGNATURE	DATE	
ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

DETAILS OF ACCESS CHAMBER 2

APPROVAL BY JW DEPOT			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

SCALE

REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0513 - T1
PROJECT No. | DRAWING No. | REV.

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SHEET 1 OF 1

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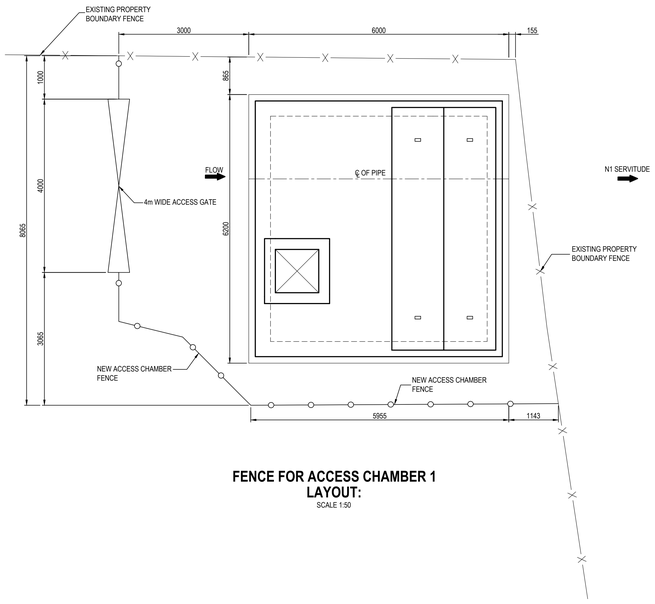
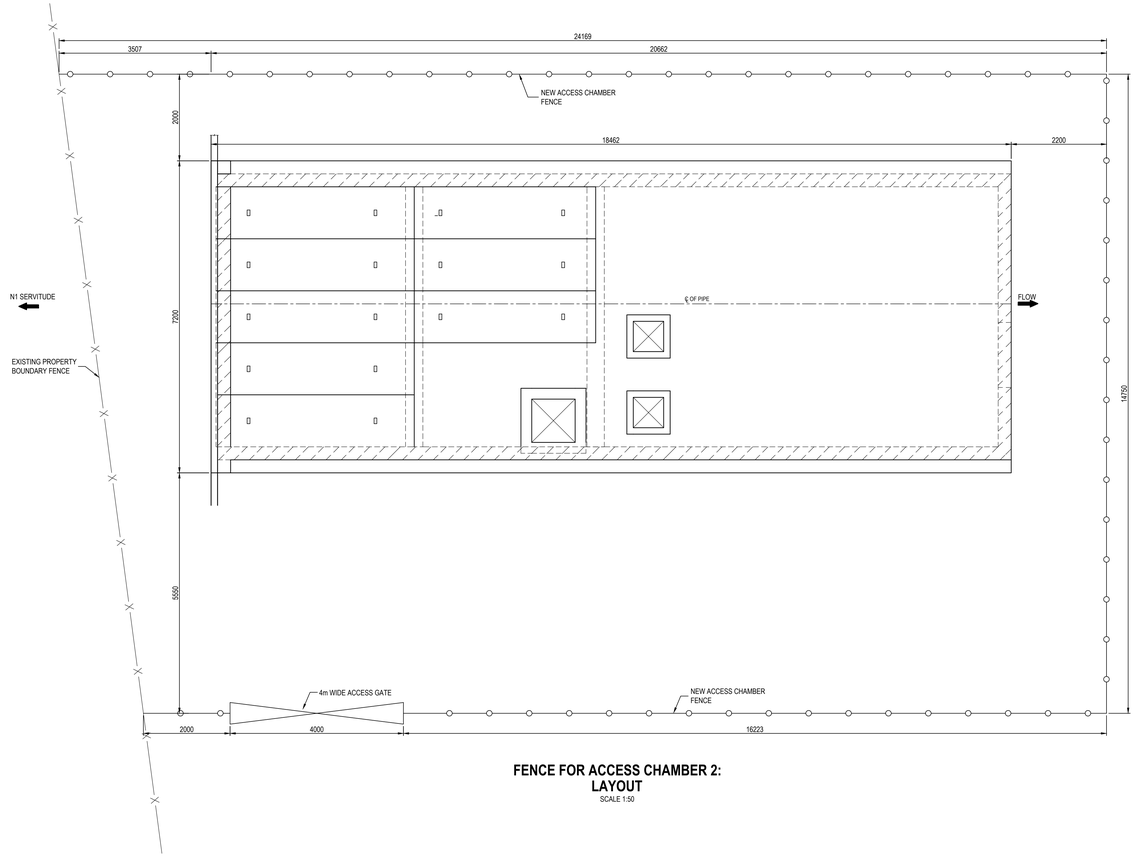


FENCE FOR ACCESS CHAMBER 1 LAYOUT:
SCALE 1:50



FENCE FOR ACCESS CHAMBER 2: LAYOUT
SCALE 1:50

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NOTES:

1. PERIMETER FENCING TO BE INSTALLED AROUND THE ENTIRE ACCESS CHAMBER SITE. THIS MUST BE PREFERABLY THE BOLT ON TYPE CONCRETE PALISADE OR CLEARVU FENCING AND MINIMUM HEIGHT TO BE 1.8m.
   - BARBED WIRE / RAZOR WIRE TO BE INSTALLED ON TOP SECTION OF FENCING.
   - GATES NEED TO BE STEEL IN CONSTRUCTION, SLIDING TYPE GATE, GREEN IN COLOUR AND AT LEAST 4m WIDE.
   - THE GATE MUST HAVE A LOCKABLE PEDESTRIAN GATE ACCESS BUILT INTO ITS FRAME.
   - GALVANIZED GATES CAN BE INSTALLED PROVIDED THAT THEY DO NOT GET PAINTED AS PER COLOR CODING.
   - REASONABLE ACCESS TO THE SITE NEEDS TO BE PROVIDED FROM THE MAIN ROAD TO THE SITE.
   - THIS CAN BE A CONCRETED DRIVEWAY OR CONCRETE TRACKS (FARM TRACKS).
   - PAVING AND INTERLOCKING BRICKS SHOULD BE AVOIDED.
   - PROVISION TO BE MADE FOR FINGER PRINT ACCESS INTO CHAMBER FENCING ENCLOSURES.

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DESIGNED	T. SHABALALA	OCTOBER 2024	
DRAWN	T. SHABALALA	OCTOBER 2024	
CHECKED	K. BRINK	OCTOBER 2024	
APPROVED BY:	C. KAN	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.	980570		
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	SIGNATURE	DATE	
ECSA REG. No.			

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Joburg

HALFWAY HOUSE WATER UPGRADE

FENCING AROUND ACCESS CHAMBERS

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	10/2021
T1	ISSUED FOR RE-TENDER	10/2024

DRAWING No.

111242 - 0000-DRG-WW-0514 - T1
PROJECT No. DRAWING No. REV.

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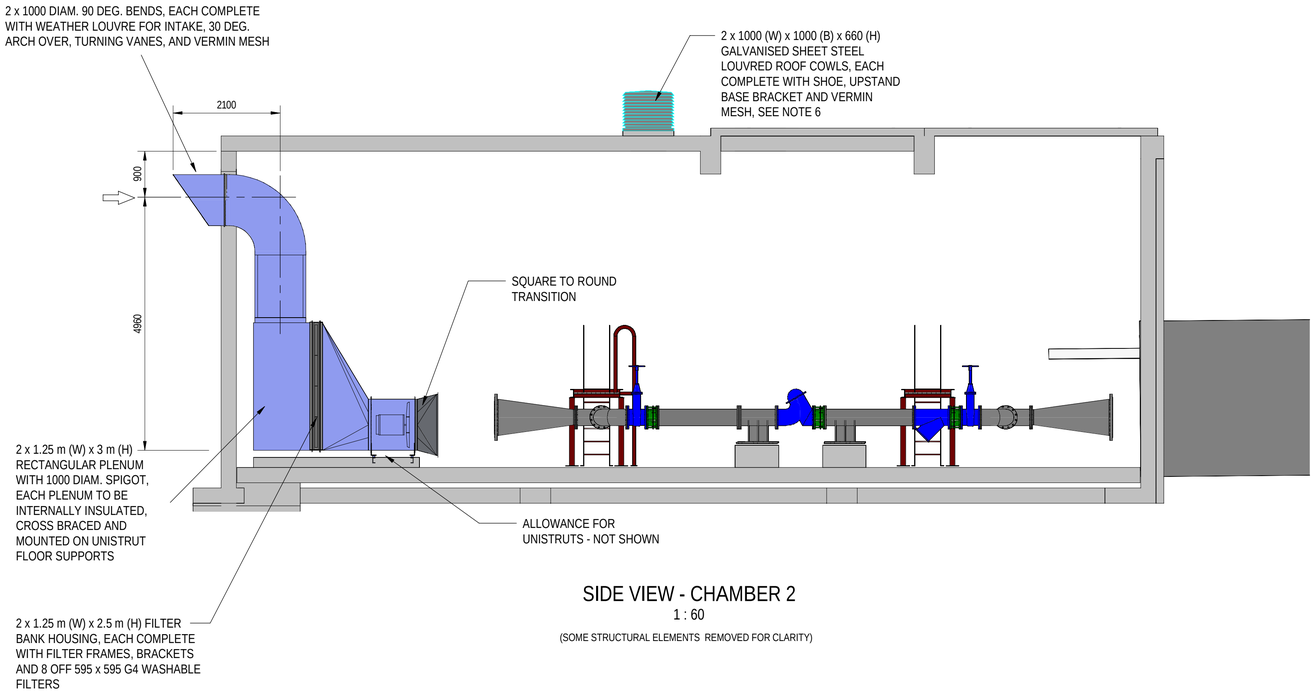

SIDE VIEW - CHAMBER 2

1 : 60

(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)

GENERAL NOTES

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5. REFER TO SCHEDULE ON SHEET 0516
6. REFER TO DRAWINGS 111242-0000-DRG-ST-3000, 3001, 3002 AND 3003 FOR CIVIL DETAILS
7. REFER TO DRAWINGS 111242-0000-DRG-EL-2000, 2001 AND 2002 FOR ELECTRICAL DETAILS

AIR TERMINAL SCHEDULE

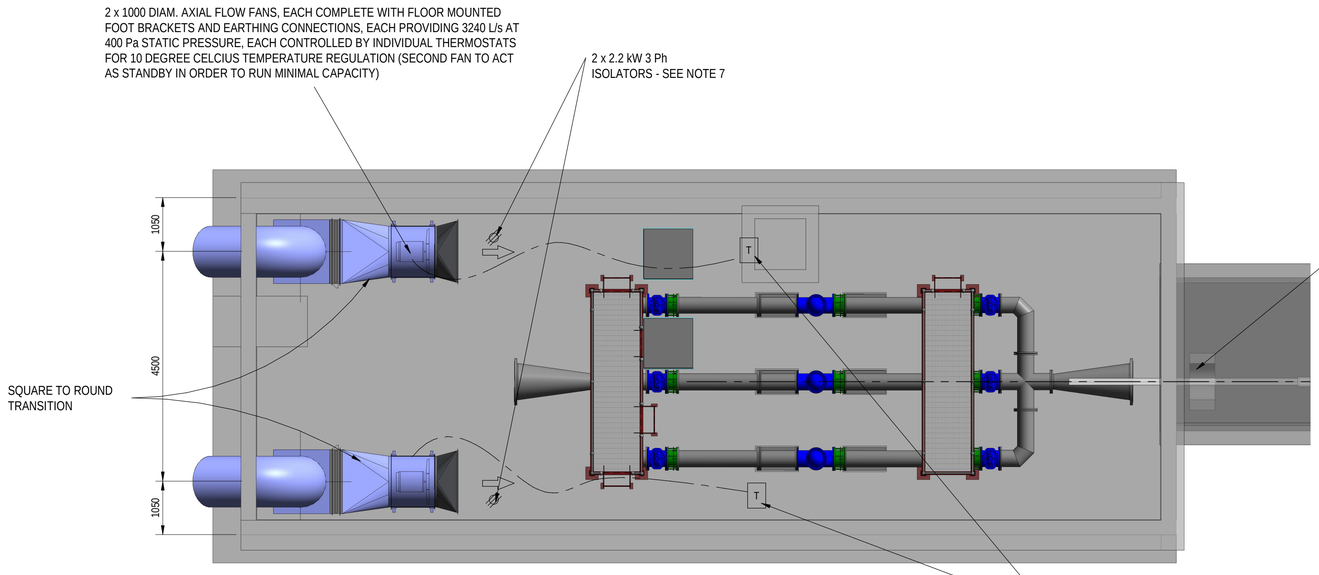
REF	TYPE	SIZE	QTY
SAG-01	DOUBLE DEFLECTION AIR GRILLE	1200 x 1200	4
WL-01	WEATHER LOUVRE C/W VERMIN MESH	1000 DIAM.	3
RAG-01	LOUVRED ROOF COWL C/W VERMIN MESH	1000 x 1000 x 660	2

