



CONTRACT JW14455
DIEPSLOOT SEWAGE AQUEDUCT



TENDER COVER PAGE

MBD 1

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF JOHANNESBURG WATER

BID NUMBER: JW14455

CLOSING DATE: 16 MAY 2025

CLOSING TIME: 10:30 AM

DESCRIPTION: DIEPSLOOT SEWAGE AQUEDUCT

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

BRIEFING SESSION	COMPULSORY
BRIEFING DETAILS	DATE AND TIME: 17 APRIL 2025 AT 13:00 ADDRESS: CRN CYPRESS AND ALOES STREETS, RIVERSIDE VIEW, DIEPSLOOT, JOHANNESBURG, 2001 (BEHIND CURRO ACADEMY, RIVERSIDE) TENDERS RECEIVED FROM NON-ATTENDED BIDDERS OF A COMPULSORY BRIEFING SESSION WILL BE DISQUALIFIED
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	TREAH HLUNGWANI	CONTACT PERSON	GCINA NDELA
TELEPHONE NUMBER	011 688 1669	TELEPHONE NUMBER	011 688 1796
E-MAIL ADDRESS	treah.hlungwani@jwater.co.za	E-MAIL ADDRESS	gcina.ndela@jwater.co.za



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NOTE: 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 current Johannesburg Water Supply Chain policy 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:



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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.



TENDER NOTICE AND INVITATION TO TENDER



1. TENDER NOTICE AND INVITATION TO TENDER

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

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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 08 APRIL 2025

The Employer is Johannesburg Water.

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 16 MAY 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.



Contract JW14455

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Volume 1 Tender and Contract
Section T1 Tender and Contract



Johannesburg Water SOC Ltd



CONTRACT NO: JW14455

DIEPSLOOT SEWAGE AQUEDUCT

VOLUME 1

TENDER AND CONTRACT

Prepared by
PMU
PO Box 61542
Marshalltown
2107

V2.0
August 2023



Contract JW14455

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Section T1 Tender and Contract



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

Ref	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	•			
	COIDA Registration Number			•	
	Tax SARS PIN No.		•		
	MAAA No. for Tax Compliant Status		•		
2	Mandatory Documents at Particular Stage:				
	CIDB grading of 9CE. Active Status at the required CIDB grading or higher at the time of Evaluation	•			
	Mandatory Tender Briefing Meeting	•			
	Complete and sign the Form of Offer	•			
	JW 6.5 Returnable Annexure B: Acknowledgement of Tender Drawings	•			
3	Administrative Documentation:				
	T2.1 Signed Certificate of Authority to Sign	•	•		
	MBD 1 - Invitation to Bid - Completed and signed	•	•		
	Central Supplier Database Registration	•			
	T2.2.4 MBD 4 - Declaration of interest - Completed and signed	•	•		
	MBD 5 - Declaration for procurement above R10 Million (all applicable taxes included) - Completed and signed.	•	•		

Employer:		Contractor:	
Witness:		Witness:	



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Ref	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)
T2.2.4	MBD 6.1 - Preference Points Schedule – Specific Goals and Price Points - Completed and signed.	•			
	JW 6.4 Returnable Annexure A – SHE Acknowledgment Form		•		
	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 Company - Current municipal rates for the company 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 OR Current municipal rates which is not older than 90 days or valid lease agreement with affidavit from owner of property in cases stated in Proof of Good Standing with Regards to Municipal Accounts document in the Tender.	•	•		
	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 OR Current municipal rates which is not older than 90 days or valid lease agreement with affidavit from owner of property in cases stated in Proof of Good Standing with Regards to Municipal Accounts document in the Tender.	•	•		
	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 the qualification may impede on the ability to evaluate like with like.	•	•		
4.	Functionality Documentation:				
	Documentary Evidence Required for Criteria 1 – (Contactable Reference Letters and Completion / Final Approval Certificates)	•			

Employer:		Contractor:	
Witness:		Witness:	



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Ref	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)
	Documentary Evidence Required for Criteria 2 – (CV, qualifications and valid registration)	•			
	Documentary Evidence Required for Criteria 3 – (CV, qualifications and valid registration)	•			
	Documentary Evidence Required for Criteria 4 – (CV, qualifications and valid registration)	•			
	Documentary Evidence Required for Criteria 5 – (CV, qualifications and valid registration)				
	Documentary Evidence Required for Criteria 6 – (Site specific method statement)	•			
5.	Specific Goals:				
	Documentary Evidence Required for Criteria 1 – (Valid Construction Sector BBBEE Certificate issued by SANAS accredited verification agency or DTI/CIPC BBBEE Certificate for Exempted Micro Enterprises or Affidavit sworn under oath, OR CIPC registration document showing percentage of ownership and share certificate where applicable)	•			
	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)	•			
6.	Scope of Work:				
	Scope of Work and or Specifications	•			
7.	Pricing Schedule:				
	Bill of Quantities/ Schedule of Quantities. completed	•			
	Alterations authenticated – Refer to Acknowledgment of Tender Conditions	•			
8.	Site Information:				
	Site Information	•			
9.	Occupational Health, Safety and Environmental Specification				
	Acknowledgement of SHE Specification & Annexures	•			
10.	Tender Drawings:				
	Acknowledgement of Project Tender Drawings	•			
11.	Terms and Conditions:				
	General Conditions of Contract	•			
	Tender Data	•			
	Pricing Data	•	•		
12.	Other Documents				
	Form of Acceptance (do not complete Form of Acceptance it will be completed by JW official)			•	
	Public Liability Insurance			•	
	Valid Registration with Compensation for Occupation Injuries and Diseases Act			•	
	Performance Security – where applicable for			•	

Employer:		Contractor:	
Witness:		Witness:	



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Ref	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)
	industrial related services				
	Comprehensive Health and Safety Plan (compliance with OHSE Specification - if applicable)			•	
	Bank Details Form			•	

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 _____

Employer:		Contractor:	
Witness:		Witness:	



Johannesburg Water (SOC) Ltd



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VOLUME 1

PART 1: TENDERING PROCEDURES



CONTRACT JW14455
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TENDERING DATA



Volume 1 Tender and Contract - Section T1 Tender and Contract

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Volume 1 Tender and Contract - Section T1 Tender and Contract

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 Part 3: Scope of Work C3.1 Scope of Work C3.2 Particular Specifications Part 4: Site Information C4 Site Information Volume 2 Occupational Health, Safety and Environmental Specification Environmental Management Plan Volume 3 Tender Drawings



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Clause number	Tender Data
C.1.4	The Employer's representative is: Contact Person: Treah Hlungwani Telephone: 011 688 1669 E-mail address: treah.hlungwani@jwater.co.za The SCM representative is: Contact Person: Gcina Ndela Telephone: 011 688 1796 E-mail address: gcina.ndela@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 an 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 9CE 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.
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 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.



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Clause number	Tender Data
	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 disqualification 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, <i>as well as the Tenderer's name, their Authorised Representative's name, postal address and telephonic contact numbers.</i>
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:



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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



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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.



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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 functionality, 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 <i>Form of Offer</i>, (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.



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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. 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. <table border="1"> <thead> <tr> <th>STAGE</th><th>DESCRIPTION</th></tr> </thead> <tbody> <tr> <td>Stage 1</td><td>Mandatory Evaluation</td></tr> <tr> <td>Stage 2</td><td>Administrative Evaluation</td></tr> <tr> <td>Stage 3</td><td>Technical Evaluation</td></tr> </tbody> </table>	STAGE	DESCRIPTION	Stage 1	Mandatory Evaluation	Stage 2	Administrative Evaluation	Stage 3	Technical Evaluation
STAGE	DESCRIPTION								
Stage 1	Mandatory Evaluation								
Stage 2	Administrative Evaluation								
Stage 3	Technical Evaluation								



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Clause number	Tender Data			
	<u>Stage 1: Mandatory Evaluation</u>			
	Description			Complied
	No	Description	Yes	No
	1	CIBD grading 9CE. Active Status at the required CIBD grading or higher at the time of Evaluation		
	2	Mandatory Tender Briefing Meeting		
	3	Form of Offer Completed and Signed		
	4	JW 6.5 Returnable Annexure B: Acknowledgement of Tender Drawings		
Tenderers who FAIL to meet the mandatory criteria or requirements of tender will result in disqualification.				



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Clause number	<u>Tender Data</u>				
	<u>Stage 2: Administrative Evaluation</u>				
	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		
	JW 6.4	Returnable Annexure A – SHE Acknowledgment Form	Completed and signed		
	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		
	MBD 9	Certificate of Independent Bid Determination	Complete and submit signed MBD 9 Form		



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Clause number	Tender Data				
	Description			Complied	
	Reference	Description	Requirement	Yes	No
	Annexure – Proof of Specific Goals	Valid Construction Sector BBBEE Certificate issued by SANAS accredited verification agency or DTI/CIPC BBBEE Certificate for Exempted Micro Enterprises or Affidavit sworn under oath, OR CIPC registration document showing percentage of ownership and share certificate where applicable	Submit applicable documentation with the tender submission		
	Annexure – Proof of Specific Goals	Valid Construction Sector BBBEE Certificate issued by SANAS accredited verification agency or DTI/CIPC BBBEE Certificate for Exempted Micro Enterprises or Affidavit sworn under oath, OR CIPC registration document 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 Company (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		
		Signed BOQ	Form in Tender Document		



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Clause number	<u>Tender Data</u>				
	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 audited financial statements	Submit applicable documentation with the tender submission		
	Annexure	Joint Venture Consortium or equivalent Agreement signed by all parties, where applicable	Where 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.				



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Clause number	Tender Data					
	Stage 3: Technical Evaluation					
	CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE
	1	Tenderers Experience with Respect to Reinforced Concrete Bridge Structures with project value of R10 Million and Pipe Installation projects with a minimum diameter of 1000mm with project values of a	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. <i>Note: This reference letter must be completed by the referee/previous client of the tenderer and included in the tender submission. Alternatively, the Clients letterhead may be used provided it complies with the functional requirements. A separate form must be completed for each reference as a requirement in the evaluation criteria. The</i>	REFERENCES FOR THE NUMBER OF COMPLETED REINFORCED CONCRETE BRIDGE STRUCTURES WITH PROJECT VALUES OF A MINIMUM OF R10M.	Completed 0 - 1 Project	10
					Completed 2 projects	
					Completed 3 projects	
					Completed more 3 projects	
				REFERENCES FOR PIPE INSTALLATION PROJECTS WITH A MINIMUM DIAMETER OF 1000mm WITH PROJECT VALUES OF A MINIMUM OF R40M	Completed 0 - 1 Project	10
					Completed 2 projects	
					Completed 3 projects	
					Completed more 3 projects	



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Clause number	Tender Data						
		minimum of R40 Million	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.				
	CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
2		Post Qualification Experience of Contracts Manager Contracts Managers with qualifications of BTech/ BSc/ BEng: Engineering (Civil) or higher AND ECSA Professional Registration (Pr. Eng. / Pr. Technologist) will obtain a score for experience of a Contracts Manager . However, the date of registration of Contracts Manager will not impact	Tenderer must Provide CV of Contracts Manager in the format given on T2.1.9 and certified copies of qualifications and valid registration certificate <i>Tenderers may provide their own CVs but the information provided should contain all information in T2.1.9</i> <i>Note: 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</i>	NUMBER OF REINFORCED CONCRETE BRIDGE STRUCTURES WITH PROJECT VALUES OF A MINIMUM OF R10M (PER PROJECT) COMPLETED AS CONTRACTS MANAGER	Completed 0 - 2 Projects or did not meet minimum qualifications.	10	0
					Completed 3 projects		4
					Completed 4 projects		8
					Completed more than 4 projects		10
				NUMBER OF PIPE INSTALLATION	Completed 0 - 2 Projects or did not meet	10	0



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Clause number	Tender Data					
		post qualification number of projects..	<i>participating in any future government tenders.</i>	PROJECTS WITH MINIMUM DIAMETER OF 1000mm WITH PROJECT VALUES OF A MINIMUM OF R40M (PER PROJECT) COMPLETED AS MANAGER	minimum qualifications.	
					Completed 3 projects	4
					Completed 4 projects	8
					Completed more than 4 projects	10
	CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE
3		Post Qualification Experience of Site / Construction Manager Site / Construction Managers with qualifications of BE.ng or BSc or B-Tech in (Civil) Engineering or higher	Tenderer must Provide CV of the Site / Construction Manager in the format given on T2.1.9 and certified copies of qualifications and valid registration certificate <i>Tenderers may provide their own CVs but the information</i>	NUMBER OF REINFORCED CONCRETE BRIDGE STRUCTURES WITH PROJECT VALUES OF A MINIMUM OF R10M (WORKING AS A SITE/CONSTRUCTION MANAGER)	Completed 0 - 1 Project or did not meet minimum qualifications.	0
					Completed 2 project	4
					Completed 3 projects	8
					10	8



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		AND ECSA Candidate Registration (Engineer or Technologist) or ECSA Professional Registration (Pr. Eng. / Pr. Technologist) will obtain a score for experience of a Construction Manager. However, the date of ECSA registration of Site/Construction Manager will not impact post qualification and number of projects.	<i>provided should contain all information in T2.1.9</i> <i>Note: 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.</i>	NUMBER OF PIPE INSTALLATION PROJECTS WITH MINIMUM DIAMETER OF 1000mm WITH PROJECT VALUES OF A MINIMUM OF R40M (WORKING AS A SITE/CONSTRUCTION MANAGER)	Completed more 3 projects		10
					Completed 0 - 1 project or did not meet minimum qualifications.	10	0
					Completed 2 projects		4
					Completed 3 projects		8
					Completed more than 3 projects		10



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	CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
4		Post Qualification Experience of Safety Officer . National Diploma Safety Management / Environmental Health/ Environmental Science/ Environmental Management or Higher/ SAMTRAC/ NEBOSH or equivalent AND 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 and number of projects.	Tenderer must Provide CV of Safety Officer in the format given on T2.1.9 and certified copies of qualifications and valid registration certificate. All Construction projects will be considered <i>Tenderers may provide their own CVs but the information provided should contain all information in T2.1.9</i> <i>Note: 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</i>	NUMBER OF CIVIL ENGINEERING CONSTRUCTION PROJECTS (PER PROJECT) COMPLETED AS SAFETY OFFICER)	Completed 0 - 2 Projects or did not meet minimum qualifications.	10	0
					Completed 3 projects		4
					Completed 4 projects		8
					Completed more than 4 projects		10