FILTER BANK SCHEDULE

REF	TYPE	FRAME SIZE	PANEL QTY	FILTER SIZE	FRAME QTY
FLT-01	G4 WASHABLE OR SIMILAR APPROVED	1250 x 2500	2	595 x 595	8

FAN SCHEDULE

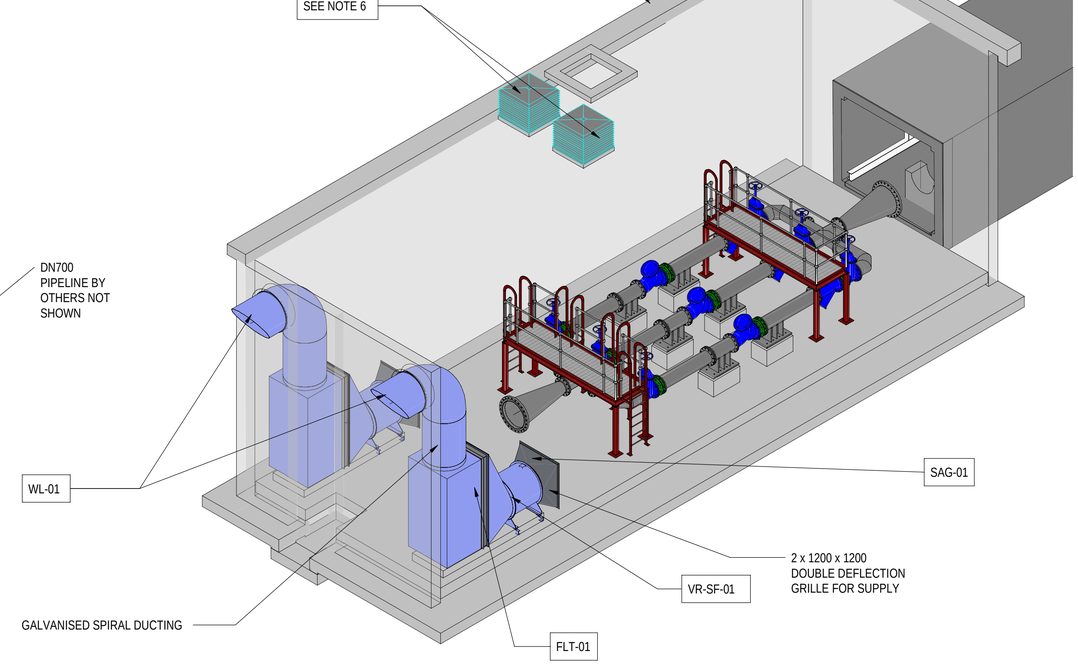
REF	SIZE	DESCRIPTION	AIR FLOW	STATIC PRESSURE	THRUST	RATED POWER	QTY
VR-SF01	1000 DIAM.	AXIAL FLOW FAN	3.24 m3/s	200 - 400 Pa	-	2.2 kW	2
VR-SF02	400 DIAM.	JET FAN	2.00 m3/s	-	20 N	1.5 kW	3
VR-SF03	1000 DIAM.	AXIAL FLOW FAN	3.24 m3/s	200 Pa	-	2.2 kW	2



PLAN VIEW - CHAMBER 2

1 : 60

(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)



(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)

ISOMETRIC VIEW - CHAMBER 2

NTS

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DRAWN	L. VAN VELZE	*31.10.24*	
CHECKED	S. CHETTY	*31.10.24*	
APPROVED BY:	S. CHETTY	*31.1024*	
	SIGNATURE	DATE	
ECSA REG. No.			
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

Joburg

HALFWAY HOUSE RESERVOIR

ACCESS CHAMBERS
VENTILATION
SHEET 1 OF 3

APPROVAL BY JW DEPOT			SCALE
CHECKED			AS SHOWN
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	FOR TENDER	10.2021
T1	FOR RE-TENDER	10.2024

DRAWING No.

111242 - 0000-DRG-WW-0516 - T1

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FILE No.

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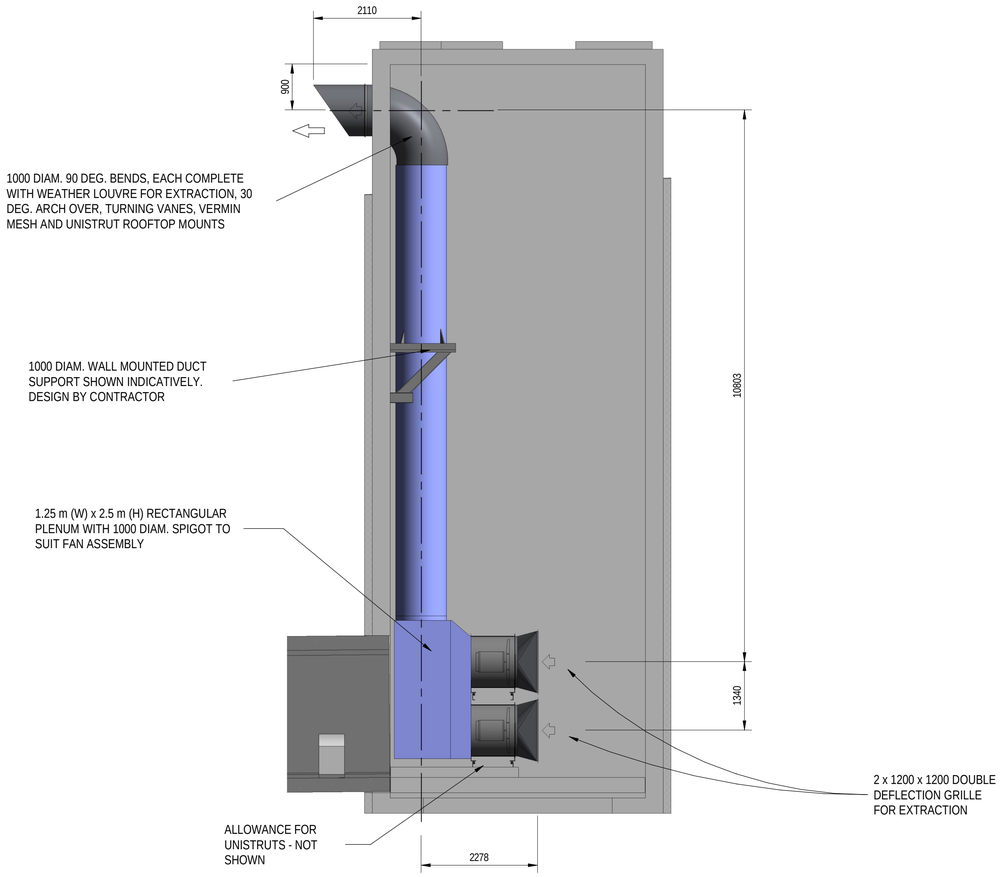
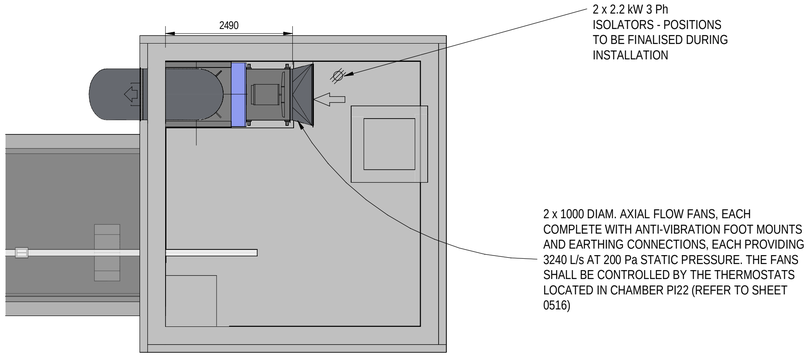


SIDE VIEW - CHAMBER 1

1 : 60

(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)



PLAN VIEW - CHAMBER 1

1 : 60

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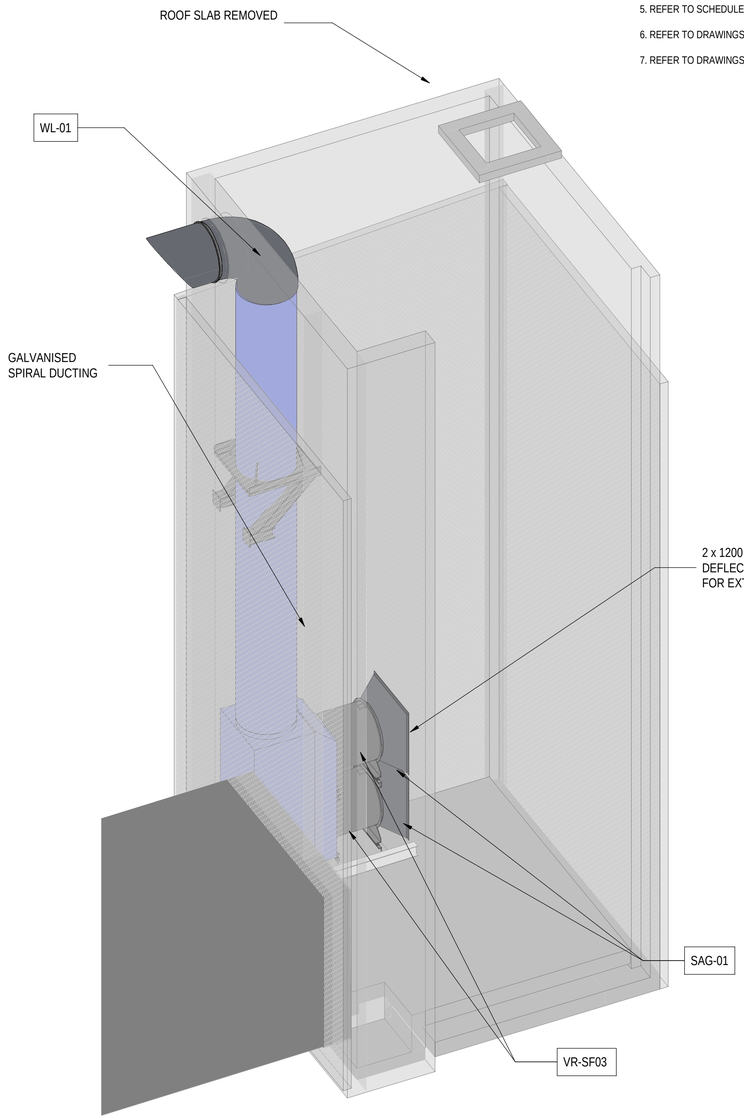
7. REFER TO DRAWINGS 111242-0000-DRG-EL-2000, 2001 AND 2002 FOR ELECTRICAL DETAILS



ISOMETRIC VIEW - CHAMBER 1

NTS

(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)

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DESIGNED	L. VAN VELZE	*31.10.24*	
DRAWN	L. VAN VELZE	*31.10.24*	
CHECKED	S. CHETTY	*31.10.24*	
APPROVED BY:	S. CHETTY	*31.10.24*	
	SIGNATURE	DATE	
ECSA REG. No.			
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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HALFWAY HOUSE RESERVOIR

ACCESS CHAMBERS
VENTILATION
SHEET 2 OF 3

APPROVAL BY JW DEPOT			SCALE
CHECKED			AS SHOWN
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

REV:	DESCRIPTION	DATE:
T0	FOR TENDER	10.2021
T1	FOR RE-TENDER	10.2024

DRAWING No.

111242 - 0000-DRG-WW-0517 - T1

PROJECT No. | DRAWING No. | REV.

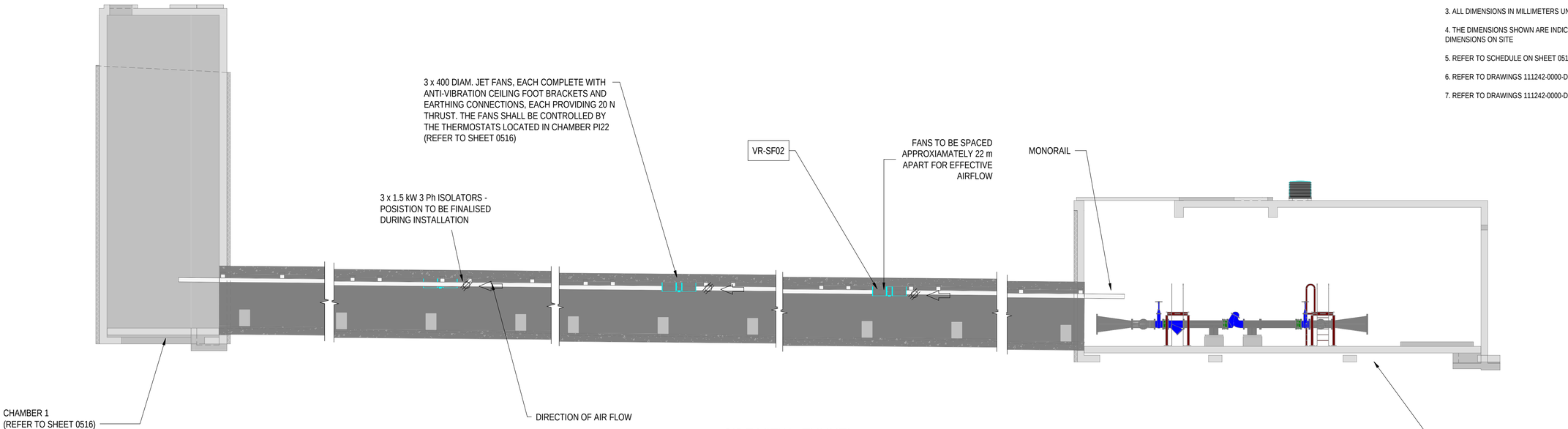
A1 ORIGINAL PAGE SIZE | SHEET 2 OF 3

FILE No.

Filename: Autodesk Docs://111242 - Halfway House Water Upgrade_R23111242 Halfway House Water Upgrade - Mechanical 2024-02-13.rvt

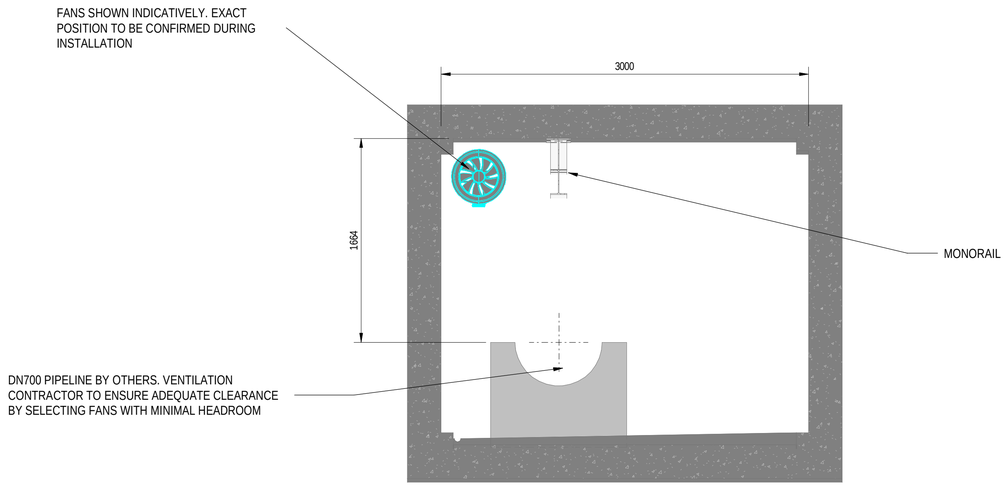
GENERAL NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE MECHANICAL PARTICULAR SPECIFICATIONS AND ALL OTHER CONTRACT DOCUMENTATION
2. DO NOT SCALE THESE DRAWINGS
3. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED
4. THE DIMENSIONS SHOWN ARE INDICATIVE AND THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE
5. REFER TO SCHEDULE ON SHEET 0516
6. REFER TO DRAWINGS 111242-0000-DRG-ST-3000, 3001, 3002 AND 3003 FOR CIVIL DETAILS
7. REFER TO DRAWINGS 111242-0000-DRG-EL-2000, 2001 AND 2002 FOR ELECTRICAL DETAILS



SIDE VIEW - TUNNEL
1 : 100

(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)



FRONT VIEW - TUNNEL
1 : 25

(SOME STRUCTURAL ELEMENTS REMOVED FOR CLARITY)

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APPROVED BY:	S. CHETTY	*31.10.24*	
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ECSA REG. No.			
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ECSA REG. No.			

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SHEET 3 OF 3

APPROVAL BY JW DEPOT			SCALE
CHECKED			AS SHOWN
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	FOR TENDER	10.2021
T1	FOR RE-TENDER	10.2024

DRAWING No.

111242 - 0000-DRG-WW-0518 - T1
PROJECT No. DRAWING No. REV.

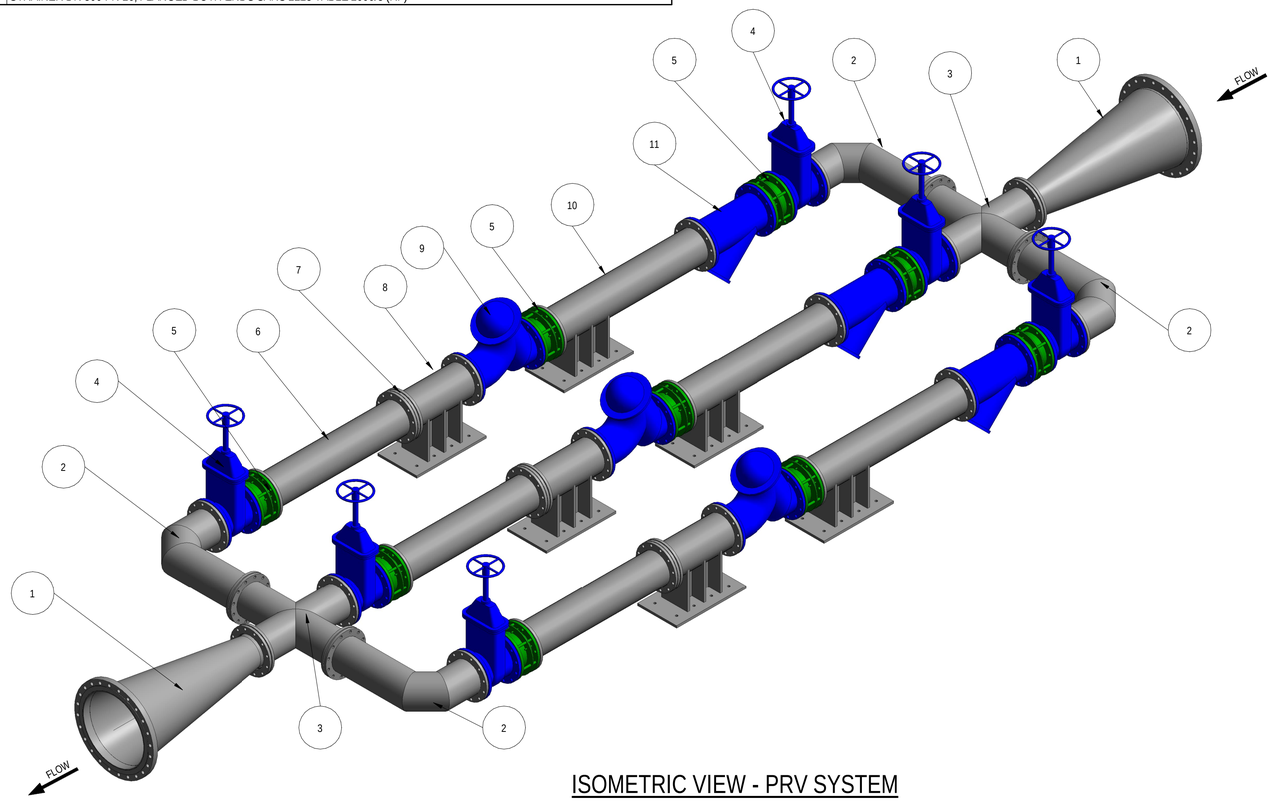
A1 SHEET 3 OF 3
ORIGINAL PAGE SIZE

FILE No.

Filename: Autodesk Docs://111242 - Halfway House Water Upgrade_R23/111242-Halfway House Water Upgrade - Mechanical 2024-02-13.rvt

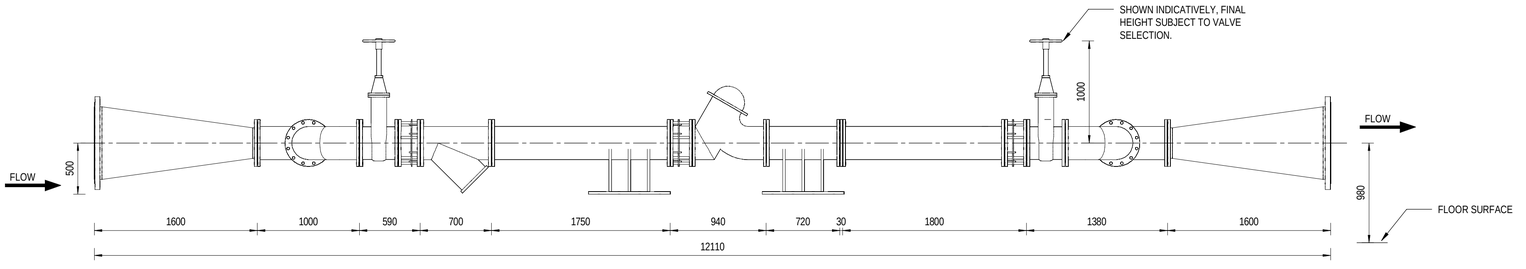
PARTLIST PRV SYSTEM

ITEM	QTY	DESCRIPTION
1	2	CONCENTRIC REDUCER; DN 700 x DN 300 x 6 mm SANS 719 GRADE C; FLANGED SANS 1123 TABLE 1600/3 (RF)
2	4	DN 300 x 6 mm 90 DEGREE ELBOW SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
3	2	DN 300 x 10 mm CROSS TEE SANS 719 CRADE C; FLANGED ALL ENDS SANS 1123 TABLE 1600/3 (RF)
4	6	RESILIENT SEAL GATE VALVE DN 300 PN 16; FLANGED SANS 1123 TABLE 1600/3 (RF)
5	9	DISMANTLING JOINT DN 300 PN 16; FLANGED SANS 1123 TABLE 1600/3 (RF)
6	3	SPOOL PIECE DN 300 x 6 mm SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
7	3	ORIFICE PLATE DN 300 WITH 159 mm OPENING
8	3	SPOOL PIECE DN 300 x 6 mm SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF) WITH ANCHOR SUPPORT
9	3	PRESSURE REDUCING VALVE DN 300 PN 16; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
10	3	SPOOL PIECE DN 300 x 6 mm SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF) WITH ANCHOR SUPPORT
11	3	STRAINER DN 300 PN 16; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)



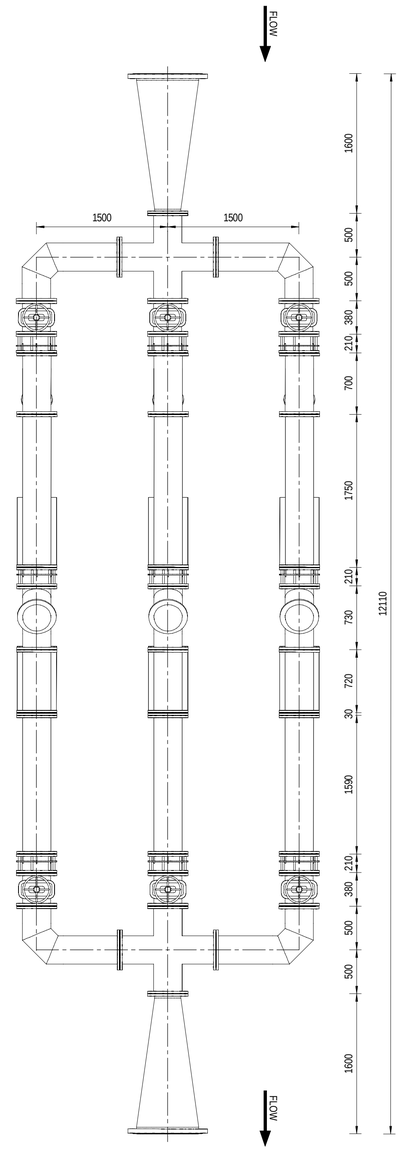
ISOMETRIC VIEW - PRV SYSTEM

NTS



SIDE VIEW - PRV SYSTEM

SCALE 1 : 30



PLAN VIEW - PRV SYSTEM

SCALE 1 : 35

NOTES:

1. ALL PIPEWORK IS INDICATIVE AND SHALL NOT BE MANUFACTURED FROM THIS DRAWING. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE PIPEWORK, VALVES AND SPECIALS. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE DESIGN ENGINEER FOR APPROVAL BEFORE MANUFACTURING OR FABRICATION COMMENCES. THE DESIGN MUST BE IN ACCORDANCE WITH THE MECHANICAL SPECIFICATION AND OTHER RELATED CONTRACT DOCUMENTS.
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3. ALL FLANGES AND FITTINGS BELOW GROUND SHALL BE COVERED WITH A VISCO-ELASTIC COATING (STOPAQ OR SIMILAR APPROVED) AND WRAPPED WITH PVC TAPE.
4. UNLESS OTHERWISE SPECIFIED ALL PIPE SPOOLS WILL BE MILD STEEL PIPES, HOT DIPPED GALVANISED IN ACCORDANCE WITH SANS 121.
5. SPOOL PIECES WITHIN A STRUCTURE SHALL PROVIDED WITH APPROPRIATE LIFTING LUGS TO FIT THE EQUIPMENT PROVIDED IN THE PRESSURE REDUCING VALVE CHAMBER.
6. REFER TO 111242-0000-ST-3002 AND 3003 FOR CIVIL DETAILS.
7. REFER TO DRAWINGS 111242-0000-DRG-EL-2000, 2001 AND 2002 FOR ELECTRICAL DETAILS.

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DRAWN	L. VAN VELZE	*29.10.24*	
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APPROVED BY:	S. CHETTY	*29.10.24*	
	SIGNATURE	DATE	
ECSA REG. No.			
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ECSA REG. No.			

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HALFWAY HOUSE RESERVOIR

ACCESS CHAMBER 2
PRV DETAILS
SHEET 1 OF 2

APPROVAL BY JW DEPOT			SCALE
CHECKED			AS SHOWN
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	FOR TENDER	10.2021
T1	FOR RE-TENDER	10.2024

DRAWING No.

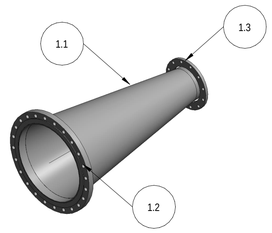
111242 - 0000-DRG-WW-0519 - T1
PROJECT No. DRAWING No. REV.

A1 SHEET 1 OF 2
ORIGINAL PAGE SIZE
FILE No.

Filename: Autodesk Docs://111242 - Halfway House Water Upgrade_623\111242-Halfway House Water Upgrade - PRV Mechanicals.rvt

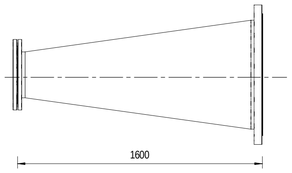
ITEM 1 PARTLIST

ITEM	QTY	DESCRIPTION
1.1	1	CONCENTRIC REDUCER; DN 700 x DN 300 x 6 mm SANS 719 GRADE C
1.2	1	DN 700 FLANGE SANS 1123 TABLE 1600/3 (RF)
1.3	1	DN 300 FLANGE SANS 1123 TABLE 1600/3 (RF)



ISOMETRIC VIEW - ITEM 1

NTS

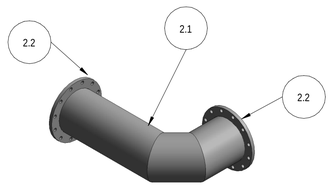


SIDE VIEW - ITEM 1

SCALE 1 : 20

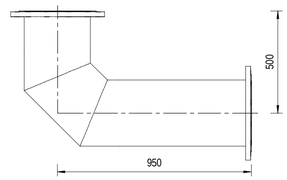
ITEM 2 PARTLIST

ITEM	QTY	DESCRIPTION
2.1	1	DN 300 x 6 mm 90 DEGREE ELBOW SANS 719 GRADE C
2.2	2	DN 300 FLANGE SANS 1123 TABLE 1600/3 (RF)



ISOMETRIC VIEW - ITEM 2

NTS

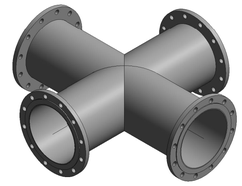


PLAN VIEW - ITEM 2

SCALE 1 : 15

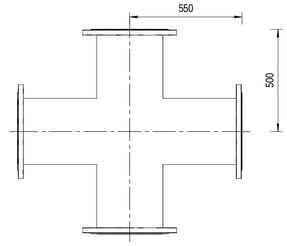
ITEM 3 PARTLIST

ITEM	QTY	DESCRIPTION
3.1	1	DN 300 x 10 mm CROSS TEE SANS 719 CRADE C
3.2	4	DN 300 FLANGE SANS 1123 TABLE 1600/3 (RF)



ISOMETRIC VIEW - ITEM 3

NTS



PLAN VIEW - ITEM 3

SCALE 1 : 15

NOTES:

1. ALL PIPEWORK IS INDICATIVE AND SHALL NOT BE MANUFACTURED FROM THIS DRAWING. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE PIPEWORK, VALVES AND SPECIALS. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE DESIGN ENGINEER FOR APPROVAL BEFORE MANUFACTURING OR FABRICATION COMMENCES. THE DESIGN MUST BE IN ACCORDANCE WITH THE MECHANICAL SPECIFICATION AND OTHER RELATED CONTRACT DOCUMENTS.
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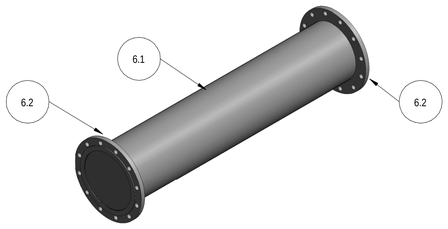
6. REFER TO 111242-0000-ST-3002 AND 3003 FOR CIVIL DETAILS.
7. REFER TO DRAWINGS 111242-0000-DRG-EL-2000, 2001 AND 2002 FOR ELECTRICAL DETAILS.