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	CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE
	5	Post Qualification Experience of an Environmental Officer . National Diploma/BA/BSc in Environmental Management/ Environmental Health/ Environmental Science or Higher.	Tenderer must Provide CV of Environmental Officer in the format given on T2.1.9 and certified copies of qualifications.	NUMBER OF CIVIL ENGINEERING CONSTRUCTION PROJECTS (PER PROJECT) COMPLETED AS AN ENVIRONMENTAL OFFICER)	Completed 0 - 2 Projects or did not meet minimum qualifications.	10	0
					Completed 3 projects		4
					Completed 4 projects		8
					Completed more than 4 projects		10
	CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE		MAX SCORE	SCORE



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6		Site Specific Method Statement	Tenderer must provide a Site Specific Method Statement which addresses the following sections: Method Statement Section 1 - Approach Statement and Introduction (Maximum - 4 Pages) which illustrates an understanding of the scope. This is inclusive of the following major components of section 1: - Construction of underground 2100 ID GRP sewer pipeline by-pass to link exit and entry chambers including pipe jacking and the reinforced concrete bridge - Isolation of existing bridge sewer pipe by installation of sluice gates at the upstream and downstream ends to direct sewer into the exist and entry chambers, GRP and	Site Specific Method Statement not submitted		20	0
				Tenderer has not fully covered fully major components of two method statement sections			8
				Tenderer has fully covered major components of two method statement sections			16
				Tenderer has covered fully all of the major components of all the three method statement sections			20



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			maintain the flow in the by-pass sewer pipe. • Clear and clean the existing bridge sewer pipe internally to allow human and inspection equipment access • Provide all temporary works for a successful internal inspection and assessment of the bridge sewer pipe • Carry out internal sewer pipe and pipe joints repairs as required • Re-instate sewage flow in the bridge sewer pipe • Undertake structural repairs to the pipeline externally and to the supporting bridges • Procure and install specified insulation and protective cladding over the bridge sewer pipe • Carry out bridge sewer pipe security installations				



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			comprising fencing, cabling, cameras, illumination, and guard room. Method Statement Section 2 - Quality Control Plan (Maximum 4 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 2: • Construction of GRP sewer by-pass pipeline, including pipe jacking • Construction of reinforced concrete bridge • Manufacturing of Concrete Precast Elements • Design, Supply and Installation of Sluice Gates on the upstream and downstream ends of the bridge to direct				



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			sewage into exit and entry chambers • Design, supply and installation of temporary panels on exit and entry chambers • Internal and external repairs to existing bridge sewer pipe and bridge structure • Electrical and Security installations • Compliance to OHS Laws, specifications, rules and regulations • Compliance to Environmental laws, specifications, rules and regulations. 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				



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			contractual timelines, alignment to method statements / work plan submissions and including all contractual dates and requirements. This is inclusive of the following major components: • Mobilisation and Site Establishment • Obtaining Wayleaves • Setting out of the works • Exposing existing services and relocations as necessary • Design and approval of Sluice gates • Design and approval of temporary steel panels • Manufacture of Precast Concrete Elements • Procurement and Construction of GRP sewer by-pass • Construction of reinforced concrete bridge • Repairs to existing external bridge pipeline and bridge structure				



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			• Connection of existing GRP sewage by-pass to exit and entry chambers • Construction of Scour valve and associated pipeline • Construction of electrical and security services installation • Installation of Sluice gates on exit and entry chambers • Diversion of sewage into by-pass pipeline • Cleaning and Access into existing pipeline • Repairs to existing pipeline interior • Sewage diversion to repaired pipeline • Site Handover				
		Minimum Required Score					80
		Maximum Score Allocated					100
	Tenderers who FAIL to meet the minimum required score or requirements of tender will result in disqualification.						



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Clause number	Tender Data								
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 PREFERENCE 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. JW 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 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: <table><tr><th>DESCRIPTION</th><th>POINTS</th></tr><tr><td>PRICE</td><td>90</td></tr><tr><td>SPECIFIC GOALS</td><td>10</td></tr><tr><td>Total points for Price and Specific Goals must not exceed</td><td>100</td></tr></table> (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.	DESCRIPTION	POINTS	PRICE	90	SPECIFIC GOALS	10	Total points for Price and Specific Goals must not exceed	100
DESCRIPTION	POINTS								
PRICE	90								
SPECIFIC GOALS	10								
Total points for Price and Specific Goals must not exceed	100								



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Clause number	Tender Data
	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: 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.



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	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. Specific Goals Analysis <table> <tr> <th>PROCUREMENT CRITERIA BASED ON OWNERSHIP</th><th>OUTCOME</th></tr> <tr> <td>Owned by black people</td><td>90%</td></tr> <tr> <td>Owned by black people who are youth</td><td>12%</td></tr> <tr> <td>Owned by people who are women</td><td>24%</td></tr> <tr> <td>Owned by black people with disabilities</td><td>0%</td></tr> <tr> <td>Owned by black people who are military veteran</td><td>0%</td></tr> <tr> <td>Owned by black people living in rural or underdeveloped areas</td><td>0%</td></tr> <tr> <td>Owned by black people living in township</td><td>0%</td></tr> <tr> <td>Business located within the boundaries of COJ Municipality</td><td>25%</td></tr> <tr> <td>Businesses located within the boundaries of Gauteng Province</td><td>42%</td></tr> <tr> <td>EME</td><td>8%</td></tr> <tr> <td>QSE</td><td>58%</td></tr> <tr> <td>GEN</td><td>33%</td></tr> <tr> <td>Sample Size</td><td>12</td></tr> </table>	PROCUREMENT CRITERIA BASED ON OWNERSHIP	OUTCOME	Owned by black people	90%	Owned by black people who are youth	12%	Owned by people who are women	24%	Owned by black people with disabilities	0%	Owned by black people who are military veteran	0%	Owned by black people living in rural or underdeveloped areas	0%	Owned by black people living in township	0%	Business located within the boundaries of COJ Municipality	25%	Businesses located within the boundaries of Gauteng Province	42%	EME	8%	QSE	58%	GEN	33%	Sample Size	12
PROCUREMENT CRITERIA BASED ON OWNERSHIP	OUTCOME																												
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Clause number	Tender Data				
	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., 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: <table> <tr> <th>The specific goals allocated points in terms of this tender</th><th>Number of points allocated (90/10 system)</th></tr> <tr> <td>Businesses located within Gauteng</td><td>6</td></tr> </table>	The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system)	Businesses located within Gauteng	6
The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system)				
Businesses located within Gauteng	6				



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Clause number	Tender Data																																					
	province																																					
	Business owned by 51% or more- by Black Youth	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 or DTI/CIPC BBBEE Certificate for Exempted Micro Enterprises or Affidavit sworn under oath, OR CIPC registration document showing percentage of ownership and share certificate where applicable																																				
	Businesses located within Gauteng Province	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																																				
	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:																																						
<table><tr><th>Affidavit Prescribed Formats</th><th>Category</th><th>Financial Threshold</th></tr><tr><td colspan="3">Generic Enterprises</td></tr><tr><td></td><td>BO QSE</td><td>Between R10m and R50m</td></tr><tr><td></td><td>BO EME</td><td>Less than R10m</td></tr><tr><td colspan="3">Sector Specific Enterprises</td></tr><tr><td></td><td>BO QSE</td><td>Between R10m and R50m</td></tr><tr><td></td><td>BO EME</td><td>Less than R10m</td></tr><tr><td colspan="3">Construction Sector Code</td></tr><tr><td></td><td>EME Contractor</td><td>Less than R3m</td></tr><tr><td></td><td>BO EME BEP</td><td>Less than R1.8m</td></tr><tr><td colspan="3">Financial Sector Code</td></tr><tr><td></td><td>BO QSE</td><td>Between R10m and R50m</td></tr></table>			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
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Clause number	Tender Data		
		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. Requirements for a valid BBBEE Certificate are as follows: - 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. - 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. - 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. - The deponent shall sign the declaration in the presence of the commissioner of oaths (COA). - Below the deponent's signature the COA shall certify that the deponent has acknowledged that he knows and understands the contents of the		



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Clause number	Tender Data
	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 functionality is part of the evaluation process and two or 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 functionality. (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 $P_s = 90 \left(1 - \frac{P_t - P_{\min}}{P_{\min}} \right)$ Where P_s = Points scored for comparative price of bid under consideration P_t = Comparative price of bid under consideration

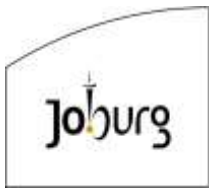


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Clause number	Tender Data
	Pmin = Comparative price of lowest acceptable bid
C.3.12	Add the following to the clause: "Accept that the submission of a Tender shall be construed as an acknowledgement by the Tenderer that they are satisfied with the insurance cover, the Employer will affect under the contract."
C.3.13.1	Add to the existing clause: Tender offers will only be accepted if: a) 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. The letter and Guarantee shall be from the financial institution registered with the Financial Sector Conduct Authority (FSCA). b) 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; c) 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;
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



DIEPSLOOT SEWAGE AQUEDUCT

VOLUME 1

RETURNABLE DOCUMENTS AND SCHEDULES

Employer:		Contractor:	
Witness:		Witness:	



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T2.1 LIST OF RETURNABLE DOCUMENTS

The tenderer must complete the following returnable documents:

<u>Document</u>	<u>Page</u>
1. Returnable Schedules required for tender evaluation purposes	
T2.1.1 Record of addenda to tender documents	RD.4
T2.1.2 Certificate of Authority	RD.5
T2.1.3 Compulsory Enterprise Questionnaire	RD.10
T2.1.4 Preferential Procurement	RD.12
MBD 6.1 Preference points claim form in terms of the preferential procurement regulations	RD.13
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.36
T2.1.9 Curriculum vitae of key personnel	RD.37

T2.2 LIST OF RETURNABLE DOCUMENTS

<u>Document</u>	<u>Page</u>
2. Other documents required only for tender evaluation purposes	
T2.2.1 Certificate of Contractor Registration issued by the Construction Industry Development Board	RD.41
T2.2.2 SARS Tax Compliance Status Pin and Proof of CSD registration i.e. MA number	RD.42

T2.3 LIST OF RETURNABLE SCHEDULES

<u>Document</u>	<u>Page</u>
3. Other documents that will be incorporated into the contract	
T2.3.1 JW 6.4 Returnable Annexure A – SHE Acknowledgment Form	RD.44
T2.3.2 JW 6.5 Returnable Annexure B: Acknowledgement of Tender Drawings	RD.45
T2.3.3 Minutes of the Mandatory Tender Briefing Meeting	RD.47

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.

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
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T2.1 LIST OF RETURNABLE DOCUMENTS

Document

Page

1. Returnable Schedules required for tender evaluation purposes

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T2.1.7	Contactable reference template	RD.34
T2.1.8	Schedule of key personnel	RD.36
T2.1.9	Curriculum vitae of key personnel	RD.37

Employer:		Contractor:	
Witness:		Witness:	



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

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
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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. JW14455 and any contract resulting from it on behalf of the company.

Chairman:

As Witnesses: 1.....

2.....

Date:

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
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(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.

Employer:		Contractor:	
Witness:		Witness:	



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(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.

Employer:		Contractor:	
Witness:		Witness:	



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(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.

Employer:		Contractor:	
Witness:		Witness:	



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(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:

Employer:		Contractor:	
Witness:		Witness:	



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	☐ 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 any provincial legislature	☐ a member of an accounting authority of any national or provincial public entity
☐ a member of the National Assembly or the National Council of Province	☐ an employee of Parliament or a provincial legislature
☐ a member of the board of directors of any municipal entity	
☐ an official of any municipality or municipal entity	

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

Employer:		Contractor:	
Witness:		Witness:	



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	☐ 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 any provincial legislature	
☐ a member of the National Assembly or the National Council of Province	☐ a member of an accounting authority of any national or provincial public entity
☐ a member of the board of directors of any municipal entity	☐ an employee of Parliament or a provincial legislature
☐ an official of any municipality or municipal entity	

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:

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

Employer:		Contractor:	
Witness:		Witness:	



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.13
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.

Employer:		Contractor:	
Witness:		Witness:	



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.

Employer:		Contractor:	
Witness:		Witness:	



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- 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).

Employer:		Contractor:	
Witness:		Witness:	



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

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

Where

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

Employer:		Contractor:	
Witness:		Witness:	



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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)
Businesses located within Gauteng province	6	
Business owned by 51% or more- by Black Youth	4	
Total	10	

Employer:		Contractor:	
Witness:		Witness:	



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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.

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
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.....	
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	☐

Employer:		Contractor:	
Witness:		Witness:	



- 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 least 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]

Employer:		Contractor:	
Witness:		Witness:	



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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

.....
.....

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
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MBD 4

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state¹.
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, shareholder²):.....

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.

.....

¹MSCM 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.

Employer:		Contractor:	
Witness:		Witness:	



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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:.....
.....

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
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4.Full details of directors / trustees / members / shareholders.

Full Name	Identity Number	State Employee Number

.....
Signature

.....
Date

.....
Capacity

.....
Name of Bidder

Employer:		Contractor:	
Witness:		Witness:	



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 <i>audi alteram partem</i> 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:		

Employer:		Contractor:	
Witness:		Witness:	



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

Employer:		Contractor:	
Witness:		Witness:	



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.

.....
.....

Employer:		Contractor:	
Witness:		Witness:	



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- 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

.....
.....

Employer:		Contractor:	
Witness:		Witness:	



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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

Employer:		Contractor:	
Witness:		Witness:	



MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Municipal Bidding Document (MBD) must form part of all bids¹ 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.

Employer:		Contractor:	
Witness:		Witness:	



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 consortium³ 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.