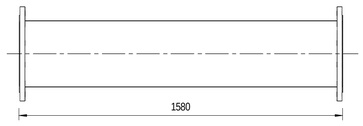
ITEM 6 PARTLIST

ITEM	QTY	DESCRIPTION
6.1	1	SPOOL PIECE DN 300 x 6 mm SANS 719 GRADE C
6.2	2	DN 300 FLANGE SANS 1123 TABLE 1600/3 (RF)



ISOMETRIC VIEW - ITEM 6

NTS

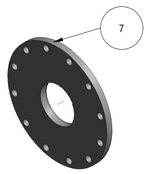


PLAN VIEW - ITEM 6

SCALE 1 : 15

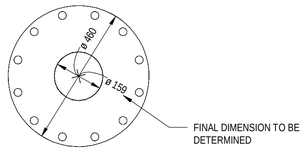
ITEM 7 PARTLIST

ITEM	QTY	DESCRIPTION
7	3	ORIFICE PLATE DN 300 WITH 159 mm OPENING



ISOMETRIC VIEW - ITEM 7

NTS

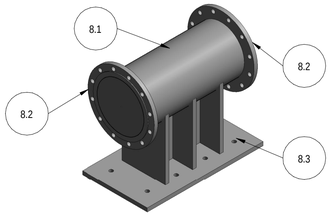


SIDE VIEW - ITEM 7

SCALE 1 : 10

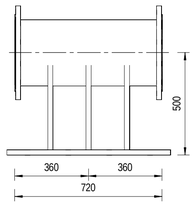
ITEM 8 PARTLIST

ITEM	QTY	DESCRIPTION
8.1	1	SPOOL PIECE DN 300 x 6 mm SANS 719 GRADE C
8.2	2	DN 300 FLANGE SANS 1123 TABLE 1600/3 (RF)
8.3	1	DN 300 PIPE ANCHOR SUPPORT - REFER TO DRAWING 111242-0000-DRG-WW-0521



ISOMETRIC VIEW - ITEM 8

NTS

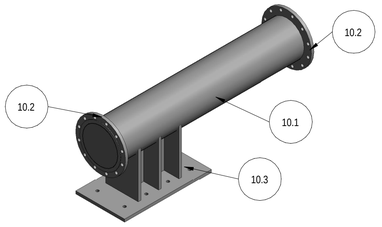


SIDE VIEW - ITEM 8

SCALE 1 : 15

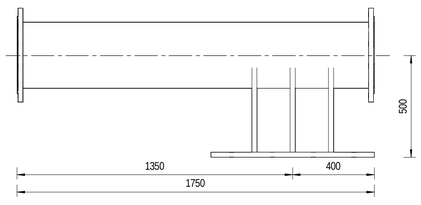
ITEM 10 PARTLIST

ITEM	QTY	DESCRIPTION
10.1	1	SPOOL PIECE DN 300 x 6 mm SANS 719 GRADE C
10.2	2	DN 300 FLANGE SANS 1123 TABLE 1600/3 (RF)
10.3	1	DN 300 PIPE ANCHOR SUPPORT - REFER TO DRAWING 111242-0000-DRG-WW-0521



ISOMETRIC VIEW - ITEM 10

NTS



SIDE VIEW - ITEM 10

SCALE 1 : 15

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DRAWN	L. VAN VELZE	*29.10.24*	
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APPROVED BY:	S. CHETTY	*29.10.24*	
	SIGNATURE	DATE	
ECSA REG. No.			
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ECSA REG. No.			

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HALFWAY HOUSE RESERVOIR

ACCESS CHAMBER 2
PRV DETAILS
SHEET 2 OF 2

APPROVAL BY JW DEPOT			SCALE
CHECKED			AS SHOWN
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	FOR TENDER	29.10.24

DRAWING No.

111242 - 0000-DRG-WW-0520 - T0

PROJECT No. DRAWING No. REV.

A1 SHEET 2 OF 2

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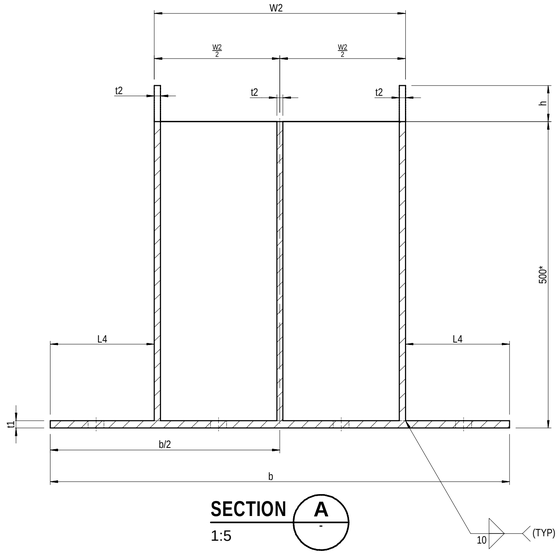

SECTION A
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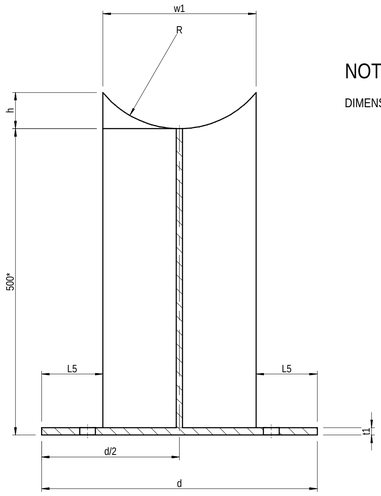

SECTION B
1:5

NOTE

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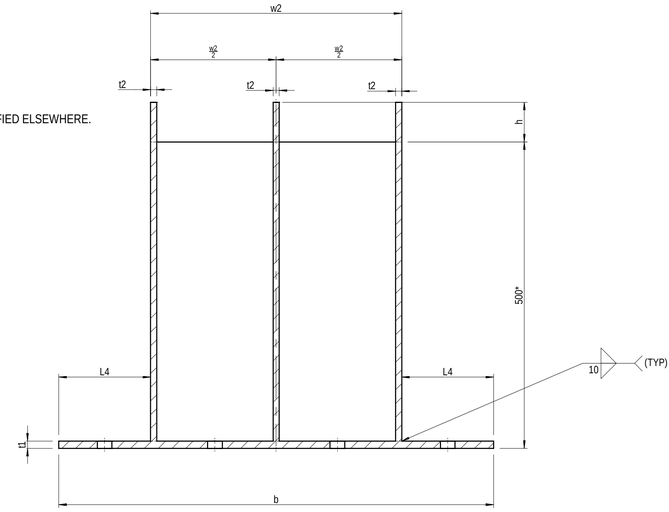

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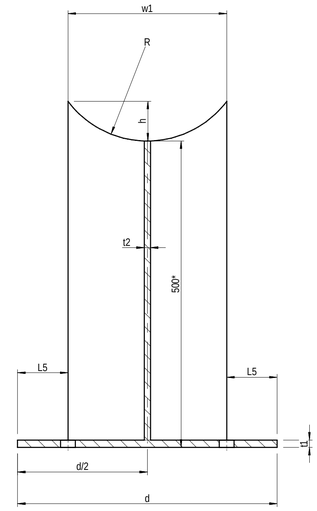
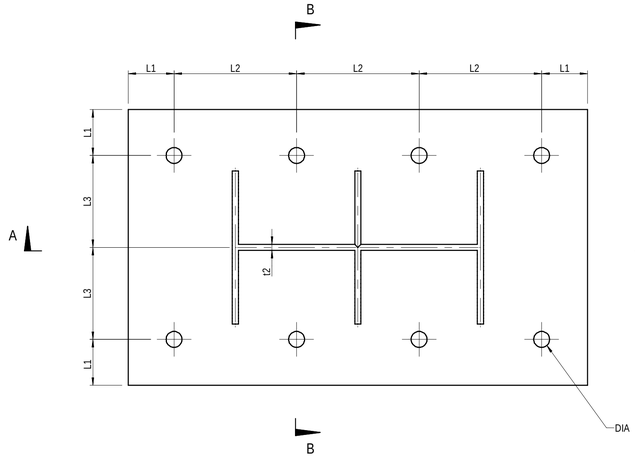
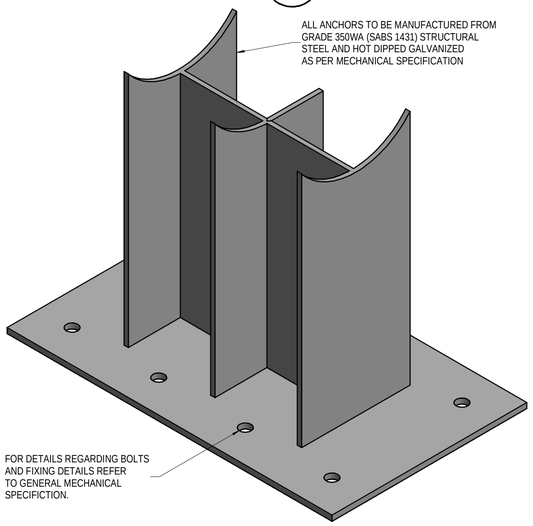


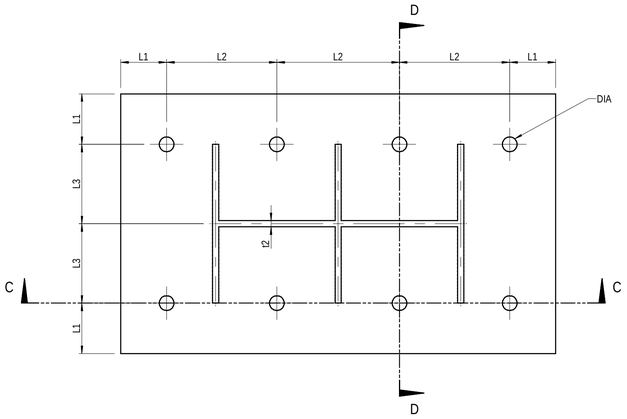
SECTION D
1:10



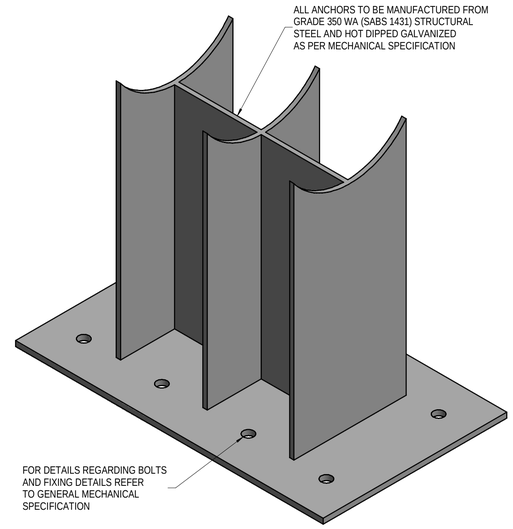
PLAN VIEW
1:5
ANCHOR TEE SUPPORT (SIDE OUTLET)



ISOMETRIC VIEW
N.T.S.
ANCHOR TEE SUPPORT (SIDE OUTLET)



PLAN VIEW
1:5
ANCHOR TEE SUPPORT (TOP OUTLET) / SPOOL ANCHOR



ISOMETRIC VIEW
N.T.S.
ANCHOR TEE SUPPORT (TOP OUTLET)/ SPOOL ANCHOR

ANCHOR TEE AND SPOOL SUPPORTS

Tee DN	b (mm)	d (mm)	t1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	DIA (mm)	CHEMICAL ANCHOR SIZE (GRADE 8.8)	h (mm)	w1 (mm)	w2 (mm)	t2 (mm)	R (mm)
50	350	200	10	45	130	55	95	75	Ø 14	M12	13	50	160	6	30.4
100	400	250	12	50	100	75	90	75	Ø 18	M16	30	100	220	8	57.45
150	650	300	16	85	160	65	185	75	Ø 22	M20	47	150	280	10	83.05
200	700	350	18	95	170	90	190	75	Ø 26	M24	65	200	320	12	109.55
250	750	400	20	90	190	110	185	75	Ø 26	M24	72	250	380	16	136.5
300	800	450	24	100	200	125	200	75	Ø 26	M24	90	300	400	18	161.95
350	850	500	24	100	210	150	215	75	Ø 26	M24	109	350	420	20	117.8
400	860	550	24	100	220	175	210	75	Ø 26	M24	124	400	440	20	203.2
450	900	580	25	110	227	180	230	75	Ø 32	M30	130	430	440	22	228.5
500	930	620	25	110	237	200	235	85	Ø 32	M30	140	450	460	24	254
550	960	650	30	115	244	210	240	90	Ø 32	M30	140	470	480	24	279.5
600	980	680	30	120	247	220	245	95	Ø 32	M30	140	490	490	25	305
700	1000	810	30	120	253	235	255	95	Ø 32	M30	170	620	490	25	356
800	1000	895	30	120	253	328	255	95	Ø 32	M30	200	705	490	25	406
900	1000	980	30	120	253	370	255	95	Ø 32	M30	220	790	490	25	457
1000	1000	1070	30	120	253	415	255	95	Ø 32	M30	250	880	490	25	508

GENERAL NOTES

1. ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SANS REQUIREMENTS.
2. ALL DIMENSIONS ARE IN MILLIMETER, UNLESS OTHERWISE SPECIFIED.
3. DO NOT SCALE FROM THESE DRAWINGS.
4. ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
5. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS.
6. STEEL TO SANS 50025 GRADE 350 WA.
7. REMOVE ALL SHARP EDGES AND BURS.
8. FOR DETAILS REGARDING BOLTS AND FINXING DETAILS REFER TO GENERAL MECHANICAL SPECIFICATIONS.
9. ALL SUPPORTS TO BE MANUFACTURED FROM GRADE 350 WA (SANS 1431) STRUCTURAL STEEL AND HOT DIPPED GALVANIZED AS PER MECHANICAL SPECIFICATION.

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DESIGNED	L. VAN VELZE	31.10.24
DRAWN	L. VAN VELZE	31.10.24
	S. CHETTY	31.10.24
APPROVED BY:	S. CHETTY	31.10.24
	SIGNATURE	DATE
ECSA REG. No.		
CHECKED BY:		
	SIGNATURE	DATE
ECSA REG. No.		

Joburg
HALFWAY HOUSE RESERVOIR

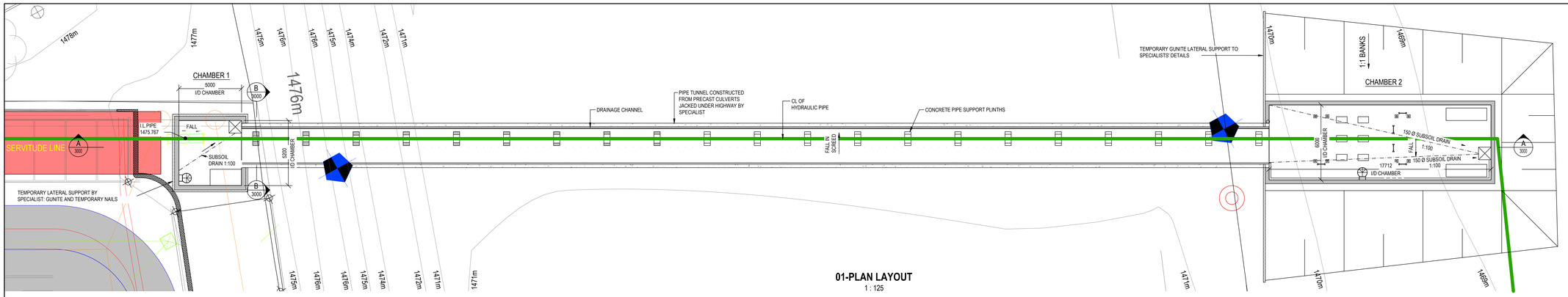
STANDARD DETAIL
ANCHOR PIPE SUPPORT
GALVANISED STEEL

APPROVAL BY JW DEPOT		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE
APPROVAL BY JW PLANNING		
CHECKED		
APPROVED BY:		
	SIGNATURE	DATE

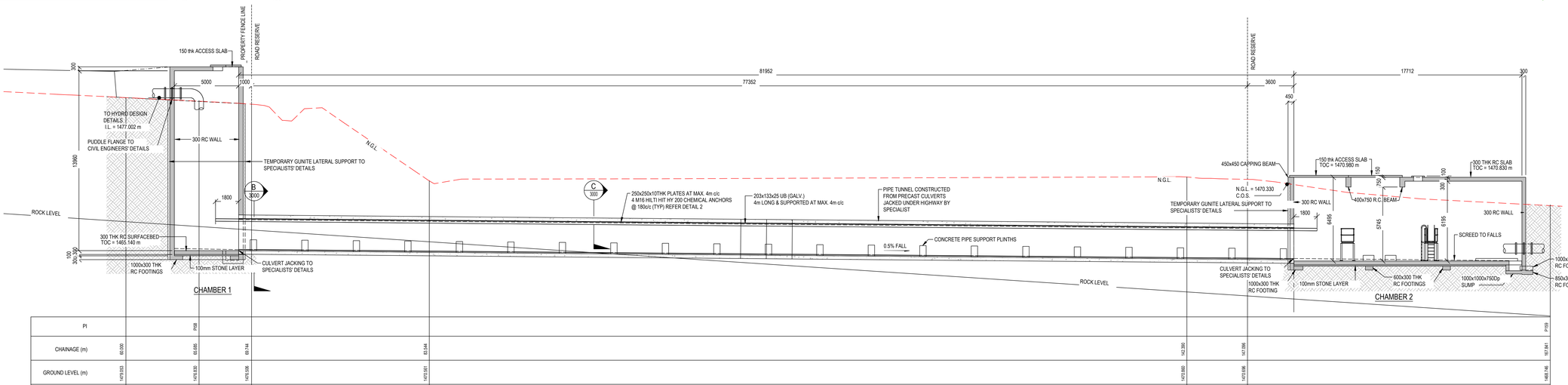
SCALE: AS SHOWN

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	FOR TENDER	31.10.24

DRAWING No.
111242 - 0000-DRG-WW-0521 - T0
PROJECT No. / DRAWING No. / REV.
A1 ORIGINAL PAGE SIZE
SHEET 1 OF 1
FILE No.



01-PLAN LAYOUT
1 : 125



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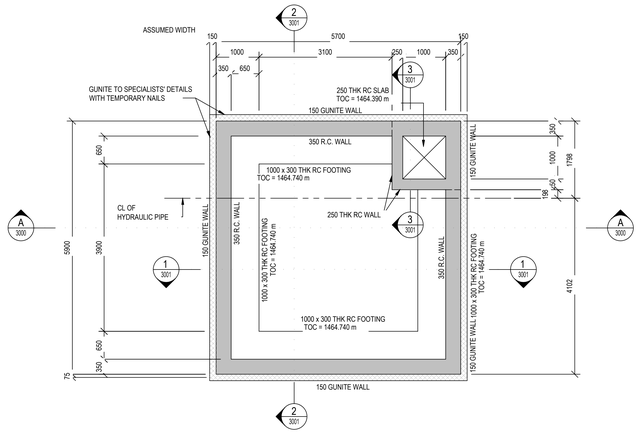
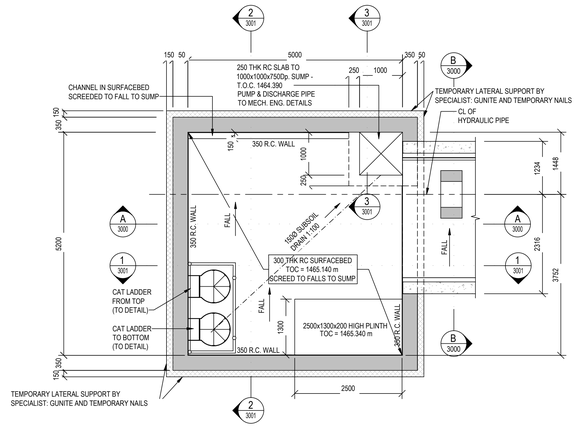
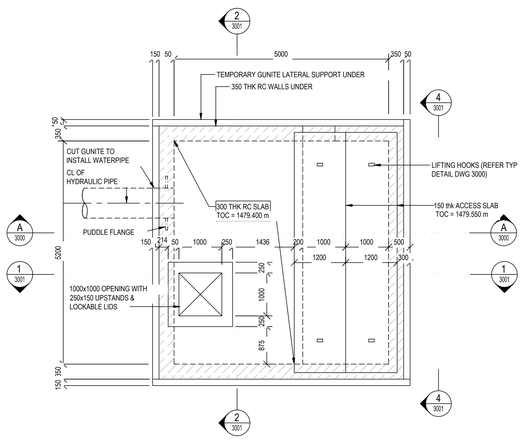


CHAMBER 1 - FOUNDATION LAYOUT
1 : 50

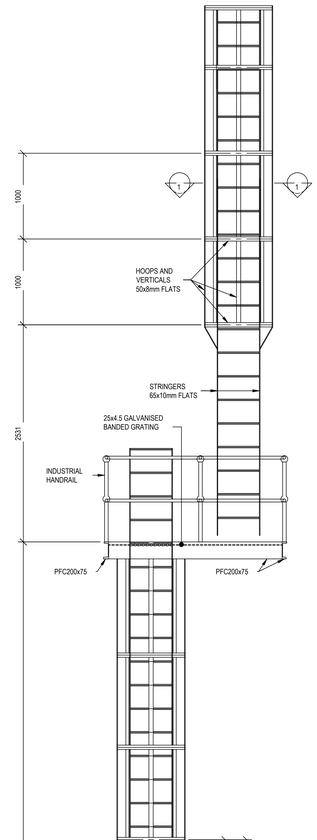


CHAMBER 1 - SURFACEBED LAYOUT
1 : 50



CHAMBER 1 - ROOF PLAN
1 : 50

NOTE:
OPENING IN WALL REQUIRED FOR VENT POSITION & SIZE TBC



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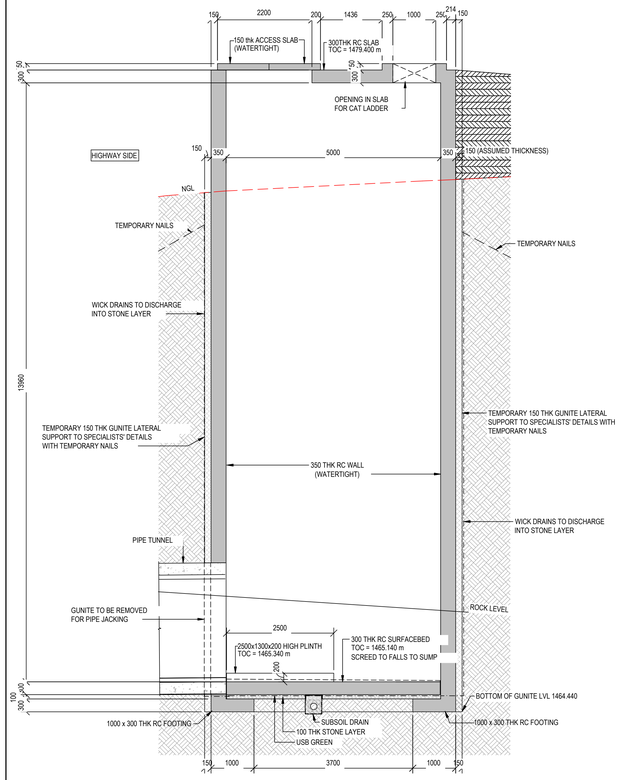
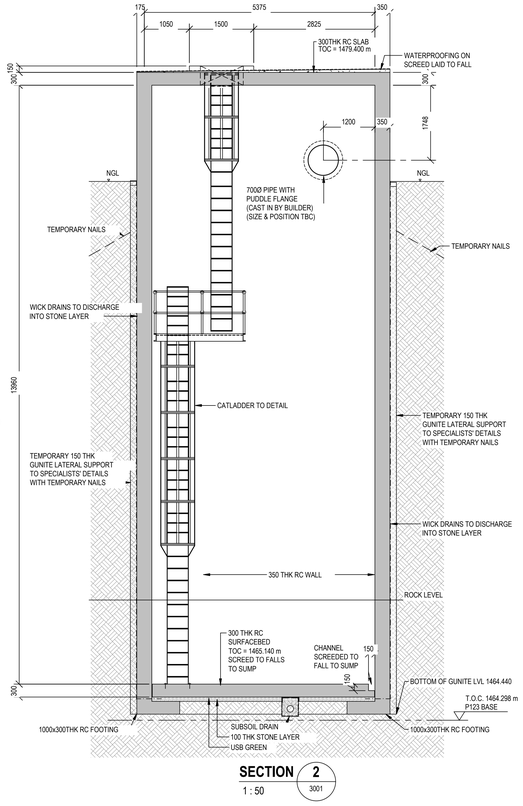
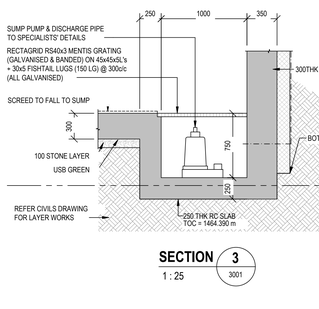