Employer:		Contractor:	
Witness:		Witness:	



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- (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

Employer:		Contractor:	
Witness:		Witness:	



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DIEPSLOOT SEWAGE AQUEDUCT
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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

Employer:		Contractor:	
Witness:		Witness:	



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

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

Employer:		Contractor:	
Witness:		Witness:	



T2.1.7 CONTACTABLE REFERENCE TEMPLATE (REINFORCED CONCRETE BRIDGE STRUCTURE)

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. **JW14455** for **DIEPSLOOT SEWAGE AQUEDUCT**

Name of Tenderer:

Name of Project:

Approximate value of Contract

.....

Description of Services Provided (Reinforced concrete bridge structures)

.....
.....
.....
.....
.....
.....
.....

Name of authorised person:

Signature:..... Date

Telephone/Mobile:

Email:

.....

Completed on behalf (Name of Client)

.....

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.

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
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T2.1.7 CONTACTABLE REFERENCE TEMPLATE (PIPELINE)

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. **JW14455** for **DIEPSLOOT SEWAGE AQUEDUCT**

Name of Tenderer:

Name of Project:

Approximate value of the goods/ service provided

.....

Description of Services Provided (Indicate Pipe Diameter and Material)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Name of authorised person:

Signature:..... Date

Telephone/Mobile:

Email:
.....

Completed on behalf (Name of Client)
.....

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.

Employer:		Contractor:	
Witness:		Witness:	



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
Contracts Manager, Site Agent / Construction Manager & Alternative Construction Manager						
Safety Officer, SHE Representative, First Aider, Risk Assessor, Incident Investigator, Fall Protection Planner & Confined Space Supervisor						
Environmental Officer						
Technicians, Surveyors, Foremen, Construction Supervisor etc.						
Artisans and other Skilled workers						
Plant Operators						
Semi-skilled Workers						
Unskilled Workers						
Others:						

SIGNATURE:.....

DATE:

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

Employer:		Contractor:	
Witness:		Witness:	



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

Employer:		Contractor:	
Witness:		Witness:	



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6. Project-based Experience

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Site Agent, Alternative Construction Manager etc.)	
Description of Duties	
Description of Project Scope (including min pipe diameter & project value, reinforced concrete bridge with project value)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Site Agent, Alternative Construction Manager etc.)	
Description of Duties	
Description of Project Scope (including min pipe diameter & project value, reinforced concrete bridge with project value)	

Employer:		Contractor:	
Witness:		Witness:	



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Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Site Agent, Alternative Construction Manager etc.)	
Description of Duties	
Description of Project Scope (including min pipe diameter & project value, reinforced concrete bridge with project value)	

Project Name	
Project Client	
Project Dates	
Project Value	
Project position (e.g. Contracts Manager, Site Agent, Alternative Construction Manager etc.)	
Description of Duties	
Description of Project Scope (including min pipe diameter & project value, reinforced concrete bridge with project value)	

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

Employer:		Contractor:	
Witness:		Witness:	



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DIEPSLOOT SEWAGE AQUEDUCT
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T2.2 LIST OF RETURNABLE DOCUMENTS

<u>Document</u>	<u>Page</u>
2. Other documents required only for tender evaluation purposes	
T2.2.1 Certificate of Contractor Registration issued by the Construction Industry Development Board	RD.41
T2.2.2 SARS Tax Compliance Status Pin and Proof of CSD registration i.e. MA xxxxxxxxxxxx number	RD.42

Employer:		Contractor:	
Witness:		Witness:	



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)

Employer:		Contractor:	
Witness:		Witness:	



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 xxxxxxxxxxxx number.

SIGNATURE:.....

DATE:

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

Employer:		Contractor:	
Witness:		Witness:	



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T2.3 LIST OF RETURNABLE SCHEDULES

<u>Document</u>	<u>Page</u>
3. Other documents that will be incorporated into the contract	
T2.3.1 JW 6.4 Returnable Annexure A – SHE Acknowledgment Form	RD.44
T2.3.2 JW 6.5 Returnable Annexure B: Acknowledgement of Tender Drawings	RD.45
T2.3.3 Minutes of the Mandatory Tender Briefing Meeting	RD.47

Employer:		Contractor:	
Witness:		Witness:	



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 (Volume 2)
- 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

Employer:		Contractor:	
Witness:		Witness:	



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:

LIST OF DRAWINGS	
DRAWING NUMBER:	DESCRIPTION:
CIVILS	
13247-02/C/SEW/314-A	TYPICAL JW NAMEBOARD DRAWING
BRIDGE 1:	
13247-02/C/SEW/300-D	PLAN AND PROFILE: SEWER DIVERSION PIPELINE
13247-02/C/SEW/310-A	BRIDGE 1 SITE PLAN: SEWER PIPELINE BRIDGE
BRIDGE 2:	
13247-02/C/SEW/301-5	PLAN AND PROFILE: SEWER DIVERSION PIPELINE
13247-02/C/SEW/305-3	PIPE JACKING DETAIL
13247-02/C/SEW/311-3	BRIDGE 2 SITE PLAN: SEWER PIPELINE BRIDGE
BRIDGE 3:	
13247-02/C/SEW/302-D	PLAN AND PROFILE: SEWER DIVERSION PIPELINE
13247-02/C/SEW/312-A	BRIDGE 3 SITE PLAN: SEWER PIPELINE BRIDGE
COMMON TO BRIDGES 1, 2 & 3:	
13247-02/C/SEW/304-2	PIPE REPAIR TYPICAL DETAILS
13247-02/C/SEW/306-2	DIVERSION/RE-ENTRY TYPICAL CHAMBER DETAILS
13247-02/C/SEW/307-2	TYPICAL PIPE BEDDING
13247-02/C/SEW/308-2	SCOUR CHAMBER DETAILS
13247-02/C/SEW/309-2	TEMPORARY MANHOLE RAISING, FIELD INLET, GRID INLET, MANHOLE & THRUST BLOCK DETAILS.
STRUCTURES	
BRIDGE 1:	
13247-02/S/001/A	GENERAL ARRANGEMENT (1 OF 2)
13247-02/S/002/A	GENERAL ARRANGEMENT (2 OF 2)
13247-02/S/003/A	SECTIONS AND DETAILS
13247-02/S/004/A	DETAILS
13247-02/S/R/001/A	FOUNDATION AND PIERS REBAR DETAIL
13247-02/S/R/002/A	DECK 1&7 REBAR DETAIL
13247-02/S/R/003/A	DECK 2,3,4,5,6 REBAR DETAIL
13247-02/S/017/A	RE-ENTRY CHAMBER SLAB AND CONCRETE ANCHOR DETAILS
13247-02/S/020/A	RE-ENTRY CHAMBER SLAB REBAR

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
RETURNABLE DOCUMENTS



BRIDGE 2:	
13247-02/S/013/A	GENERAL ARRANGEMENT
13247-02/S/014/A	SECTIONS AND DETAILS
13247-02/S/015/A	DETAILS
13247-02/S/R018/A	FOUNDATION AND ABUTMENT 2, END WALL AND DECK 1 REBAR DETAILS
13247-02/S/R019/A	DECK 2 REBAR DETAIL
13247-02/S/R020/A	DECK 3 REBAR DETAIL
13247-02/S/R021/A	DECK 4 AND PIPE SUPPORT REBAR DETAIL
13247-02/S/018/A	PLATFORM, CAT LADDERS, BALUSTRADE AND CONCRETE ANCHOR DETAILS
BRIDGE 3:	
13247-02/S/008/A	GENERAL ARRANGEMENT (1 OF 2)
13247-02/S/009/A	GENERAL ARRANGEMENT (2 OF 2)
13247-02/S/010/A	SECTIONS AND DETAILS
13247-02/S/011/A	DETAILS
13247-02/S/R013/A	FOUNDATION AND PIERS REBAR DETAIL
13247-02/S/R014/A	DECK 1&6 REBAR DETAIL
13247-02/S/R015/A	DECK 2,3,4,5 REBAR DETAIL
13247-02/S/019/A	PLATFORM, CAT LADDERS, BOUNDARY WALL AND CONCRETE ANCHOR DETAILS
13247-02/S/025/A	BOUNDARY WALL PLAN AND PROFILE
13247-02/S/026/A	BOUNDARY WALL PLAN, PROFILE AND DETAILS
13247-02/S/027/A	BOUNDARY WALL DETAILS
ELECTRICAL	
13247-02/E/ELEC/700/E	BRIDGE 2: TYPICAL GUARDHOUSE LAYOUT-SLEEVES, POWER AND LIGHTING LAYOUTS
13247-02/E/ELEC/701/C	BRIDGE 1: ELECTRICAL INSTALLATION-LIGHTING LAYOUT
13247-02/E/ELEC/702/E	BRIDGE 2: ELECTRICAL INSTALLATION-LIGHTING LAYOUT
13247-02/E/ELEC/703/E	BRIDGE 2: ELECTRICAL INSTALLATION-SLEEVES DETAILS
13247-02/E/ELEC/704/C	BRIDGE 2: MV OVERHEAD RETICULATION LAYOUT (1 OF 3)
13247-02/E/ELEC/705/C	BRIDGE 2: MV OVERHEAD RETICULATION LAYOUT (2 OF 3)
13247-02/E/ELEC/706/C	BRIDGE 2: MV OVERHEAD RETICULATION LAYOUT (3 OF 3)
13247-02/E/ELEC/707-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (1 OF 5)
13247-02/E/ELEC/708-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (2 OF 5)
13247-02/E/ELEC/709-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (3 OF 5)
13247-02/E/ELEC/710-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (4 OF 5)
13247-02/E/ELEC/711-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (5 OF 5)
13247-02/E/ELEC/712	MAIN KIOSK, DB-GH AND EK-2 SINGLE LINE DIAGRAM

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

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
RETURNABLE DOCUMENTS



Name of tenderer	
Name of Authorized person	
Authorized Signature*	

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

Employer:		Contractor:	
Witness:		Witness:	



Contract JW14455
DIEPSLOOT SEWAGE AQUEDUCT
RETURNABLE DOCUMENTS



T2.3.3 Minutes of the Mandatory Tender Briefing Meeting

Minutes of the Mandatory Tender Briefing Meeting

Employer:		Contractor:	
Witness:		Witness:	

Johannesburg Water (SOC) Ltd



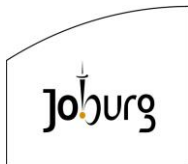
CONTRACT JW14455

DIEPSLOOT SEWAGE AQUEDUCT

VOLUME 1

PART 1: AGREEMENT AND CONTRACT DATA

Employer:		Contractor:	
Witness:		Witness:	



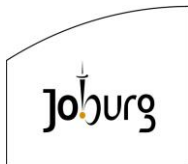
Contract: JW14455
DIEPSLOOT SEWAGE AQUEDUCT
Volume 1 Tender and Contract
Section C1 Agreement and Contract Data



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Employer:		Contractor:	
Witness:		Witness:	



Contract: JW14455
DIEPSLOOT SEWAGE AQUEDUCT
Volume 1 Tender and Contract
Section C1 Agreement and Contract Data



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:

JW 14455: DIEPSLOOT SEWAGE AQUEDUCT

The Tenderer, 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 Tenderer, 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 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, 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)

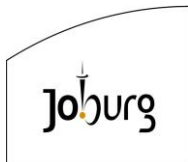
**Name and signature
of witness**

(Name)

(Signature)

Date

Employer:		Contractor:	
Witness:		Witness:	



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, pricing schedules (Bill of Quantities) 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 a 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 Street,
Newtown.**

(Name and address of organisation)

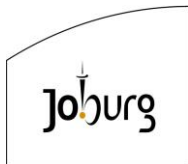
Name and signature
of witness

(Name)

(Signature)

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

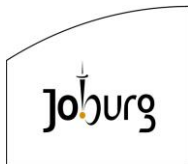
Details

7 Subject

Details

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.

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW14455
DIEPSLOOT SEWAGE AQUEDUCT
Volume 1 Tender and Contract
Section C1 Agreement and Contract Data



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

For the Contractor

(Name and address of organisation)

**Name and signature
of witness**

(Name)

(Signature)

Date

For the Employer:

Name(s)

Capacity

For the Employer

**Johannesburg Water SOC (Ltd), Turbine Hall, 65 Ntemi Piliso Street,
Newtown**

(Name and address of organisation)

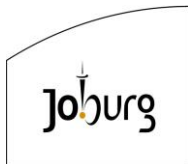
**Name and signature
of witness**

(Name)

(Signature)

Date

Employer:		Contractor:	
Witness:		Witness:	



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 Third Edition (2015), published by the South African Institution of Civil Engineering, is applicable to this Contract.

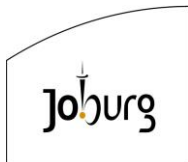
Copies of these conditions of contract may be obtained from the South African Institution of Civil Engineering (Telephone number: 011-805 5947)

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	Delete Clause 1.1.1.14 and replace with the following: “Due Completion Date” means the date of expiry of the time stated in the Contract Data for achieving Practical Completion of the Works, calculated from the date on which the Employer’s Agent instructs the commencement of Works and adjusted by such extensions of time or acceleration as may be allowed in terms of the Contract.” The time for achieving Practical Completion is 30 months (inclusive of special non-working days). The programme should include Easter, Builders break and public holidays in the 30 months to achieve Practical Completion.										
1. 1.1.15	The name of the Employer is Johannesburg Water (SOC) Limited Contact person is: W. Chitsa										
1.1.1.16	The name of the Employer’s Agent will be confirmed upon signing of contract										
1.1.1.26	The Pricing Strategy is a Re-measurement Contract.										
1.2.1.2	The address of the Employer is: <table> <tr> <td>Physical</td><td>Postal</td></tr> <tr> <td>Turbine Hall</td><td>P.O. Box</td></tr> <tr> <td></td><td>61542</td></tr> <tr> <td>65 Ntemi Piliso Street</td><td>Marshalltown</td></tr> <tr> <td>Newtown</td><td>2107</td></tr> </table>	Physical	Postal	Turbine Hall	P.O. Box		61542	65 Ntemi Piliso Street	Marshalltown	Newtown	2107
Physical	Postal										
Turbine Hall	P.O. Box										
	61542										
65 Ntemi Piliso Street	Marshalltown										
Newtown	2107										
3.2.3	Specific Approval – The Employer’s Agent is required to obtain the Employer’s approval for the following: • Approval of Variation Orders • The use of contingencies • Approval to exceed the Contract Sum • Approval of Subcontracting Plan and work package breakdown • Stoppage/ suspension of works • Approval of Prov. Sum (three quote system)										
4.4.2	Add the following after this clause: Apart from subcontractors identified by the Contractor for the execution of certain sections of the Works, subcontractors shall also include SMME’s (Small Medium and Micro Enterprises), who are identified from the Local Community for the execution of										

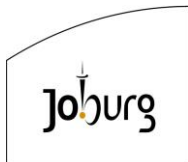
Employer:		Contractor:	
Witness:		Witness:	



Section C1 Agreement and Contract Data

GCC Clause	Information
	certain sections of the Works identified by the Employer or Employer and Contractor. The relocation of the electrical fence and security system over the Dainfern Valley Estate boundary wall shall form part of the work identified by the Employer. This work shall be undertaken by the nominated subcontractor from the Dainfern Valley Estate. The appointment of subcontractors and the allocation of work to subcontractors shall, in addition to the provisions of the General Conditions of Contract, comply with, but not be limited to, the provisions of C1.2.1.2.14 (see below). A minimum value of 10% of the Contract Price shall be subcontracted to SMME's. Where the identified items for subcontracting do not form 10% of the Contract Price, the Contractor shall identify additional works that will be subcontracted to ensure compliance with the minimum subcontracting percentage.
4.10.1	Delete Clause 4.10.1 and replace with the following: The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all employees (excluding local labourers) and for their payment, housing, feeding and transport (provided that any use of any part of the Site for said purposes shall be subject to the prior approval of the Employer's Agent) and the Contractor indemnifies the Employer against any liability arising out of the Contractor's said arrangements, whether such arrangements involve the use of the Site or not. The Contractor shall employ general labourers from Local Communities (otherwise known as Local Labour), in accordance with the Tender Data, Scope of Work, Site Information, and Specifications. All Local Labour shall be recruited through the Community Liaison Officer (CLO) and/or Labour Desk Officer (LDO). The Contractor remains fully responsible for all Local Labour that are employed for the execution of the Works, as if they were the Contractor's own labour.
4.11.1	Add the following to this clause: Competent Employees shall include, amongst others, the following Key Personnel: • Contracts Manager • Site Manager / Construction Manager • Alternative Construction Manager • Safety Officer • Environmental Officer • SMME Project Mentor/Foreman • Construction Supervisor • Confined Space Supervisor • SHE Representative • First Aider • Risk Assessor • Incident Investigator • Civil Engineering Interns • Shutter hands, building assistants, scaffolding erectors, plumbers and electrical assistants, small construction equipment operators, etc

Employer:		Contractor:	
Witness:		Witness:	



Section C1 Agreement and Contract Data

GCC Clause	Information		
	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) • Approval of the Environmental File (Clause 4.3) • Initial programme & cashflow projections (Clause 5.6) • Guarantee from Bank or Insurance Company (Clause 6.2) registered with the Financial Sector Conduct Authority (FSCA) - Proforma Guarantee to be submitted within two weeks after contract appointment for Approval by Employer • Insurance of the Works, Plant, etc. (Clause 8.6), including but not limited to: ○ SASRIA Policy ○ Liability Insurance ○ Insurance of Construction Machinery and Plant ○ Insurance of Motor Vehicle Liability, etc. • Compliance Certificate in respect of COID • Signed Notification to the Department of Labour • Construction Permit (where applicable). The Employer will require Health and Safety documentation from the Contractor to acquire this permit. • Organogram of resources • Subcontract plan/ proposal which includes a number of Subcontractors that meet requirements as per conditions of C1.2.1.2.14		
5.3.2	The time to submit the documentation required before Commencement of the Works is 28 days.		
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.		
5.8.1	Working days shall be Monday to Friday, between 07h00 to 17h00 (Special non-working days are to be included in the programme and showed as such).		
5.8.1	The non-working days are Sundays. The special non-working days are all Public Holidays in terms of the Public Holidays Act (as amended), and the annual “Builder’s Break” as defined by SAFCEC on an annual basis.		
5.13.1	The penalty for failing to complete the Works is the greater of: An amount equal to the 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 GRP. • Connection testing & commissioning of GRP connections to entry and re-entry chambers • Construction, testing & acceptance of all bridge structural works. • Rehabilitation of existing concrete pipe and associated concrete bridge repairs • Construction, testing & acceptance of pipe jacking works.		
Employer:		Contractor:	
Witness:		Witness:	

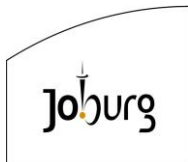
Section C1 Agreement and Contract Data

GCC Clause	Information
	• Payment of all SMME's • Payment of all local labour employed on the project • Installation, testing & commissioning of all electrical and mechanical infrastructure. • Reinstatements of man-made surfaces, including road surfaces. • Compliance to all OHS specifications and requirements • Environmental rehabilitation of site
5.16.3	The latent defects period is 10 years.
6.2.1	The time to deliver the Form of Guarantee is within 28 days from the Commencement Date. The security to be provided by the Contractor shall be in the form of an "On Demand" Guarantee and will comply with the requirements of Clause 6.2.3 and C1.3 FORMS AND SECURITIES. The value of the Performance Guarantee shall be ten (10) % of the Contract Sum, which sum excludes VAT.
6.8.2	The Contract Price Adjustment is applicable for this contract. The contract rates shall be fixed for the first 12 months and thereafter the rates will be adjusted by the change in CPA (as published by Statistics SA and will be fixed for the next 12 months) The following formula will be applicable. $(1 - x) \left[\frac{aLt}{Lo} + \frac{bPt}{Po} + \frac{cMt}{Mo} + \frac{dFt}{Fo} - 1 \right]$ In which the symbols have the following meaning as per GCC 2015: "x" is the proportion of "Ac" which is not subject to adjustment. "a", "b", "c" and "d" are the coefficients contained in the Contract Data, which are deemed, irrespective of the actual constituents of the work, to represent the proportionate value of labour, contractors' equipment, material (other than "special materials" specified in the Contract Data) and fuel respectively. "L" is the "Labour Index" "P" is the "Plant Index" "M" is the "Materials Index" "F" is the "Fuel Index" The suffix "o" denotes the base indices applicable to the base month as stated in the Contract Data. The suffix "t" denotes the current indices applicable to the month in which the last day of the period falls to which the relevant monthly statement relates. If any index relevant to any particular certificate is not known at the time when the certificate is prepared, the Engineer shall estimate the value of such index. Any correction which may be necessary when the correct indices become known, shall be made by the Engineer in subsequent payment certificates.

Employer:		Contractor:	
Witness:		Witness:	

Section C1 Agreement and Contract Data

GCC Clause	Information
	The value of the 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 d = 0,10 Fuel The province where the Site is located is Gauteng and the urban area where the project is implemented is Johannesburg. The Consumer Price Indices for Labour (L), Plant (P), Material (M) and Fuel (F) are as published by Statistics South Africa for the applicable time. The base month is one month before the tender closing date. Escalation shall be fixed for the first 12 months.
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 maximum percentage retention on the amounts due to the Contractor is 10% of the Contract Sum.
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: • The Contractor providing a payment certificate with all required supporting documents to the Employer's Agent on dates to be communicated to the Contractor upon award. • The payment certificate being submitted with an original tax invoice. • A statement being submitted on the last day of the month. Payment will be made within 30 days of receipt of the Contractor's statement. 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. 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 Add to Clause 6.10.5 the following: Payment will be subject to Johannesburg Water processes as outlined in clause 6.10.4 as amended.
6.10.6.2	Delete Clause 6.10.6.2
Employer:	Contractor:
Witness:	Witness:



Section C1 Agreement and Contract Data

GCC Clause	Information
6.11	Delete Clause 6.11
7.8.2	Cost of making good of defects Amend Clause 7.8.2.1 as follows: In the first line, correct the spelling of 'therefore'.
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 materials supplied by the Employer to be included in the insurance sum is R8 625 778.97 (Vat. Excl.) This amount includes 2500 x 1.5 JP 100D IW (Sil) Freight 2500mm rubber ring ST, DN2100 PN6 SN5000 pipe with Coupling (12m Lengths GRP) and High Yield Steel. This value is only applicable to Bridge 2 project.
8.6.1.1.3	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum is an amount equal to 15% of the Contract Price.
8.6.1.3	The limit of indemnity for liability insurance is R20,000,000 (Twenty million Rand) for any single claim – the number of claims to be unlimited during the Construction and Defects Liability Periods
8.6.1.5	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: - The Contractor shall insure all Construction Machinery and Plant (including tools, offices and other temporary structures and content) and other items, other than those intended for incorporation into the works, owned, leased or hired and brought on to the Site against all risks of physical loss or damage for the period that such Plant shall be on the Site to the full value thereof. In respect of Machinery and Plant brought on to the Site by or on behalf of Sub-Contractors, the Contractor shall be deemed to have complied with the provisions of this Sub-Clause if it has ensured that such Sub-Contractors have similarly insured such Plant and Machinery. Such insurance shall be effected with an Insurer and in terms approved by the Employer (which approval shall not be unreasonably withheld) and the Contractor shall, when required, submit to the Employer's Insurance Brokers, via the Employer's Agent, the policy or policies of insurance and receipts for payment of the current premiums. - The Contractor and the Sub-contractors shall effect and maintain at their cost, insurance under the provision of the Compensation for Occupational Injuries and Diseases Act (COID), 1993 (Act No. 130 of 1993) - The Contractor and the Sub-Contractors shall effect and maintain at their own cost, motor vehicle liability insurance with at least indemnification for "balance of third party" risks, including passenger liability with a limit of indemnity of not less than R2,5 million. - Where the contract involves manufacturing and/or fabrication of the works or part thereof at premises other than the Site, the Contractor shall satisfy

Employer:		Contractor:	
Witness:		Witness:	

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GCC Clause	Information
	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. Any other Insurance cover that may be deemed necessary by the Contractor to ensure full and successful completion of the Works.
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
10.4.2	Dispute resolution shall be by Amicable Settlement, failing which, any dispute shall be resolved by way of ad-hoc Adjudication.
10.3.4	Continuation of works during dispute resolution; Notwithstanding any Dispute Notice that may have been issued or actual dispute or disagreement that may have arisen 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.
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 the Contractor, should the latter fail to provide reporting as required in C1.2.1.2.6, C1.2.1.2.14 and the specification highlighted in the Scope of Work, 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 R5,000.00 per report per occasion; and
- If the Contractor fails to complete the aforementioned 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 JW Senior Management, he shall reserve the right to:

- i. perform the Works internally or through another Contractor; and

Employer:		Contractor:	
Witness:		Witness:	

- 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 labourer or SMME

- The Employer shall levy a penalty on the Contractor, should the latter fail to provide payment to 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 incident per occasion; and
- If the Contractor fails to complete the aforementioned 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 JW 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

Employer:		Contractor:	
Witness:		Witness:	

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 a formula determined by the Employer 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 will impose a penalty value of R20,000.00 per audit report.

e) Failure to meet the environmental compliance target

Monthly compliance rating will be calculated for each Contractor as per a formula determined by the Employer 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 will impose a penalty value of R20,000.00 per audit report.

f) Penalties payable

If penalties are payable, they will be deducted prior to the addition of (VAT) but after the calculation of retention.

g) Penalties irreversible

The Contractor shall note that all penalties once imposed shall be non-recoverable or non-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 accept and comply with instructions from the Employer's Health and

Employer:		Contractor:	
Witness:		Witness:	

Safety Representative or the Employer's Environmental Representative with regards to matters regarding Health & Safety or Environmental Management respectively, but with further approval from the Employer's Agent.

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 similar acts have been done by any persons employed by the Contractor 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 the same consequences shall apply.

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 construction 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 PSIRA registration (where applicable)
- Valid CSD compliance status
- Valid EME affidavit

Employer:		Contractor:	
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- Active 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

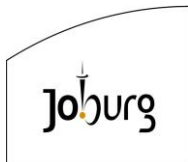
All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Employer's Agent's instructions and shall be subjected from time to time to such tests as the Employer's Agent may direct at the place of manufacture or fabrication, or on the Site or at 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 authorized representative and the Contractor shall afford full opportunity for the Employer's Agent or his duly authorized 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.

Employer:		Contractor:	
Witness:		Witness:	



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:

- 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 public 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.

Employer:		Contractor:	
Witness:		Witness:	

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 Contractor must subcontract a minimum of 10% of the value of this Contract to an entity(s) described below. The value of the Contract for the purposes of this calculation shall be equal to the Contract Price (excluding VAT) as described in the General Conditions of Contract.

The subcontractor/s chosen for this purpose must be registered on National Treasury's Central Supplier Database (CSD) and must be from one of the following designated groups:

- An EME or QSE which is at least 51% owned by black people;
 - An EME or QSE which is at least 51% owned by black people who are youth;
 - An EME or QSE which is at least 51% owned by black 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 veterans;
 - 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. Provision was made for subcontracting in the Bill of Quantities. Subcontracting activities are indicated in the Bill of Quantities. Where the provision for subcontracting is less than the minimum subcontracting requirement, the Contractor will identify additional subcontracting items or tasks that will meet the subcontracting minimum of 10% of the value of this Contract. 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.
 - Where the identified items for subcontracting do not form 10% of the Contract Price, the Contractor shall identify additional works that will be subcontracted to ensure compliance with the minimum subcontracting percentage
 - 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);

Employer:		Contractor:	
Witness:		Witness:	

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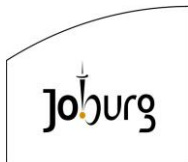
and shall indicate costs (amongst others) for labour, material, handling, mark-ups, etc. to prove that the rate that was submitted during tender stage was in fact market related; and in balance with other rates that were submitted for work items that will not be undertaken by Subcontractors.