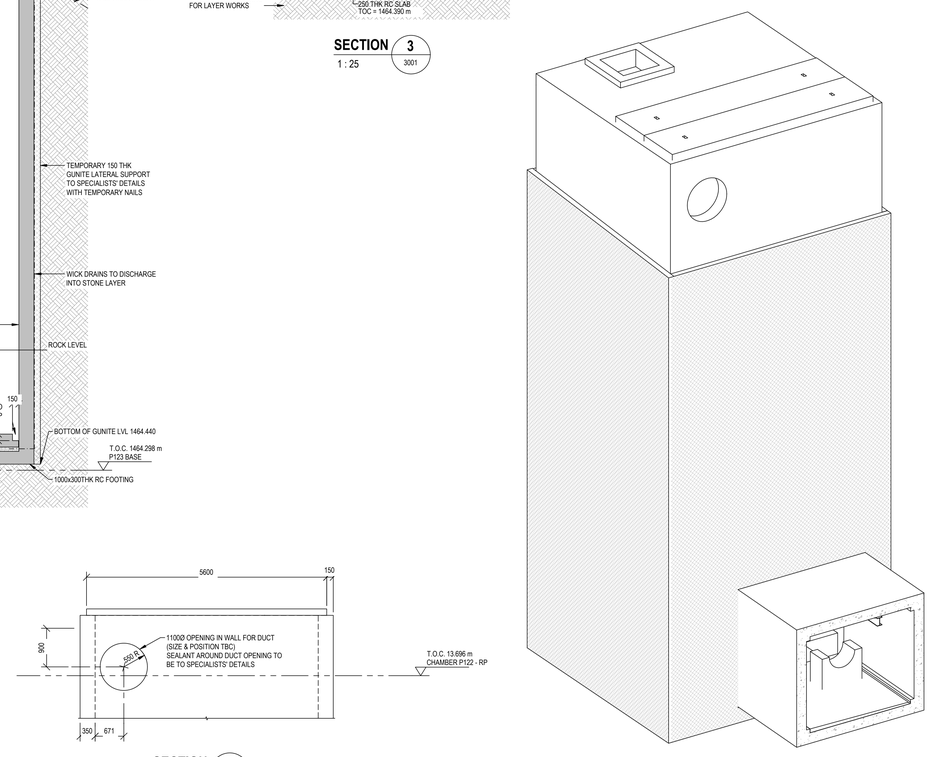
SECTION 1
1 : 50
3001



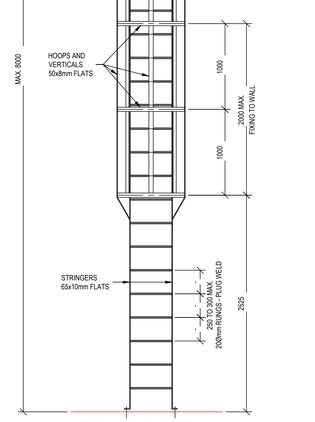
SECTION 2
1 : 50
3001



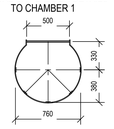
SECTION 3
1 : 25
3001



3D VIEW CHAMBER 1



TYPICAL CAT LADDER DETAILS TO CHAMBER 1



TYPICAL SECTION 1-1 THRO' CAT LADDER

SECTION 4
1 : 50
3001

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DRAWN	C. LEENDERTS	OCTOBER 2024
CHECKED	S. YATES	OCTOBER 2024
APPROVED BY:	M. AXELROD	OCTOBER 2024
	SIGNATURE	DATE
ECSA REG. No.		
CHECKED BY:		
	SIGNATURE	DATE
ECSA REG. No.		

Johannesburg Water

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HALFWAY HOUSE WATER UPGRADE

CHAMBER 1
LAYOUT, SECTIONS, DETAILS & 3D VIEW

APPROVAL BY JW DEPOT			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

SCALE

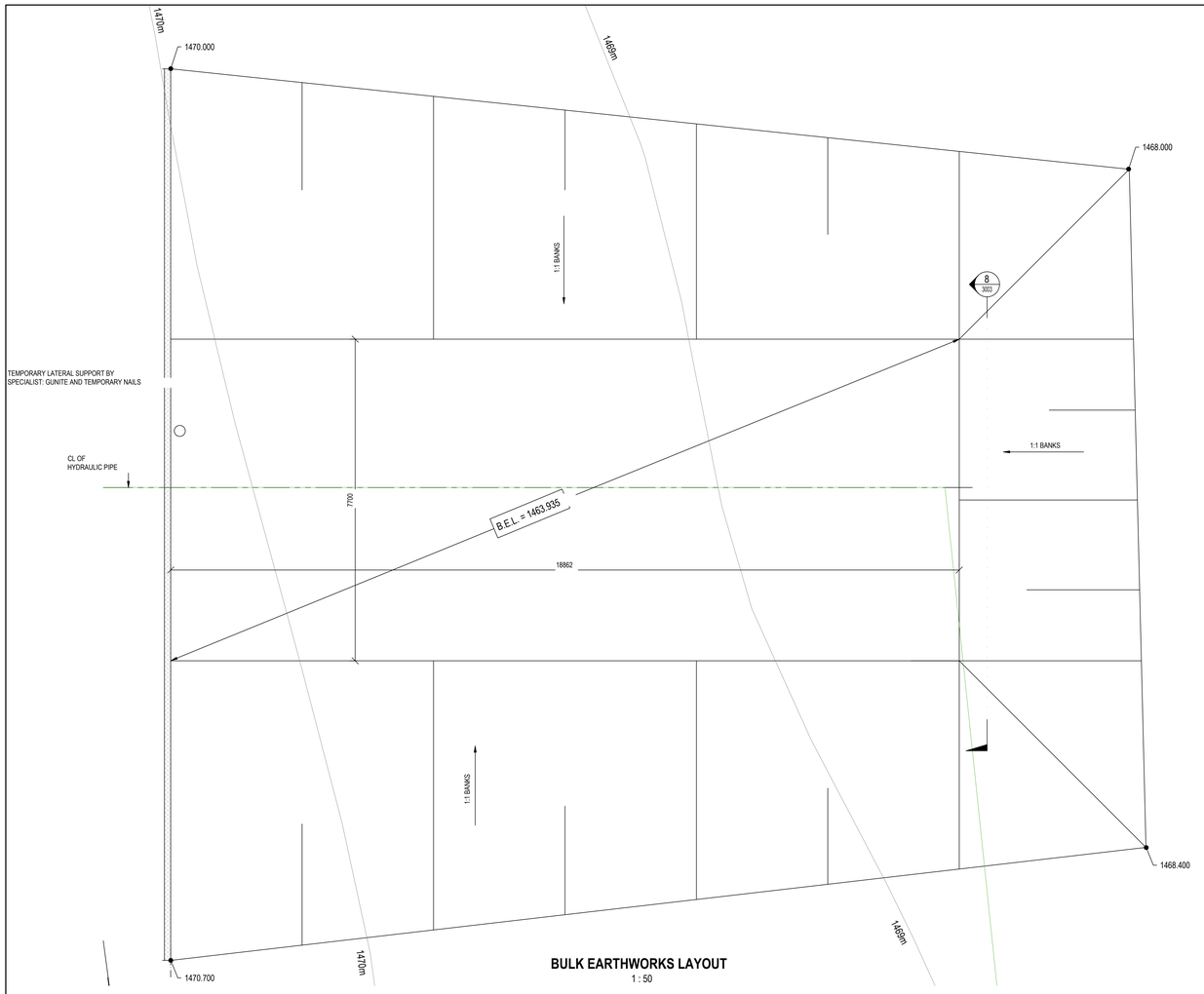
AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	11/2021
T1	ISSUED FOR RE-TENDER	11/2024

DRAWING No.

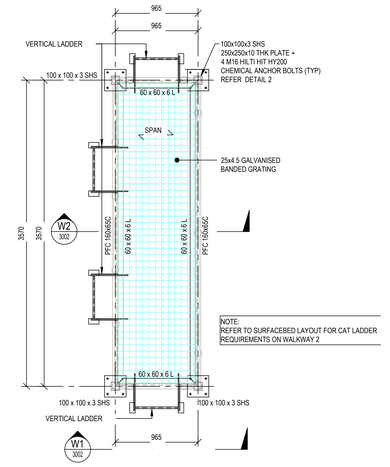
111242 - 0000-DRG-SS-3001 - T1
PROJECT No. | DRAWING No. | REV.

A0 ORIGINAL PAGE SIZE | SHEET 1 OF 1

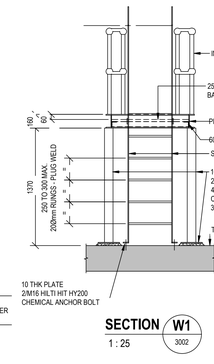
FILE No.



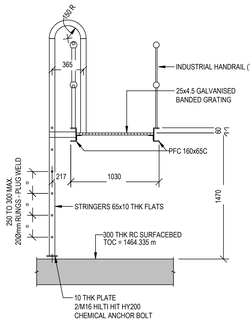
BULK EARTHWORKS LAYOUT
1 : 50



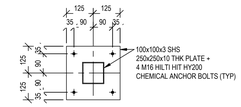
WALKWAY 1 DETAIL (WALKWAY 2 SIMILAR)



SECTION W1
1 : 25



SECTION W2
1 : 25



DETAIL 2
1 : 10

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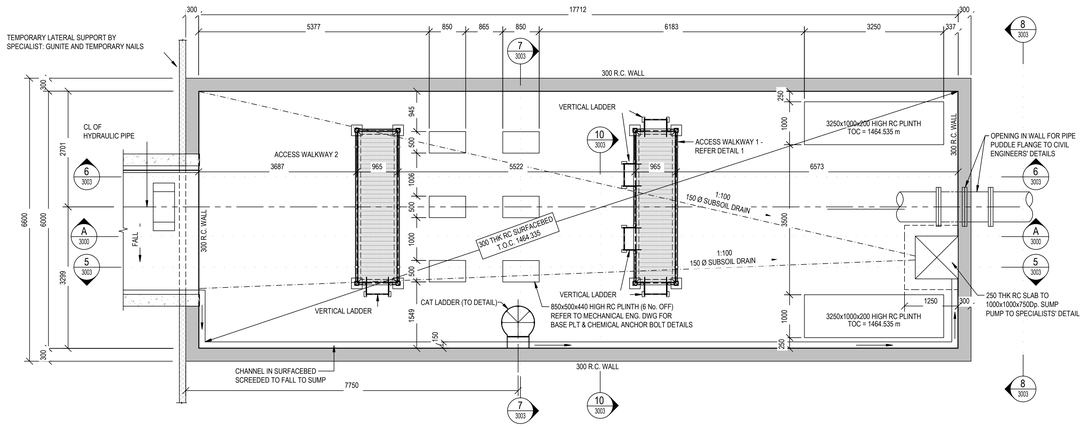
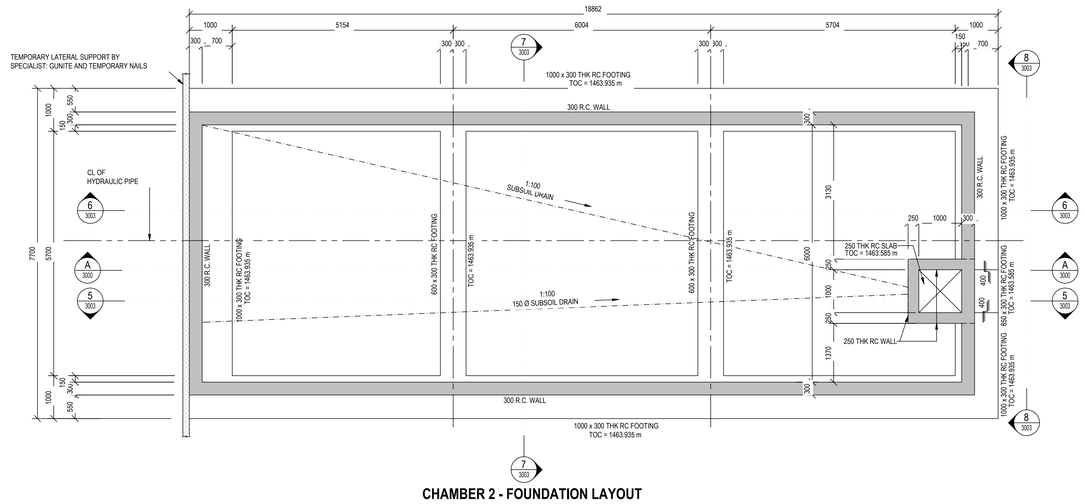
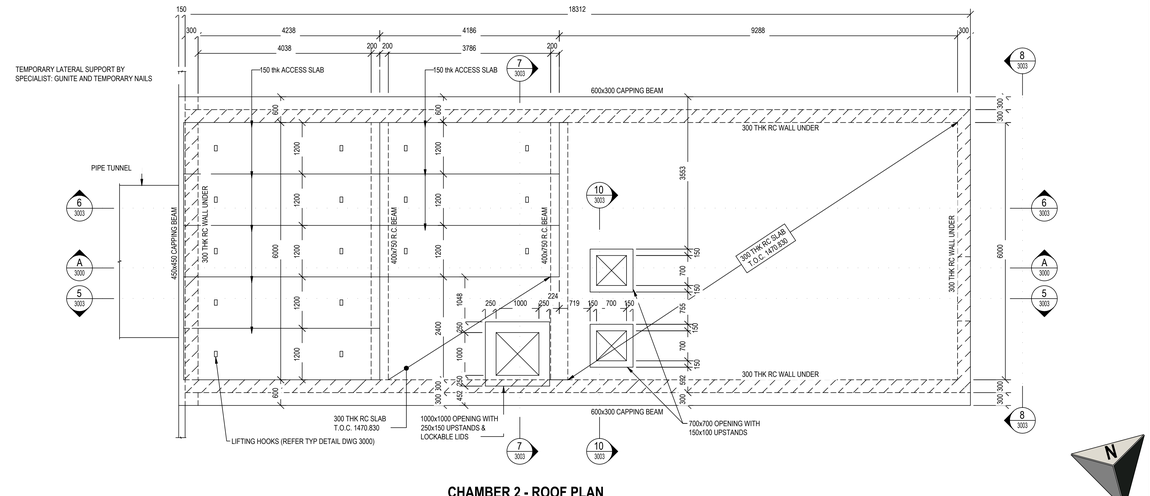