- Should any delays be experienced during the period of the Contract due to the appointment of subcontractors by the Contractor, work stoppages by subcontractors, industrial action by subcontractors, etc. such delays shall be assigned to the Contractor, and no claims for Extension of Time will be entertained by the Employer.
- The Contractor will be liable to pay a penalty if the Subcontracting target of 10% has not been met by the end of the Contract. The Employer will deduct this penalty amount through the Payment Certificate process. The Employer will have full discretion as to when the penalty will be applied (i.e. the month in which the penalty amount will be deducted). In calculating the total amount that has been (will be) paid to SMME's, all amounts that have actually been reimbursed to SMME's will be taken into account including P&G's, amounts for actual work done, etc.
- The penalty amount described above shall be equal to 50% (fifty percent) of the difference between the target Subcontract amount (i.e. 10% of the Contract Price) and the actual amount that has been spent on Subcontractors/SMME's by the end of the Contract.

3. The form of contract to be used with sub-contracting SMMEs shall be the SAFCEC General Conditions of Sub-Contract for Civil Works. This 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

Employer:		Contractor:	
Witness:		Witness:	



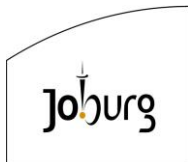
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be based on approved timesheets.

- 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.

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Witness:		Witness:	



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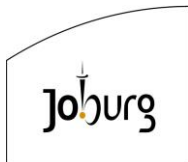
4. The successful Contractor shall submit periodic SMME/Subcontractor reports to the Employer's Agent as follows:
- Status of progress against the Subcontracting Plan (described above), to the approval of the Employer's Agent
 - Subcontractor *domicilium* and registered address of business, as well as 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.
5. 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.
6. 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.

Employer:		Contractor:	
Witness:		Witness:	

C1.2.1.2.15 Competent Employees

No.	Competent Employees	Qualifications	Experience
1	Contracts Manager	Minimum Qualifications of Contracts Manager Only Contract Managers with qualifications of BTech/ BSc/ BEng: Engineering (Civil) or higher AND ECSA Professional Registration (Pr. Eng. / Pr. Technologist) will obtain a score for the experience of a Contracts Manager. However, the date of registration of Contracts Manager will not impact post-qualification number of projects.	Minimum of: 03 projects Completed (Working as a Contracts Manager) in Reinforced Concrete bridge structure with project values of a minimum of R10 Million And 03 projects Completed (Working as a Contracts Manager) in Pipe installation projects with minimum diameter 1,000 mm with project values of a minimum of R40 Million bulk pipelines will be considered.
2	Site Manager / Construction Manager & Alternative Construction Manager	Minimum Qualifications of Site Manager/ Construction Manager & Alternative Construction Manager BEng or BSc or B.Tech in (Civil Engineering) Engineering or higher And ECSA Candidate Registration (Engineer or Technologist) or ECSA Professional Registration (Pr. Eng. / Pr. Technologist) will obtain a score for experience of a Construction Manager. However, the date of ECSA registration of Construction Manager will not impact post qualification number of projects.	Minimum of: 02 project Completed (Working as a Site / Construction Manager) in Reinforced Concrete bridge structure with project values of a minimum of R10 Million And 02 project Completed (Working as a Site / Construction Manager) in Pipe installation projects with minimum diameter 1,000 mm with project values of a minimum of R40 Million bulk pipelines will be considered.
3	Safety Officer	Minimum Qualification Experience of Safety Officer. National Diploma Safety Management / Environmental Health/ Environmental Science/ Environmental Management or Higher/ SAMTRAC/ NEBOSH or equivalent AND Registered with SACPCMP in the "Construction Health and Safety" Sector will be considered. However, the time of	Minimum of 3 projects completed in Civil Engineering construction projects.

Employer:		Contractor:	
Witness:		Witness:	



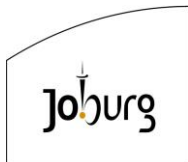
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		registration of Safety Officer will not impact post qualification and number of projects.	
4	Environmental Officer	Minimum Qualification Experience of an Environmental Officer . National Diploma/BA/BSc in Environmental Management/ Environmental Health/ Environmental Science or Higher.	Minimum of 3 projects completed in Civil Engineering construction projects.
5	SMME Project Mentor / Foreman	<u>Qualification in Civil Engineering or the Built Environment and SACPCMP registration</u>	Minimum 5 years experience in Civil Eng or the Built environment
6	Construction Supervisor	Construction Supervisor's Training/Certificate	Minimum 3 Years experience in Civil Engineering Construction
7	Confined Space Supervisor	Confined Space Training/Certificate	Proven experience
8	SHE Representative	SHE Rep training/certificate	Not Applicable
9	First Aider	Level 5 or Level 3 with CPR training	Not Applicable
10	Risk Assessor	Hazard Identification and Risk Assessment (HIRA) training/certificate	Not Applicable
11	Incident Investigator	Incident Investigation training/certificate e.g. RCAT	Not Applicable
12	Civil Engineering Interns (2)	Minimum Qualification Experience of a Civil Engineering Intern. National Diploma in Civil Engineering or higher. Letter from a registered and recognised South African Educational Institution confirming student requires In-service training,	No experience required, however, only local community residents will be considered.
13	Shutter hands, building assistants, scaffolding erectors, plumbers and electrical assistants, small construction equipment operators, etc	Basic Training Certificate	At least 3 of the listed semi-skilled workers must be from the local community. (All trades inclusive).

Employer:		Contractor:	
Witness:		Witness:	



Acronyms

SAMTRAC: Safety Management Training Course

NEBOSH: National Examination Board in Occupational Safety and Health

C1.2.1.2.16 Sewage Diversion Limitations

The diversion of sewage from the existing sewer pipework into the by-pass GRP infrastructure is prohibited during the Builders Break Period.

C1.2.1.2.17 Noise control measures

Noise control measures must be strictly enforced, particularly during exam season, generally in July and November, and limited during teaching hours as far as possible.

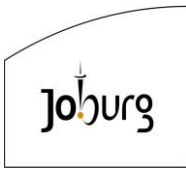
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C1.2.1.3 Variations to General Conditions of Contract

Add the following Table:

3.2.4	Employer's Agent for Health and Safety Replace Clause 3.2.4 with the following: 'In terms of Clause 1.3.2, all parties to the Contract shall be subject to the relevant requirements of the Construction Regulations 2014 (as amended) of the Occupational Health and Safety Act, Act 85 of 1993 (as amended).' Add the following at the end of the above new replacement Clause 3.2.4: 'Where the Employer is obliged to appoint an Employer's Agent for Health and Safety in terms of the Construction Regulations 2014 (as amended) of the Occupational Health and Safety Act (Act 85 of 1993 as amended), and where such Employer's Agent for Health and Safety has complied with the registration requirements of a Construction Health and Safety Agent as a specified category in terms of section 18 (1) (c) of the Project and Construction Management Professions Act (Act 48 of 2000), the applicable clauses of the latest edition of the "Standard Scope of Services for Construction Health and Safety Agents Registered In Terms Of Section 18(1)(c) of the Project And Construction Management Professions Act (Act No. 48 Of 2000)", including Clauses 2.2.5 "STAGE 5 - CONSTRUCTION DOCUMENTATION AND MANAGEMENT", and 2.2.6 "STAGE 6 - PROJECT CLOSE – OUT", and 2.2.7 "ADDITIONAL RELATED SERVICES", as published in "Registration Rules for Construction Health and Safety Agents in Terms of Section 18 (1) (c) of the Project and Construction Management Professions Act, 2000 (Act No. 48 of 2000)" by the South African Council for Construction and Project Management Professionals in terms of the Project and Construction Management Professions Act (Act 48 of 2000 as amended), shall also apply.'
5.1.1.2	Time Calculations SEPARATE THE PHRASE "shall be excluded from the calculation of the time-span concerned." BY MOVING IT ONTO A NEW LINE AS A NEW PARAGRAPH, AND PROMOTE THAT PARAGRAPH BY ONE PARAGRAPH LEVEL TO A POSITION WHERE IT FORMS THE LAST PART OF SUB-CLAUSE 5.1.1, SO THAT SUB-CLAUSE 5.1.1.2 READS AS FOLLOWS: 5.1.1.2 The day on which the timespan commences shall be excluded from the calculation of the timespan concerned."
5.7.1	Rate of progress ON PAGE 25, IN THE TOP PARAGRAPH, FOR THE SENTENCE COMMENCING WITH "Such steps shall..." REPLACE THE SENTENCE

Employer:		Contractor:	
Witness:		Witness:	



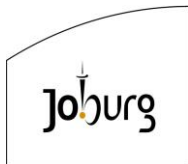
Contract: JW14455
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Section C1 Agreement and Contract Data

	“Such steps shall be approved by the Employer's Agent, which approval shall not be unreasonably withheld.” WITH “Such steps shall be subject to the approval of the Employer's Agent, which approval shall not be unreasonably withheld.”
6.5.1.3	Basis of payment for dayworks ON PAGE 40, IN THE LAST LINE OF THE SUB-CLAUSE, REPLACE THE PHRASE “ruling plant hire rates” WITH “ruling construction equipment hire rates”

Employer:		Contractor:	
Witness:		Witness:	



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 Address: _____ Postal Address: _____ _____ _____ _____ Tel: _____ Fax: _____ Email: _____
Clause 1.1.1.1 4	The time for achieving Practical Completion is 30 months from the Commencement Date
Clause 6.2.1	The security to be provided by the Contractor shall be one of the following: Fixed Performance Guarantee of 10% of the Contract Sum (which sum shall exclude VAT)
Clause 6.8.3	The variation in cost of special materials is Type Unit Rate NOT APPLICABLE

Employer:		Contractor:	
Witness:		Witness:	

Johannesburg Water (SOC) Ltd



CONTRACT NO. JW14455

DIEPSLOOT SEWAGE AQUEDUCT

VOLUME 1

PART 1.3: FORMS AND SECURITIES

Employer:		Contractor:	
Witness:		Witness:	

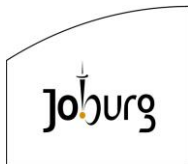
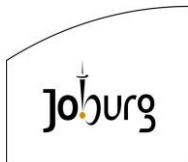


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Employer:		Contractor:	
Witness:		Witness:	



C1.3 FORMS AND SECURITIES

FORMS FOR COMPLETION BY THE CONTRACTOR

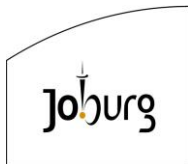
THE FOLLOWING FORMS ARE TO BE COMPLETED BY THE CONTRACTOR AFTER THE TENDER HAS BEEN AWARDED TO THE SUCCESSFUL TENDERER

- 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.

Employer:		Contractor:	
Witness:		Witness:	



C1.3.1 Form of Guarantee

TO BE PRINTED ON THE OFFICIAL LETTERHEAD OF 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**”).

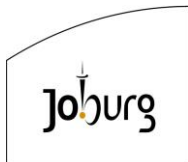
And whereas the Contract requires the Contractor to provide to the Employer an on-demand performance guarantee for the due and proper performance by the Contractor of its obligations in terms of the Contract.

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 Engineer 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.

Employer:		Contractor:	
Witness:		Witness:	

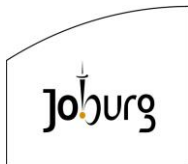


Contract: JW14455
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2. To pay to the Employer the Guaranteed Amount or the full outstanding balance upon receipt of a first written demand from the Employer to the Guarantor emailed to calling up this Performance Guarantee, such demand stating that:
 - 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

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW14455
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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 Engineer 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:

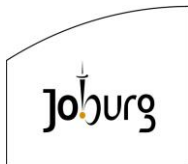
Designation:

Guarantor's signatory (2)

Name:

Designation:

Employer:		Contractor:	
Witness:		Witness:	



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 mandatory”) as envisaged by Section 37(2) of the Occupational Health and Safety Act, No. 85, of 1993 as amended.

I _____ representing _____ (mandatory) do hereby acknowledge that _____ (mandatory) 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 mandatory _____

Signature on behalf of Employer _____

Compensation Fund Registration No. of mandatory _____

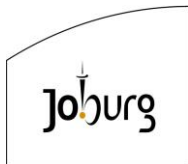
Good Standing Certificate : ☐ yes ☐ no (tick one box)

Employer:		Contractor:	
Witness:		Witness:	

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. 'Mandatory' 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 Act by the mandatory.
4. All documents attached or referred to in the above agreement form 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 mandatory 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 **JW14455: DIEPSLOOT SEWAGE AQUEDUCT**
11. The areas in which the work is to be conducted are **DAINFERN, RIVERSIDE VIEW AND DIEPSLOOT, JOHANNESBURG**
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.

Employer:		Contractor:	
Witness:		Witness:	



C1.3.4.1 Occupational Health and Safety Indemnity Undertaking

I, the undersigned _____
in my capacity as _____
of the firm _____

1. 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. 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. 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. 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 _____

Employer:		Contractor:	
Witness:		Witness:	

Johannesburg Water SOC Ltd



DIEPSLOOT SEWAGE AQUEDUCT

VOLUME 1

PART 2: PRICING DATA

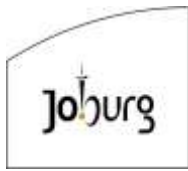
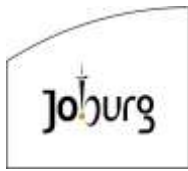


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Employer:		Contractor:	
Witness:		Witness:	



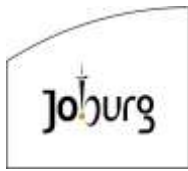
C2 PRICING DATA

c2.1 PRICING INSTRUCTIONS

C2.1.1 GENERAL PREAMBLE TO THE BILL OF QUANTITIES (CIVIL ENGINEERING WORKS)

- a) 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.
- b) 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 Specifications. Variations and amendments to the Project Standard Specifications are contained in the Scope of Work, Portion 2: Variations and/or Additions to the Project Standard Specifications.
- c) 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.
- d) 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.
- e) Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.
- f) 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 Employer's Agent 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. The Contractor must not order the quantities of materials stated in the Bill of Quantities until he has confirmed from the Construction Drawings or measurement on Site that such quantities are in fact the correct quantities.
- g) 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.
- h) 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.

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW14455
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Part2: Pricing Data



- i) 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	=	mega-newton
m ³	=	cubic metre	MN.m	=	mega-newton-metre
m ³ km	=	cubic metre-kilometre	PC sum	=	Prime Cost sum
l	=	litre	Prov sum	=	Provisional sum
kl	=	kilolitre	%	=	percent
MPa	=	megapascal	kW	=	kilowatt
W/day	=	Workday	R/only	=	Rate only

- j) 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 1200.

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.

- k) 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.
- l) While the Employer has every intent to complete the full scope of works, the Employer reserves the right to reduce or increase the scope of works according to the dictates of the budget, or to terminate this contract, with adjustment to the agreed rates, sums or fees and without payment of any penalty in this regard. The Service Provider shall however be entitled to pro-rata payment for all services carried out in terms of any adjustment to the Scope of Work or, in the case of termination, remuneration and/or reimbursement.
- m) The Bill of Quantities shall be completed by hand in BLACK INK. Bidders may also Fill in the tender electronically, Print and affix the Bill of Quantity to the Tender, it remains the bidder's responsibility to ensure it is the same as the BoQ included in the original tender document.

Employer:		Contractor:	
Witness:		Witness:	



C2.1.2 Sufficiency of tender

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his Tender for the construction of the Works and of the rates and prices, which rates and prices shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper execution and completion of the Works.

C2.1.3 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 exist.

C2.1.3.1 Applicability of payment items

All payment items forming part of this Contract shall not apply to ordered Works completed by the Contractor under this Contract, where completed Works:

- are not completed to acceptable quality;
- are not issued by the Employer's Agent;
- are still within the defects and liability period; or
- are not accepted by the Employer's Agent or his duly authorised representative.

C2.1.3.2 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:

1. clearly state this in his qualifications; and
2. 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.

C2.1.3.3 Working outside normal hours

The additional costs, if any, to perform works outside normal working hours shall be deemed to have been allowed for in the provided activity pricing rates and/or prices.

C2.1.3.4 Materials and equipment

C2.1.3.4.1 Materials

The Employer shall not provide any materials, as this shall be provided by the Contractor and deemed to have been included in the various provided rates and prices.

Employer:		Contractor:	
Witness:		Witness:	



C2.1.3.4.2 Equipment

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

C2.1.3.4.3 Damage to materials provided by the Employer

Where the Contractor or public damage any materials, provided by the Employer, whilst in the care of the Contractor, he shall immediately report such damage, arrange for the replacement and all replacement costs shall be at his expense.

C2.1.3.5 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.

C2.1.3.6 Locating existing services

The cost to locate existing services shall be included in the various works activity pricing rates and/or prices, including any excavations required and the provision and use of service detection personnel and equipment. Identified existing services shall be suitably marked at regular intervals for reference purposes.

C2.1.3.7 Confined space

The Contractor shall note that a portion of the work will be executed within confined spaces and it shall be deemed that allowance has been made in all provided activity pricing rates and/or prices.

C2.1.3.8 Concrete

Descriptions (prices) of concrete work shall be deemed to include the design of concrete mixes and all testing of concrete and materials other than compressive strength testing of concrete samples from concrete being placed in the works (the Contractor shall only be entitled to payment for those samples and compressive strength tests called for by the Employer's Agent or his duly authorized representative and which pass the test requirements), handling and depositing (by hoisting or lowering) concrete in the forms, working and packing concrete around reinforcement, all "construction joints" other than "designated joints" as defined in SANS 1200G which are given separately, shaping tops of components as required and striking off and curing.

Descriptions (prices) of concrete in surface beds cast in panels shall be deemed to include formwork, fillets and the like in forming the panels.

C2.1.3.9 Formwork

Formwork is measured to the net surfaces of concrete to be supported, except at intersections of beams with beams, columns, walls, etc. and tops of columns with slabs, beams, etc. where no deductions have been made and descriptions (prices) shall be deemed to include use and waste, except where the formwork is of a permanent nature or is to be left in, fitting together to all required shapes, all cutting, intersections, cambering where required, holes for rods, bolts, pipes and the like, propping, maintaining, keeping damp whilst the concrete is being deposited and removing of formwork.

Employer:		Contractor:	
Witness:		Witness:	



Formwork "left in" and permanent formwork shall be deemed to include leaving in formwork, props, etc.

Descriptions (prices) of formwork to soffits shall be deemed to include propping not exceeding .5.0m high unless otherwise described. Descriptions (prices) of formwork to walls and columns shall be deemed to be not exceeding 5.0m high above bearing level unless otherwise described.

Descriptions (prices) of formwork to soffits of solid slabs shall be deemed to be to slabs not exceeding 500mm thick unless otherwise described.

C2.1.3.10 Smooth formwork

Descriptions (prices) shall be deemed to include for rubbing off all projections at seams etc. after removal of the formwork, making good any defects with 2:1 cement mortar and leaving a smooth surface with all arises slightly rounded, all to the satisfaction of the Employer's Agent or his duly authorized representative.

C2.1.3.11 Reinforcement

Descriptions (prices) for all steel reinforcement to concrete shall be deemed to include cutting and waste, bending, hooked ends, binding at lappings and intersections with annealed wire, all as above described, hoisting or lowering and maintaining in position whilst the concrete is being deposited and cover blocks and spacers in accordance with the relevant SANS Codes of Practice.

C2.1.3.12 Precast concrete

Descriptions (prices) of precast concrete shall be deemed to include reinforcement required for manufacturing, handling and erection purposes, steel rod or wire loop hooks and/or mortices for Lewis bolts required for handling and transporting, any necessary temporary propping and strutting, bedding, jointing and pointing.

C2.1.3.13 Testing

The cost of testing of the ordered Works shall be included in the various applicable Works items. In particular those:

- clearly intended by or provided for in the specifications.
- involving testing or tests to ensure that the design of the whole of the Works or any part of the Works is appropriate for the purpose which it was intended to fulfil.

No additional or separate payment for testing shall be entertained by the Employer.

C2.1.3.14 Cost of samples

All samples shall be supplied by the Contractor at his own cost unless the supply thereof is clearly intended in the specifications or Bill of Quantities to be at the cost of the Employer. Payment shall not be made for samples which do not comply with the specifications.

C2.1.3.15 Failure to submit reports and associated visual media

The Contractor's payment certificate shall be accompanied by confirmation from the Employer's Agent or his duly authorised representative then at items listed for payment have been successfully executed and/or delivered as required. Failure to obtain such confirmation from the Employer's Agent or his duly authorised

Employer:		Contractor:	
Witness:		Witness:	



representative shall result in non-payment of the Contractor's payment certificate until the default has been corrected or the deemed incomplete items are excluded from the payment certificate.

C2.1.3.16 Payment ONLY for works completed

The Contractor shall note that payment shall only be made for Work activities successfully (delivering the end result) executed, complying with the quality requirements and provided to the Employer's Agent or his duly authorized representative.

C2.1.3.17 Training

The Contractor is required to provide training on all equipment installed during the installation and commissioning periods of the contract. Pricing shall make adequate provision for the training of the Employer's delegated staff members.

C2.1.3.18 Maintenance

Pricing shall include for attendance to maintenance items in accordance with the requirements of the contract conditions and specifications.

C2.1.3.19 Disposal of existing equipment

Pricing shall provide allowance for the successful disposal of all redundant and obsolete equipment indicated for removal from the facility.

C2.1.3.20 Certificate of Compliance

Pricing shall provide allowance for the issuing of the relevant Certificates of Compliance for the installation(s) at the facility. One certificate of compliance is required per electrical distribution board completed, and the certificate shall cover all downstream works.

C2.1.4 SMME Portion of the Works

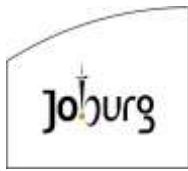
A particular portion of the works shall be allocated for construction by appointed SMMEs, as per the Scope of Works. The main contractor shall identify these activities from the BoQ's and compile the detailed work packages to be submitted with the SMME's subcontracting plan.

The Main Contractor shall retain liability and responsibility for the management, scheduling, and quality control of all works performed by the sub-contractors. After appointment of the Main Contractor, Johannesburg Water will supply the Main Contractor with a list of SMMEs which the Main Contractor can approach to provide rates for the items identified for construction by the SMME. The Main Contractor will be expected to conduct a competitive process to recommend a Sub-Contractor or Sub-Contractors to Johannesburg Water. Johannesburg Water will then evaluate all rates provided by the Sub-Contractor for fairness. Johannesburg Water will then either a) approve the appointment of the Sub-Contractor or Sub-Contractors 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

Employer:		Contractor:	
Witness:		Witness:	



- Compliance with all aspects of the Scope of Work
- Assistance with sourcing of applicable material in line with the technical data sheets

Further an allowance has been made for "Training" – this is related to CETA accredited training which is to be agreed with the Employer during project execution. No amount can be claimed under this item for on-site or on-the-job training, only for accredited training which the SMME receives.

C2.1.5 HEALTH AND SAFETY AND ENVIRONMENTAL MANAGEMENT

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 (2003).

C2.1.5.1 Implementation of health and safety plan

Unit: Month

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. The rate shall include implementation of health and safety plan for all sub-contractors and SMMEs.

C2.1.5.2 Safety officer

Unit: Month

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 2 for the duration of the Contract. The rate shall be on a monthly basis for services rendered.

C2.1.5.3 EMP Implementation and maintenance

Unit: Month

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 Environmental Management Plan. Remuneration shall be on a monthly basis for services rendered. The rate shall include implementation of EMP for all sub-contractors and SMMEs.

C2.1.5.4 Environmental officer

Unit: Month

The rate shall include the wages and salary that is to be paid to the environmental officer/s, whose responsibility it is to ensure that all activities required fully comply with the EMP for the duration of the Contract. The rate shall be on a monthly basis for services rendered.

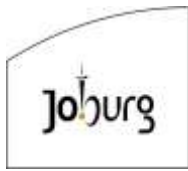
C2.1.5.5 OHS Mentor

Unit: Sum

The costs shall fully cover the compensation of the SACPCMP Registered OHS Mentor for preparing and submitting the Construction Permit until approval.

NOTA BENE: The Contractor shall clearly state the number of Health and Safety and Environmental officers in the provided space in the Bill of Quantities that he has allowed for in his price. Where no

Employer:		Contractor:	
Witness:		Witness:	

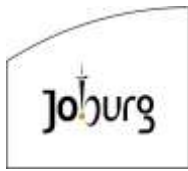


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number is provided the Employer shall assume that adequate provision, minimum 1 per site, has been made to implement the provided Health and Safety Plan and EMP successfully.

Employer:		Contractor:	
Witness:		Witness:	



BILL OF QUANTITIES

Employer:		Contractor:	
Witness:		Witness:	



SUMMARY OF BILL OF QUANTITIES

SUMMARY OF BILLS OF QUANTITIES	
DESCRIPTION	AMOUNT
TOTAL OF BILL 0	R
TOTAL OF BILL 1	R
TOTAL OF BILL 2	R
TOTAL OF BILL 3	R
SUB-TOTAL A	R
PLUS 15% VAT	R
TENDER SUM CARRIED TO FORM OF OFFER	R