CHAMBER 2 - SURFACEBED LAYOUT
1 : 50



CHAMBER 2 - FOUNDATION LAYOUT
1 : 50



CHAMBER 2 - ROOF PLAN
1 : 50

CONSULTING ENGINEERS			
ZUTARI IMPACT. ENGINEERED.	DESIGNED	M. AXELROD	OCTOBER 2024
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	CHECKED	S. YATES	OCTOBER 2024
	APPROVED BY:	M. AXELROD	OCTOBER 2024
		SIGNATURE	DATE
	ECSA REG. No.		
CLIENT	CHECKED BY:		
		SIGNATURE	DATE
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HALFWAY HOUSE WATER UPGRADE

CHAMBER 2
LAYOUT, SECTIONS, DETAILS

APPROVAL BY JW DEPOT			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	
APPROVAL BY JW PLANNING			
CHECKED			
APPROVED BY:			
	SIGNATURE	DATE	

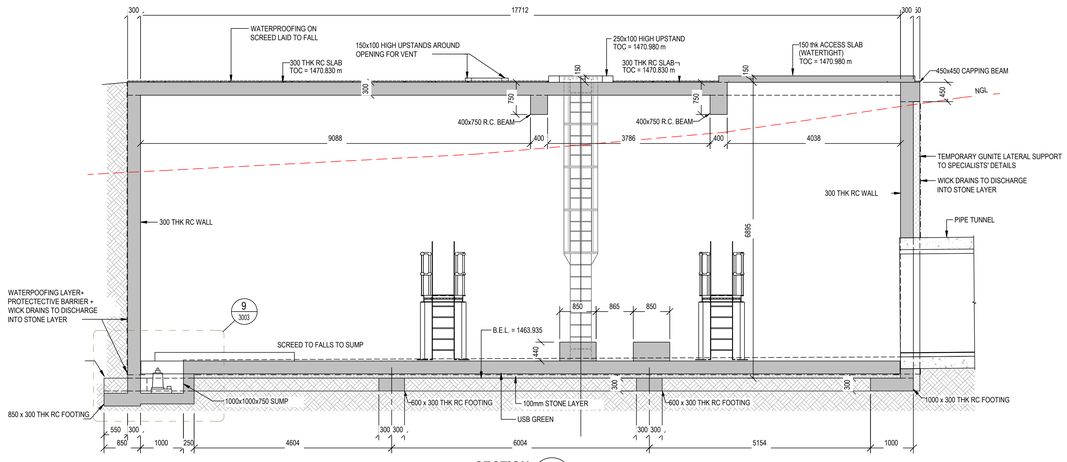
SCALE

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	11/2021
T1	ISSUED FOR RE-TENDER	11/2024

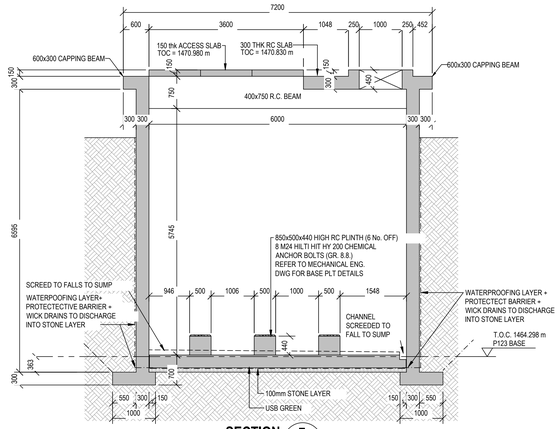
DRAWING No.

111242 - 0000-DRG-SS-3002 - T1
PROJECT No. DRAWING No. REV.

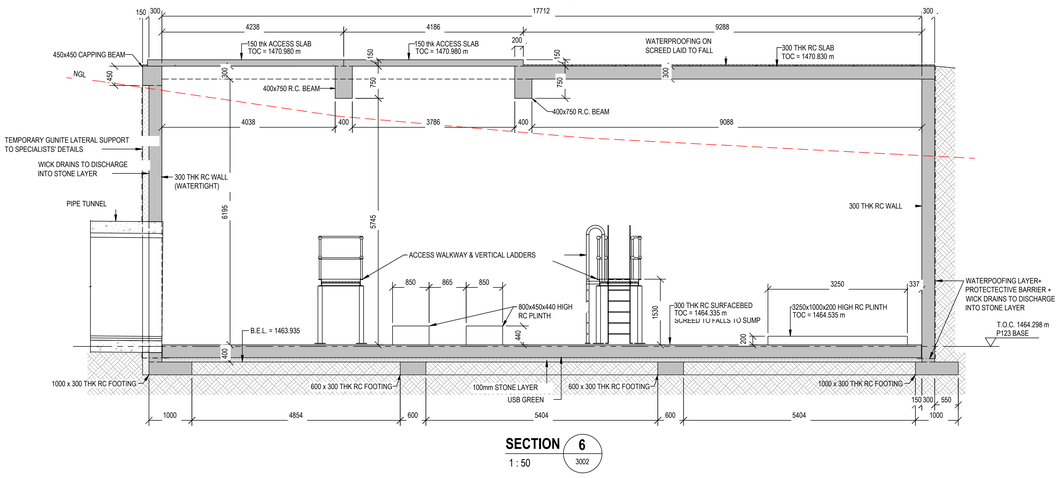
A0 ORIGINAL PAGE SIZE
SHEET 1 OF 2
FILE No.



SECTION 5 (3002) — 1 : 50



SECTION 7 (3002) — 1 : 50



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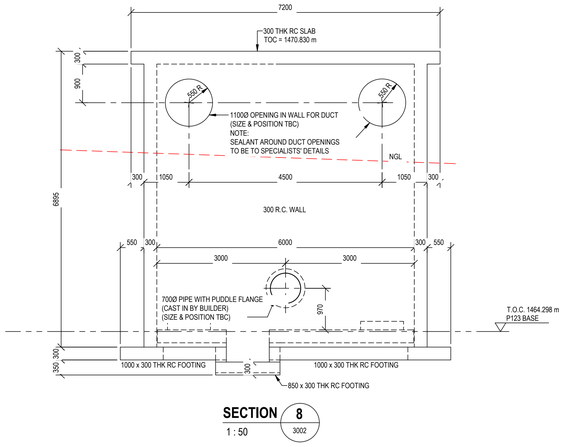
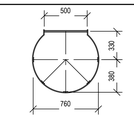


SECTION 8 (3002) — 1 : 50

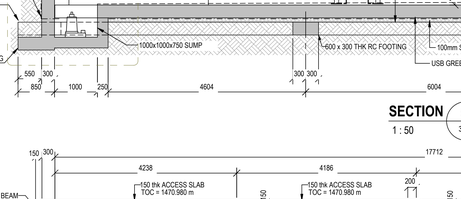
TYPICAL CAT LADDER DETAILS



TYPICAL SECTION 1-1
THRO' CAT LADDER

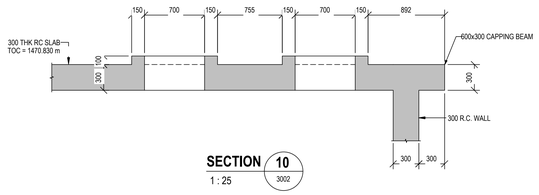
TYPICAL SECTION 1-1
THRO' CAT LADDER

Halfway House Cat Ladder Chamber 2
1 : 25

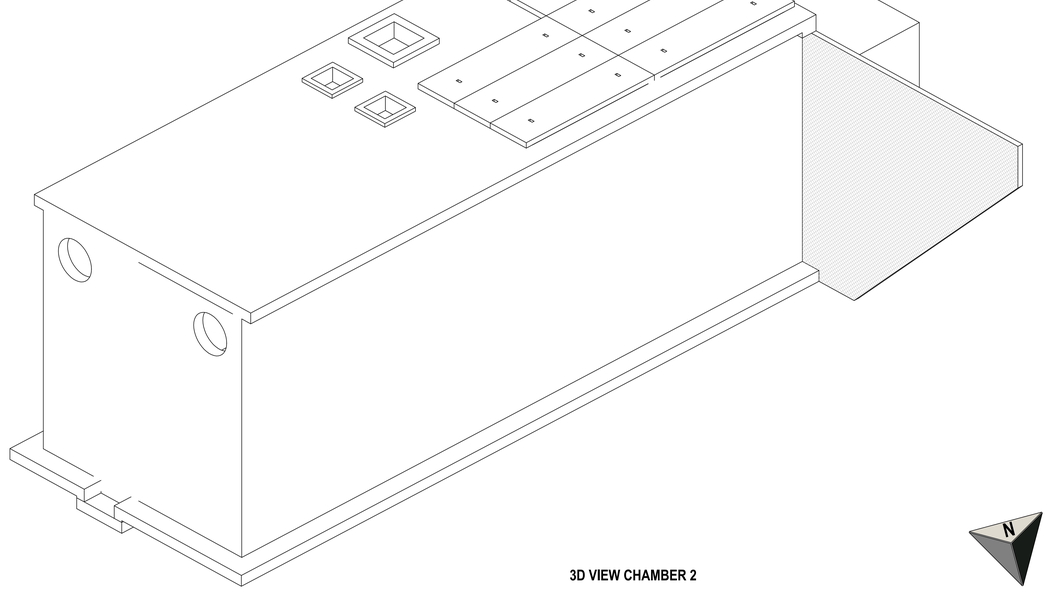


1000x1000x750Dp. SUMP
1 : 25

9 (3003)



SECTION 10 (3002) — 1 : 25



3D VIEW CHAMBER 2

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2001

DESIGNED	M. AXELROD	OCTOBER 2024	
DRAWN	C. LEENDERTS	OCTOBER 2024	
CHECKED	S. YATES	OCTOBER 2024	
APPROVED BY:	M. AXELROD	OCTOBER 2024	
	SIGNATURE	DATE	
ECSA REG. No.			
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

CHAMBER 2

LAYOUT, DETAILS & 3D VIEWS

APPROVAL BY JW DEPOT			SCALE
CHECKED			
APPROVED BY:			
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APPROVAL BY JW PLANNING			
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APPROVED BY:			
	SIGNATURE	DATE	

AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	11/2021
T1	ISSUED FOR RE-TENDER	11/2024

DRAWING No.

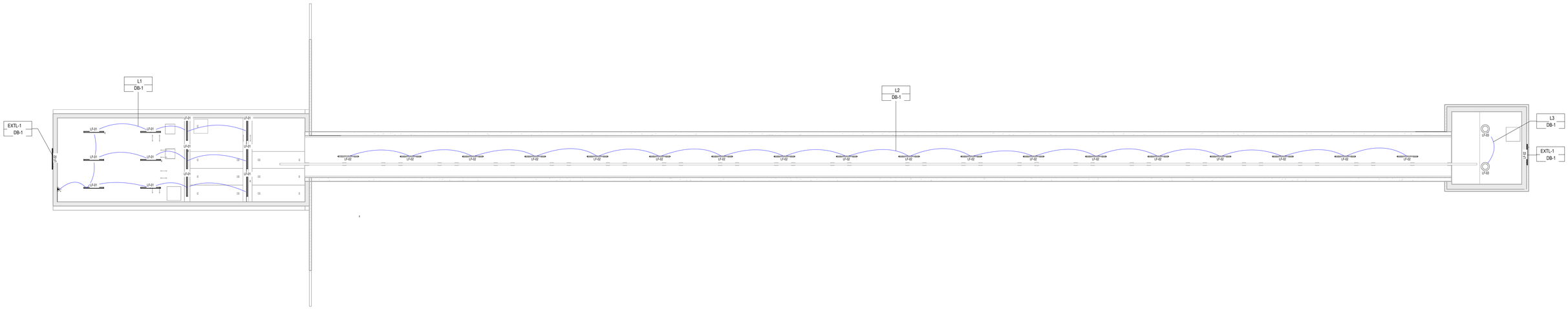
111242 - 0000-DRG-SS-3003 - T1
PROJECT No. / DRAWING No. / REV.

A0 ORIGINAL PAGE SIZE | SHEET 2 OF 2

FILE No.

ELECTICAL LEGEND

	TYPE L5 - 58W LED 400K VAPOUR PROOF FITTING SURFACE MOUNTED AT 2500mm AFFL
	TYPE L6 - 58W LINEAR 4000K FLOODLIGHT SURFACE MOUNTED AT 6000mm
	TYPE L8 - 18W BULKHEAD LED 400K WALL MOUNTED AT 4500mm AFFL
E	DENOTES EMERGENCY LIGHT FITTING WITH EMERGENCY BACKUP
	TYPE L9 - 170-200W LED LOW BAY LIGHT FITTING 400K MOUNTED AT 14m AFFL
PE	PHOTOCELL MOUNTED AT 5600mm AFFL
	20A WEATHER PROOF SWITCHED SOCKET OUTLET MOUNTED AT 1200mm AFFL
	LIGHT SWITCH SURFACE MOUNTED AT 2600mm AFFL
	20A SINGLE PHASE ISOALTOR WEATHERPROOF IP65 SSO MOUNTED AT +1200mm AFFL
	20A THREE PHASE ISOLATOR WEATHERPROOF IP65 SSO MOUNTED AT +1200mm AFFL
	MCC/DISTRIBUTION BOARD MOUNTED AT 1200mm AFFL TO BOTTOM OF DB
	P8000 300mm TRUNKING ELECTRICAL SERVICES
	1500mm DIA CABLE MESH TRAY- DATA SERVICES
	P2000 - POWER TRUNKING



1 ELECTRICAL LIGHTING PLAN
1 : 100

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APPROVED BY:	J.MUTALE		
	SIGNATURE	DATE	01-11-2024
ECSA REG. No.	20130921		
CHECKED BY:			
	SIGNATURE	DATE	
ECSA REG. No.			

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HALFWAY HOUSE WATER UPGRADE

ELECTRICAL SERVICES
LIGHTING LAYOUT

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111242 - 0000- DRG- EL-2000 - T0
PROJECT No. DRAWING No. REV.

A0 ORIGINAL PAGE SIZE
SHEET 1 OF 1
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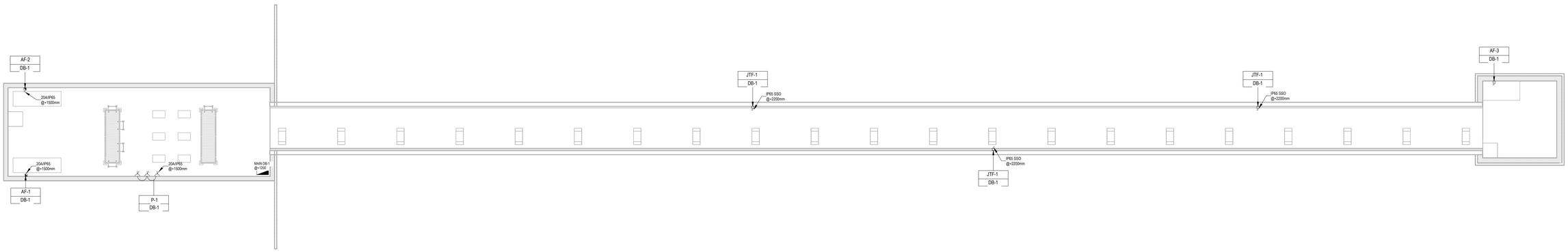
	1500mm DIA CABLE MESH TRAY- DATA SERVICES
	P2000 - POWER TRUNKING



ELECTRICAL POWER PLAN
1 : 100

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HALFWAY HOUSE WATER UPGRADE

ELECTRICAL SERVICES
POWER LAYOUT

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111242 - 0000- DRG- EL-2001 - T0
PROJECT No. DRAWING No. REV.

A0 SHEET 1 OF 1
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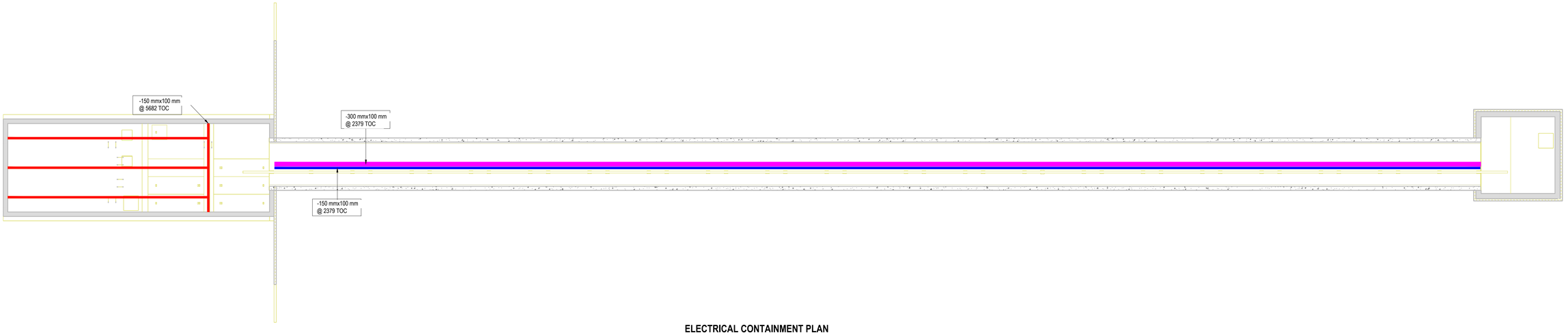

ELECTRICAL CONTAINMENT PLAN
1 : 100

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	SIGNATURE	DATE	01-11-2024
ECSA REG. No.	20130921		
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HALFWAY HOUSE WATER UPGRADE

ELECTRICAL SERVICES
CONTAINMENT LAYOUT

APPROVAL BY JW DEPOT			SCALE
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APPROVAL BY JW PLANNING			
CHECKED			
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AMENDMENTS		
REV:	DESCRIPTION	DATE:
T0	ISSUED FOR TENDER	01-11-2024

DRAWING No.

111242 - 0000- DRG- EL-2002 - T0
PROJECT No. DRAWING No. REV.

A0 SHEET 1 OF 1
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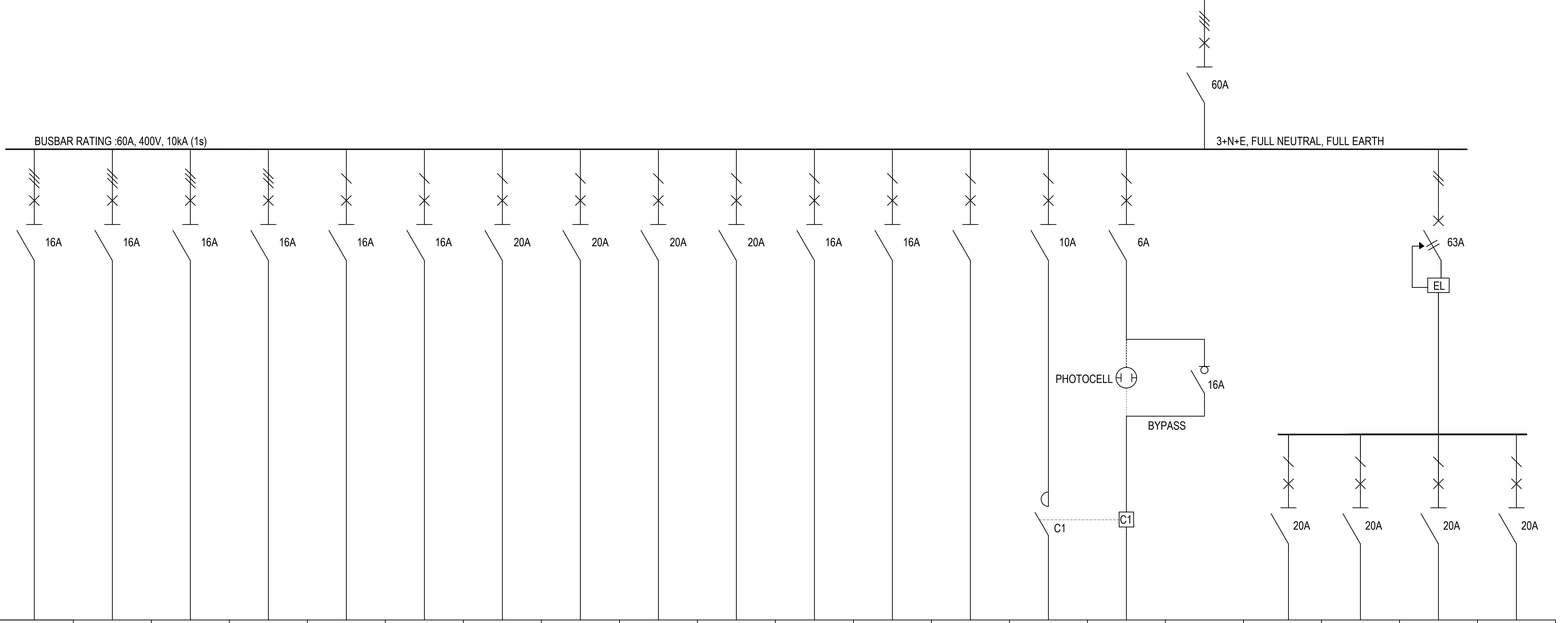
FILE No.

DB NUMBER	DB-1
SUPPLY FROM	MUNICIPALITY MINISUB
UPSTREAM C/B SIZE	80A
CABLE SIZE	4C x 25mm² PVC/PVC/SWA/PVC
EARTH CABLE SIZE	16mm² BCEW



WAY No.	1-3	4-6	7-9	10-12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	27
NUMBER OF CORES	4C	4C	4C	4C	4C	4C	2C	2C	2C	2C	2C	2C	2C	2C	2C	-	2C	2C	2C	
CONDUCTOR SIZE	4	4	4	4	4	4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.5	-	2.5	2.5	2.5	
ECC SIZE	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.5	-	2.5	2.5	2.5	
CIRCUIT DESIGNATION	-	-	-	-	-	-	-	-	-	-	L1	L2	L3	EXTL-1	C1	-	P1	P2	P3	
DESCRIPTION	JTF-1	JTF-2	JTF-3	HO-1	VA-1	VA-2	AF-1	AF-2	AF-3	AF-4	LIGHT CIRCUIT	LIGHT CIRCUIT	LIGHT CIRCUIT	EXTERIOR LIGHT CIRCUIT	CONTACTOR FOR EXTERNAL LIGHTS	BYPASS	POWER CIRCUIT	POWER CIRCUIT	POWER CIRCUIT	EQUIPMENT SPARE
	JET FAN 1	JET FAN 2	JET FAN 3	HOIST	VALVE ACTUATOR 1	VALVE ACTUATOR 2	AXIAL FLO W FAN 1	AXIAL FLO W FAN 2	AXIAL FLO W FAN 3	AXIAL FLO W FAN 4										

Single Line Diagram
NTS

DISTRIBUTION BOARD SPECIFICATION

METHOD OF INSTALLATION		ACCESS REQUIREMENTS		CONSTRUCTION DATA		COMPARTMENTS		CABLE ENTRY		FINAL FINISH		ELECTRICAL DATA		SPARE SPACE		PREFERRED EQUIPMENT	
FLOOR STANDING		OPEN CONSTRUCTION		MILD STEEL 1.6mm	●	INCOMER SECTION		TOP	●	EPOXY POWDER COATED	YES	MAIN BUSBAR RATING	DWG	3 POLE 10kA	-	AIR CIRCUIT BREAKER	
WALL MOUNTED	●	DOORS	●	MILD STEEL 2.0mm		NORMAL SECTION	●	BOTTOM	●	DB COLOUR	ORANGE	VOLTAGE RATING	DWG	3 POLE 5kA	-	CIRCUIT BREAKERS	
FLUSH		LOCKABLE DOORS	●	ELECTRO GALVANISED		EMERGENCY SECTION		REAR		NORMAL SECTION		SUB BUSBAR FAULT LEVEL	DWG	1 POLE 5kA	20%	SURGE ARRESTORS	
PEDESTAL MOUNTED		FRONT ACCESS	●	STAINLESS STEEL		UPS SECTION		SIDE		EMERGENCY SECTION		CONTROL VOLTAGE	-	TABULAR COMPONENTS	-	CONTACTORS	
KIOSK		REAR ACCESS		3CR12	●	TABULAR CONSTRUCTION		NEUTRAL / EARTH		UPS SECTION		FREQUENCY	50Hz	MECHANICAL SPACE	30%	TERMINALS	
ARCHITRAVE		REMOVABLE GLAND PLATES	●	FIBRE GLASS		METERING/INDICATION		FULL NEUTRAL	●			SURGE ARRESTOR RATING	-			INDICATING LAMPS	
OVER TRENCH		DOOR INTERLOCK		IP65	●	CONTROL TRANSFORMER		HALF NEUTRAL				POWER FACTOR CORRECTION				INSTRUMENTS	
SURFACE								EARTH BAR	●							PFC CONTROLLER	
								EARTH STUD									
								INSULATED EARTH									

NOTES

1. SEE DRAWING 111229-060-DR-EL-000 FOR LEGEND.
2. REFER TO PROJECT SPECIFICATION FOR POWER METER REQUIREMENTS.
3. INSTALLATION TO BE IN ACCORDNCE WITH SANS 10142-1 & 10142-2.
4. PHOTOCELL SENSOR LOCATED OUTSIDE OF DB TO BE WIRED TO EXTERNAL PHOTOCELL RELAY.
5. FUSED SWITCH DISCONNECTORS TO COME C/W FUSE MONITORS.

LEGEND	
	ISOLATOR (3-PHASE)
	CIRCUIT BREAKER (3-PHASE)
	CIRCUIT BREAKER (1-PHASE)
	FUSE HOLDER(LABELLED)
	SURGE PROTECTION DEVICE
	EARTH LEAKAGE

NOTES

1. DB TYPE-
   FLOOR STANDING: NO
   SURFACE WALL MOUNTING: YES
   FLUSH WALL MOUNTING: NO
2. CABLE ENTRIES-
   TOP: YES
   BOTTOM; YES
3. DB ACCESS PLATES-
   TOP: NO
   SIDES: NO
   REAR: NO
4. PADLOCKABLE DOORS: YES
5. COLOURS-
   INTERNAL: WHITE
   EXTERNAL: WHITE
6. SPARE SPACE: 15%
7. SPACE LIMITATION - DB NOT TO EXCEED-
   HEIGHT: N/A
   WIDTH: N/A
   DEPTH: N/A
8. PAINT FINISH: POWDER COATED.
9. DB TO BE PROVIDED WITH REMOVALE GLAND PLATE AT THE BOTTOM.
10. PROVISION FOR 1x P9000 ENTRY TO BE PROVIDED AT TOP OF DB.
11. BUSBAR TO HAVE COLOUR CODE INDICATION.
12. ALL CIRCUITS TO BE LABELLED IN FACTORY, AS PER DESCIPTION INDICATED.
13. ALL CONTACTORS, TERMINALS, etc, TO BE LABELLED, AS INDICATED ON DRAWING, ie."C1" / "T1".
14. ALL SWITCHGEAR TO BE OF ABB OR SCHNEIDER MANUFACTURE.
15. BY-PASS SWITCH TO BE MOUNTED BEHIND FACEPLATE.
16. WHERE MORE THAN ONE CABLE IS TO BE CONNECTED TO A CIRCUIT BREAKER, THE CIRCUIT BREAKER SHALL BE PROVIDED WITH BUSBAR STUBS AND FLASH BARRIERS.
17. ALL LARGE FRAME BREAKERS TO BE PROVIDED WITH FLASH BARRIERS.
18. DB TO BE PROVIDED WITH PLASTIC COVERED, A4 LEGEND CARD HOLDERS.
19. DESCRIPTION ON LEGEND CARDS SHALL BE TYPED.
20. ALL SHOP DRAWINGS TO BE SUBMITTED TO THE ENGINEER, FOR COMMENTS AND APPROVAL, PRIOR TO MANUFACTURE.

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HALFWAY HOUSE WATER UPGRADE

ELECTRICAL SERVICES

DISTRIBUTION BOARD SINGLE LINE DIAGRAM

APPROVAL BY JW DEPOT			
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SCALE 1:100

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