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
	SANS 1200A	PRELIMINARY AND GENERAL				
1.1	8.3	FIXED - CHARGE ITEMS (BRIDGES 1, 2 & 3)				
1.1.1	8.3.1	Contractual requirements	Sum	1		
	8.3.2	Establishment of Facilities on the Site :				
	PSA 8.3.2.1	a) Facilities for Engineer				
1.1.2		(i) Name Boards (No.5)	Sum	1		
1.1.3	PSA 8.3.2.1 & PSAB 4.2	(ii) Communication for Employer's Agent Rep. and two (2) computer laptops for the Civil Engineering Interns	Sum	1		
1.1.4		(iii) Offices facilities (No.1)	Sum	1		
1.1.5		(iv) Meeting Room (No.1)	Sum	1		
1.1.6		(v) Parking facilities (No.2)	Sum	1		
	PSA 8.3.2.2	b) Facilities for Contractor				
1.1.7		(i) Offices and storage sheds	Sum	1		
1.1.8		(ii) Water supply-connection by Council, Electric Power supply - connection by Council and Communications	Sum	1		
1.1.9		(iii) Dealing with water	Sum	1		
1.1.10		(iv) Portable latrines	Sum	1		
1.1.11		(v) Tools and equipment	Sum	1		
1.1.12		(vi) Workshops	Sum	1		
1.1.13		(vii) On-site Security	Sum	1		
1.1.14		(viii) Access to works	Sum	1		
1.1.15		(ix) Plant	Sum	1		
1.1.16		(x) Site Camp fencing	Sum	1		
1.1.17	8.3.3	Other fixed-charge obligations (To be specified by the Tenderer)	Sum	1		
	8.3.4	Remove Engineer's and Contractor's Site establishment on completion of construction	Sum	1		
1.1.18	PSA 8.3.5	Additional Contractual Obligations				
1.2.19	PSA 8.3.5.1	Notice and warning to consumers	Sum	1		
1.1.20	PSA 8.3.5.2	OHS Obligations	Sum	1		
1.1.21	PSA 8.3.5.3	EMP Obligations	Sum	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
1.2	8.4	TIME-RELATED ITEMS (BRIDGES 1, 2 & 3)				
	PSA 8.4.2	Operation and maintenance of facilities on the Site for duration of construction, except where otherwise stated:				
	PSA 8.4.2.1	a) Facilities for Engineer for duration of construction (SANS 1200 AB)				
1.2.1		(i) Name Boards	Months	30		
1.2.2		(ii) Communication	Months	30		
1.2.3		(iii) Offices facilities	Months	30		
1.2.4		(iv) Meeting Room	Months	30		
1.2.5		(v) Parking facilities	Months	30		
1.2.6		(vi) Survey assistants and materials	Months	30		
	PSA 8.4.2.2	b) Facilities for Contractor for duration of construction, except where otherwise stated				
1.2.7		(i) Offices and storage sheds	Months	30		
1.2.8		(ii) Water supply-connection by Council, Electric Power supply - connection by Council and Communication	Months	30		
1.2.9		(iii) Dealing with water	Months	30		
1.2.10		(iv) Portable latrines- maintenance	Months	30		
1.2.11		(v) Tools and equipment	Months	30		
1.2.12		(vi) Workshops	Months	30		
1.2.13		(viii) Access to the works	Months	30		
1.2.14		(ix) Plant	Months	30		
1.2.15	PSA 8.4.3	Supervision for duration of construction	Months	30		
1.2.16	8.4.4	Company and Head Office overhead cost	Months	30		
1.2.17	PSA 8.4.5	Other time related obligations (To be specified by the Tenderer)	Months	30		
1.2.18	PSA 8.4.6	Provide Protective safety clothing	Months	30		
1.2.19	PSA 8.4.7	On-site security	Months	30		
1.2.20	C2.1.5.1	Implementation of health and safety plan	Months	30		
1.2.21	C2.1.5.2	Safety Officer (____)(No. to be specified by the Tenderer)	Months	30		
1.2.22	C2.1.5.3	EMP implementation and maintenance	Months	30		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
1.2.23	C2.1.5.4	Environmental Officer (____)(No. to be specified by the Tenderer)	Months	30		
1.3		PROVISIONAL SUMS (BRIDGES 1, 2 & 3)				
1.3.1	8.7	Day works				
1.3.2		Labour	P/ Sum	1	240 000.00	R240 000.00
1.3.3		Percentage adjustment to item 1.3.2	%	240000.00		
1.3.4		Materials	P/ Sum	1	300 000.00	R300 000.00
1.3.5		Percentage adjustment to item 1.3.4	%	300000.00		
1.3.6		Plant	P/ Sum	1	750 000.00	R750 000.00
1.3.7		Percentage adjustment to item 1.3.6	%	750000.00		
1.3.8		Alterations and connections to Municipal Services and repair of damage to services where approved by the engineer.	P/ Sum	1	240 000.00	R240 000.00
1.3.9		Percentage adjustment to item 1.3.8	%	240000.00		
1.3.10		Check testing where ordered by the Engineer	P/ Sum	1	40 000.00	R40 000.00
1.3.11		Percentage adjustment to item 1.3.10	%	40000.00		
1.3.12	PD 2.3.1a	Community Liaison Officer (CLO's)(No. 3) - Salaries	P/ Sum	1	430 000.00	R430 000.00
1.3.13	PD 2.3.1b	Community Liaison Officer (CLO) - Communication	P/ Sum	1	22 790.00	R22 790.00
1.3.14	PD 2.3.1c	Overheads, charges and profit on CLO item above	%	452790.00		
1.3.15	PD 3.3.1/PSA 8.5.3	Training of targeted labour	P/Sum	1	1 350 000.00	R1 350 000.00
1.3.16	PD 3.3.2/PSA 8.5.5	Overheads, charges and profit on Training item above	%	1350000.00		
1.3.17	PSA 8.5.6	Fixed & Time Related P & G's for Local SMME's	P/Sum	1	2099000.00	R2 099 000.00
1.3.18		Handling charges on item 1.3.17 above	%	R2 099 000.00		
1.3.19	PSA 8.5.7	Contractor's Obligations in respect of SMME's				
		(a) Remuneration Supervisor for SMME's (Based on R35000/month for all three bridges)	P/Sum	1	1050000.00	R1 050 000.00
		Handling charges on item 1.3.19 above	%	R1 050 000.00		
1.3.20	C2.1.5.5	OHS Mentor from the Contractor (Registered SACPCM)	Sum	1		
1.3.21	PSA 8.5.8	Compensation for Community Liaison Period	Months	3		
1.3.22	PSA 8.5.9	(a) Remuneration Civil Engineering Interns (2.No., Based on R5000/month)	P/Sum	1	240000.00	R240 000.00
		Handling charges on item 1.3.22 above	%	R240 000.00		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
1.4	8.8	TEMPORARY WORKS (BRIDGES 1, 2 & 3)				
1.4.1	8.8.1	Construct and maintain main access road to works	Sum	1		
1.4.2	8.8.6	Dealing with river flood including all impounding and diversion	Sum	1		
1.4.3	8.8.3	Protection of adjacent structures until construction in the vicinity is complete	Sum	1		
1.4.4	PSA 8.8.7	Supply, install and monitor early warning for sewage flooding.	Sum	1		
1.4.5	PSA 8.8.8	Supply, install and remove hoarding (no less than 1.8m high) for the construction site perimeter.	m	7320		
		Existing Services				
1.4.6	8.8.4	a) Supply or hire of specialist equipment for the detection of particular services	Sum	1		
1.4.7		b) The use of equipment referred to in item (a) above	Sum	1		
1.4.8		c) Excavation by hand in soft material to expose existing services in the proposed diversion pipeline way.	m ³	300		
1.4.9		d) Temporary protection of existing services as required	Sum	1		
1.4.10	PSA 8.8.4(e)	e) Excavation to expose bridge bases and check possible encroachments onto the pipeline route	m ³	300		
1.4.11	PSA 8.8.5	Survey and setting out works	Sum	1		
1.4.12	PSA 8.8.9	Demolish existing boundary walls and gates and reinstate after construction (prov)	m	150		
1.4.13	PSA 8.9.1	Protection of Survey beacons/stand pegs and submission of certificate from a registered land surveyor confirming non-disturbance of pegs	Sum	1		
1.4.14	PSA 8.9.3	Compensation in terms of sub clause 9.1.4 for delays due to the circumstances described in sub clauses 9.1.1 and 9.1.2 of the general conditions of contract, as amended	Day	1		
TOTAL CARRIED TO SUMMARY						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 2: SITE CLEARANCE AND EARTHWORKS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
2.0	SANS 1200C	SECTION 2: SITE CLEARANCE				
2.1		CLEAR SITE				
2.1.1	8.2.1	Clear and grub the working space and provide a pipe laying platform, an access road, pipe storage strip and pipe storage mounds alongside the trench for pipe laying operations	ha	0.74		
2.1.2	8.2.2	Remove and grub large trees and tree stumps of girth:				
		a) over 1m and up to and including 2m	No	5		
		b) over 2m and up to and including 3m	No	2		
2.1.3	PSC 8.2.2.1	Penalty for unauthorized removal or damage of indigenous trees along the route	Sum/tree	1	-12500	Rate Only
2.1.4	PSC 8.2.5	Take down existing fences, stockpile and re-instate after construction works	Sum	1		
2.1.5	8.2.10	Remove topsoil to nominal depth of 150mm and stockpile on pipeline route only	m³	450		
2.1.6	PSC8.2.11	Remove, store, preserve and replant selected trees along the diversion pipeline	No	5		
2.1.7	8.2.8	Demolish and remove structures/buildings and dismantle steelwork.	Sum	1		
2.1.8	8.2.9	Transport materials and debris to unspecified sites and dump (Provisional) (10km maximum haulage)	m³/km	2500		
2.1.9	PSC 8.2.19	Reinstatement of 1.8 metre high concrete palisade fence	m	20		
2.2	SANS 1200D 8.3.3	EARTHWORKS Restricted Excavation				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose (including shoring and or bracing of trench sides):				
		3.8m wide and total trench depth for pipes 2.1m diameter				
2.2.1		i) Exceeding 0.0m but not exceeding 2.0m	m³	270		
2.2.2		ii) Exceeding 2.0m but not exceeding 3.0m	m³	350		
2.2.3		iii) Exceeding 3.0m but not exceeding 4.0m	m³	6270		
2.2.4		iv) Exceeding 4.0m but not exceeding 5.0m	m³	100		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 2: SITE CLEARANCE AND EARTHWORKS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	8.3.2	b) Extra over items 2.2.1 to 2.2.4 incl. for, (Provisional as approved by the Engineer):				
2.2.5		i) Intermediate excavation	m³	1206		
2.2.6		ii) Hard rock excavation, using mechanical and non-blast methods	m³	2813		
	SANS 1200DB	Excavation				
2.2.7	8.3.2	a) Excavate and dispose of unsuitable material from trench bottom in rock and marshy areas. (Provisional as approved by the Engineer)	m³	282		
2.2.8	8.3.3	Excavation Ancillaries				
	8.3.3.1	Make up deficiency in backfill material (Provisional as approved by the Engineer)				
2.2.9		(a) From other necessary excavations on site	m³	50		
2.2.10		(b) by importation from designated borrow pits	m³	10		
2.2.11		(c) By importation from commercial or off-site sources selected by the Contractor (Including haulage). Provisional as approved by Engineer)	m³	1500		
2.3	SANS 1200DB	Bulk Excavation				
2.3.1	8.3.2	Excavate in all materials for Scour Valve chambers and structure, backfill, compact and dispose of surplus/unsuitable material for:	m³	30		
2.3.2	PSDB 8.3.7	Accommodation of Traffic	L/Sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 3: MEDIUM PRESSURE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
3.0	SANS 1200LB	SECTION 3: MEDIUM PRESSURE PIPELINE				
3.1		BEDDING				
	8.2.1	Provision of Bedding from Trench Excavation.				
3.1.1		(a) Selected granular material	m³	100		
3.1.2		(b) Selected fill Material	m³	100		
	8.2.2	Supply only of bedding by importation				
	8.2.2.1	I) From other necessary excavations				
3.1.3		(a) Selected granular material	m³	50		
		(b) Selected fill Material	m³	50		
	8.2.2.3	II) From commercial sources				
3.1.4		(a) Selected granular material	m³	1830		
		(b) Selected fill Material	m³	2060		
3.2	SANS 1200L	MEDIUM PRESSURE PIPELINE				
	PSL 8.2.1	Supply, handle, lay, joint, bed and test GRP pipe complete with couplings				
3.2.1		2100mm diameter GRP PN 6 Pipe	m	745		
3.2.2	8.2.1	Supply, handle, lay, joint, bed and test 160mm diameter Class 9 uPVC pumping pipeline.	m	270		
	PSL 8.2.2	Extra-over item 3.2.1 for specials				
3.2.3		(a) 2100mm diameter 0.2-11.25 deg. GRP bends with couplings	No	5		
3.2.4		(b) 2100mm diameter >11.25-22.5 deg. GRP bends with couplings	No	3		
3.2.5		(c) 2100mm diameter >22.5-45 deg. GRP bends with couplings	No			Rate Only
3.2.6		(d) 2100mm diameter x 160mm GRP scour tee as per detail on drawing no. 13247-02/C/SEW/308-02	No	1		
3.2.7		(e) 2100 mm diameter steel Stub end flange adaptor as per detail A on drawing no. 13247-02/C/SEW/306-02	No	2		
3.2.8		(f) 1.0m m length x 2100 mm diameter GRP Flange Spigot Connector(drilled to SANS 1123-250/3) as per detail on drawing no. 13247-02/C/SEW/306-02	No	2		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 3: MEDIUM PRESSURE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	8.2.2	Extra-Over Item 3.2.2 for 160 mm diam. uPVC Specials complete with couplings.				
3.2.9		a) >3-11.25° Bend	No	1		
3.2.10		b) >11.5 - 22.50° Bend	No	1		
3.2.11		d) 45° Bend	No	1		
3.2.12		e) 90° Bend	No	1		
3.2.13		f) 150mm diameter Gate valve, Fittings and pipework inside scour chamber as per detail on drawing no. 13247-02/C/SEW/308-02	Sum	1		
3.3	8.2.11	Thrust & Anchor blocks:				
3.3.1		1) Class 20 MPa/19 mm concrete (Thrust Blocks	m³	85		
		2) Class 25 MPa/19 mm concrete (Anchor Blocks) as per Dwg No.13247-02/S017/A	m³	15		
3.3.2	SANS 1200G 8.2.1	Rough Vertical formwork to concrete thrust & anchor blocks	m²	100		
	8.3.1	Reinforcement				
3.3.3		b) High-tensile Steel Bars	kg	825		
3.4	SANS 1200 L	Valve chambers				
3.4.1	8.2.13	Scour valve chamber complete with pipe fitting and specials to detail as per drawing No. 13247- 02/C/SEW/308-02	No	1		
3.4.2	PSL8.2.13.1	Supply and connect 150 mm diameter mobile pump to drain diversion pipeline on completion of repair works.	No	1		
3.4.3	PSL8.2.13.2	Operate the pump to clean and clear grit and debris collected in the pipe diversion pipeline during and on completion of construction.	Sum	1		
3.4.4	PSL8.2.13.3	De-establish pump installation after completion of works.	Sum	1		
3.5	SANS 1200LD	Raising and lowering of Existing Manholes				
3.5.1	PSLD 8.2.13.1	Temporary Raising of Existing Manholes to 2.5m height and dismantling as per Dwg No. 13247-02/C/SEW/309-02	P/sum	1		
3.5.2	PSLD 8.2.13.2	Seal and strap down manhole covers to prevent leakages	P/sum	1		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 3: MEDIUM PRESSURE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
3.6	8.2.3	Replace of missing covers with Polymer manhole covers on the Diversion Chamber Cover Slab.				
		a) 770mm x 610mm	No.	2		
		b) 500mm x 500mm	No.	1		
	SANS 1200DB	Finishes				
	8.3.6.1	Reinstate road complete with all courses to match original specification				
	3.6.1	b) Asphalt of thickness 30mm in roadway	m ²	60		
	3.6.2	d) 60mm concrete interlocking blocks in parking	m ²	65		
	SANS 1200D					
	3.6.3	8.3.10 Topsoiling embankments and reinstatement of trenched areas	m ²	11000		
	3.6.4	8.3.11 Grassing embankments and trenched areas with veld grass	m ²	11000		
3.7.8	SANS 1200DB	Excavation				
	8.3.3.1	Backfill in an embankment on sewage diversion pipe at entry and exit chambers from imported fill compacted to 93% Mod AASHTO density as shown on drawing 13247-02/C/SEW/300-D	m ³	1200		
TOTAL CARRIED FORWARD TO SUMMARY						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 4: DIVERSION AND RE-ENTRY CHAMBER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
4.0		SECTION 4: DIVERSION AND RE-ENTRY CHAMBERS				
4.1	SANS 1200C	SITE CLEARANCE				
4.1.1	8.2.1	Clear and grub area around the two chambers and create space for placing the removed Precast U-sections.	m ²	200		
4.1.2	PSC 8.2.12	Remove cover slabs over the entry/exit chambers, store and restore as required (6 No x 0.2 m tck x 1.2 m x 5m)	Sum	1		
4.1.3	PSC 8.2.12	Remove cover slabs over the entry/exit chambers, store and restore as required (3 No x 0.12 m tck x (aver. 1.58 m x 2.9m, aver. 2.9 m x 2.3m & 3.4mx1.5m)	Sum	1		
4.2	SANS 1200G	CONCRETE (STRUCTURAL)				
4.2.1	SANS 1200 LD 8.2.12	Design, supply and install 2.5m height adjustment watertight temporary panels to the entry chamber to possible accommodate additional required head as per concept on drawing number 13247-02/C/SEW/306-02	Sum	1		
4.2.2	SANS 1200 C 8.2.8	Break out up to 600mm thick brick plug inside the 2 x 1800 diameter flange adaptors and dispose off- site	No	2		
4.2.3	PSC 8.2.14	Cut opening through existing concrete wall and make good surfaces at the exit and re-entry chambers to create side weir as per detail on drawing No. 13247-02/C/SEW/306-02	Sum	1		
4.2.4	PSC 8.2.15	Break out and spoil concrete wall section, mass concrete infill and precast U-sections	m ³	30		
4.2.5	PSC 8.2.12	Remove Precast U-sections from chamber and store at platform next to chamber (approx.5.2 tonnes each)	No	6		
4.2.6	SANS 1200 C 8.2.8	Demolish up to 600 mm tck reinforced concrete wall, remove the embedded 1800 mm diam flange adaptors, spoil rubble, modify openings and install new a 2100mm diam flange adaptor ex Item 3.2.7 on exit and re-entry chambers as per dwg no. 13247-02/SEW/306-02	Sum	1		
	8.2	Formwork (to Steel flange (Stub) area)				
4.2.7	8.2.2	Smooth	m ²	3		
4.2.8	8.4.3	Cast in-situ 30Mpa concrete to steel stub area with reinforcement as per detail in Dwg No. 13247-02/C/SEW/306-02	m ³	1		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 4: DIVERSION AND RE-ENTRY CHAMBER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	8.3.1	Reinforcement (to Steel flange (Stub) area)				
4.2.9		a) Mild Steel Bars	kg	5		
4.2.10		b) High-tensile Steel Bars	kg	10		
	SANS 1200 GE	PRECAST CONCRETE (STRUCTURAL)				
4.2.11	8.2.1	Manufacture complete reinforced Precast U-sections as detailed in Dwg No. 13247-02/C/SEW/306-02 with 40MPa concrete to replace broken sections (provisional)	No	2		
4.2.12	SANS 1200 GE 8.2.2	Erect Precast U-sections after completion of repair work to sewer internally	No	2		
4.2.13	SANS 1200 LE 8.2.5	Cast in-situ 15 Mpa concrete infill that was broken in item no 4.2.4	m³	10		
4.2.14	SANS 1200 GE 8.2.2	Erect precast roof slabs from (item 4.1.2), grout in and seal with 50mm 20Mpa concrete topping.	L/sum	1		
4.2.15	SANS 1200 GE 8.2.5	Complete design, fabricate, supply and install main steel sluice gates and diversion gates complete to concept detail as per dwg No.13247-02/C/306-02, including sewage control and diversion	P/Sum	1	3 000 000.00	R3 000 000.00
4.2.16		Procure and install missing/brocken elements of precast concrete pallisade fencing (1.8 m high) to match existing	m	50		
TOTAL CARRIED FORWARD TO SUMMARY						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 5: COMMISSION / DE-COMMISSION BYPASS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
5.0	SANS 1200A	SECTION 5: COMMISSION / DE-COMMISSION SEWERS				
5.1.1	PSA 8.8.10	Provide labour and plant to open and close sluice gates at the upstream and downstream of the existing concrete pipeline	sum	1		
5.1.2	PSA 8.8.11	Operate, maintain, inspect and monitor the operation of the diversion system for the duration of the sewage diversion	sum	1		
5.1.3	PSA 8.8.12	Provide labour, plant and materials required to flush the diversion sewer with water and pump out the residual sewage from the by-pass through the scour chamber	sum	1		
5.1.4	PSA 8.8.13	Dismantle all temporary works associated with the operation of the by-pass pipeline	sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND CONCRETE SEWER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
6.0	COLTO 1200 PS	SECTION 6: REPAIRS ON BRIDGE DECK, HANDRAILS AND CONCRETE SEWER				
		121.01 Temporary access structures and work platforms				
		Access and Platform to (height range indicated below)				
		i) Design, supply and erect at the following structural elements(Abutments, piers, decks, parapets/balustrades/deck edges) and height ranges inclusive of dismantling and moving to the next structural element				
		a) 0 m up to 5,0 m	lump sum	1		
		b) Exceeding 5. 0 m up to 10,0 m	lump sum	1		
		c) Exceeding 10. 0 m up to 20,0 m	lump sum	1		
		d) Exceeding 20. 0 m up to 30,0 m	lump sum	1		
		ii) Dismantle and remove from location or structure				
		a) 0 m up to 5,0 m	lump sum	1		
	b) Exceeding 5. 0 m up to 10,0 m	lump sum	1			
	c) Exceeding 10. 0 m up to 20,0 m	lump sum	1			
	d) Exceeding 20. 0 m up to 30,0 m	lump sum	1			
	123.03	Proprietary cementitious repair compound Repair system 1 (cl 12305 (c)(iii)) to: (i) Spalls to piers & bridge deck	litres	200		
	124.04	Establishment on site for crack injection	lump sum	1		
124.05	Crack injection with epoxy resin to cracks in abutments and piers	m	250			
6.1		BRIDGE DECK				
		Bridge Deck & Concrete Pipe Joints				
	128.01	Remove old joint seals and clean joints	m	1000		
	128.03b	Supply and seal expansion joints with polysulphide bridge & concete pipe joint sealant	l	3000		
6.2		Handrails				
	128.05	Remove all existing steel rails and stanchions to waste.	m	1600		
	128.06	Supply and install 1.1 or 1.2m high concrete balustrades to manufacturer's specifications and details on Dwg No. 13247-02/S/017/A	m	1600		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND CONCRETE SEWER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	COLTO 1200 PS	CONCRETE PIPE REPAIRS				
6.3		External Cracks Repairs				
6.3.1	124.04	Establishment on site for crack injection	L/Sum	1		
6.3.2	124.05	Supply approved epoxy and inject cracks on the outside of the concrete outfall sewer and bridge elements (greater 0.5 mm crack width)	m	3 000		
6.3.3	124.07	Supply and apply crystalline protective coating to seal micro-cracks on the outside of the concrete outfall sewer and bridge elements (less than 0.5 mm crack widths)	m ²	10 000		
6.4		Internal Repairs				
6.4.1	PSA 8.9.6	Provision of access, lighting and ventilation in the pipeline for the duration of the internal pipe repairs.	Sum	1		
6.4.2	PSC 8.2.13	Drain, flush outfall sewer and hose down internal face of the concrete pipe using high pressure water jetting to allow for a clean and safe working environment (6735 m ² face area)	Sum	1		
6.4.3	PSA 8.9.4	Inspections and measurements of damage using technology	P/Sum	1	400 000.00	R400 000.00
6.4.4	PSA 8.9.5	Visual inspections and measurements of damage by visual assessments	P/Sum	1	200 000.00	R200 000.00
6.4.5	125.02	Preparation of Concrete Surface	m ²	6735		
6.4.6	122.03	Cutback concrete surface to specified or ordered depth	m ³	190		
6.4.7	125.01	Establishment on site for sprayed on concrete work	L/Sum	1		
6.4.8	125.03	Application of sprayed cementitious mortar or 40MPa/10mm concrete to repair scour and internal pipe damage to woodfloat finish, including wet-to-dry epoxy bonding primer	m ³	250		
6.4.9	125.03	Apply a 15mm thick sacrificial layer on the internal pipe diameter (2890mm Ø) using 40MPa 100% Calcium Aluminate cementitious structural rehabilitation concrete or similar approved	m ²	6735		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND CONCRETE SEWER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
6.5		Insulation and Cladding				
6.5.1	126.02	Supply and install 50mm thick Polyurethane sprayed-in-place insulation foam bonded to pipe per detail on dwg No.13247-02/C/SEW/306-01 or similar approved to manufacturer's specification	m ²	7 820		
		Provide pipe cladding protection by:				
6.5.2	126.03	i) Trial sample panels (glass fibre reinforced polyurethane coating & insulation)	m ²	20		
6.5.3	126.03	ii) Using pre-painted galvanised steel sheets	m ²	500		
6.5.4	126.04	iii) Using durable glass fibre reinforced polyurethane coating to manufacturer's specifications or similar approved.	m ²	7 820		
6.5.5	PSC	Remove and dispose old metal sheet cladding and polystyrene insulation	m ²	3 000		
6.5.6	126.01	Clean and prepare external concrete pipe surface to receive the insulation installation to manufacture's specification	m ²	7 820		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
7.0	COLTO	<u>SECTION 7: BY-PASS SEWER BRIDGE / DIVERSION BRIDGE</u> <u>FOUNDATION FOR STRUCTURES (Section 6100)</u>				
7.1	61.02	Excavations a) Excavating soft material situated within the following successive depth range:				
7.1.1		(i) 0m up to 2m	m³	400		
7.1.2		(ii) Exceeding 2m up to 4m	m³	290		
7.1.3		(ii) Exceeding 4m up to 6m	m³	165		
7.1.4		b) Extra over subitem 61.02 a) for excavation in hard material irrespective of the depth	m³	90		
	61.03	Access and drainage				
7.1.5		a) Access	L/Sum	1		
7.1.6		b) Drainage	L/Sum	1		
7.1.7	61.04	a) Backfill to excavations utilising materials from excavations	m³	45		
		b) Backfill to excavations utilising imported materials from commercial sources	m³	15		
7.1.8	61.07	Overbreak in excavation in hard material	m²	10		
7.1.9	61.08	d) Foundation fill consisting of mass concrete, 15Mpa	m³	25		
		e) Concrete screed, 50 mm thick, class 15/19 Concrete	m³	15		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.2	COLTO	FALSEWORK, FORMWORK AND CONCRETE FINISH(Section 6200)				
	62.02	Vertical formwork to provide:				
		a) Class F1 surface finish to:				
7.2.1		.01) Bases	m²	105		
		b) Class F2 surface finish to:				
7.2.2		.01) rectangular on Pier above & below ground	m²	380		
		.02) Curved on Pier above & below ground	m²	120		
7.2.3		.03) Deep Beams	m²	1820		
7.2.4		.04) End Retaining Walls	m²	85		
	62.03	Horizontal formwork to provide:				
		b) Class F2 surface finish to:				
7.2.5		.04) Deck, roof beams & slabs	m²	885		
	62.05	Permanent formwork:				
7.2.6		a) To form voids of:				
		i) 2220 mm dia in deck end walls	No.	2		
		ii) 650 mm dia (manhole) in deck end top tie slab	No.	2		
7.2.7	62.06	Formwork to form open joints				
		i) Deck span ends	m²	60		
	B62.10	Unformed surface finishes				
7.2.8		a) Wood-floated (Class U2)				
		i) Deck	m²	840		
		ii) Beams	m²	265		
		b) Rough Finish (Class U1)				
		i) Bases	m²	55		
CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.3	63.01	REINFORCEMENT(Section 6300)				
7.3.1		.01) Bases				
		ii) High-tensile Steel Bars	t	11.9		
7.3.2		.02) Piers				
		ii) High-tensile Steel Bars	t	15.7		
7.3.3		.03) Deck slab				
		i) Mild Steel Bars	t	0.4		
		ii) High-tensile Steel Bars	t	35.4		
7.3.4		.04) Deep Beams on deck & End Walls				
		i) Mild Steel Bars	t	1		
		ii) High-tensile Steel Bars	t	76.6		
7.4	64.0	CONCRETE FOR STRUCTURES (Section 6400)				
	64.01	Cast in situ concrete:				
		a) Class 30/19 in :				
7.4.1		i) End Retaining Walls	m³	5		
7.4.2		ii) Bases	m³	70		
7.4.3		iii) Deck	m³	340		
7.4.4		iv) Piers	m³	195		
7.4.5		v) Deep Beams	m³	960		
	64.02	Manufacturing precast concrete members:				
7.4.6		.i) Manufacture precast concrete pipe supports as per Dwg No. 13247-02/S/003/A & R015/A	No	39		
		ii) Manufacture precast concrete deck cover slabs (planks) as Dwg No. 13247-02/S/017/A & R003/A	No	131		
		iii) Manufacture precast concrete re-entry chamber cover slabs as Dwg per No.13247-02/S/017/A				
		a) Type A	No	1		
		b) Type A'	No	2		
		c) Type A"	No	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
		d) Type B	No	1		
		e) Type B'	No	1		
		f) Type C	No	1		
		g) Type D	No	1		
		h) Type E	No	1		
		i) Type F	No	1		
	64.03	Transporting and erecting precast concrete members				
		a) Concrete pipe supports in position as per Dwg No. 13247-02/S/003/A, 001 & 002 approx. mass =2.5 tonnes	No	39		
		b) Deck cover slabs (planks) to final position per Dwg No. 13247-02/S/004/A, 001 & 002 approx. mass =1.42 tonnes	No.	131		
		c) Re-entry chamber cover slabs to final position per Dwg No. 13247-02/S017/A approx. mass =2.0 tonnes	No.	7		
		d) Re-entry chamber precast concrete cover slabs as Dwg No.13247-02/S017/A approx. mass =2.8 tonnes	No	3		
	66.00	NO-FINES CONCRETE, JOINTS, BEARINGS, BOLT GROUPS FOR ELECTRIFICATION, AND PARAPETS AND DRAINAGE FOR STRUCTURES (Section 6600)				
7.5	66.06	Filled joints:				
7.5.1		i) Expansion joints filled with 20mm closed cell polystyrene and 20x20mm approved joint sealant as detailed on drawing No. 13247-02/S/004/A	m²	20		
		ii) Expansion joints filled with 74mm closed cell polystyrene as detailed on drawing No. 13247-02/S/004/A	m²	30		
	66.08	Sealing joints with:				
7.5.2		a) Sealant: 20x20mm approved joint sealant as detailed on drawing No. 13247-02/S/004/A	m	50		
	66.11	Proprietary bearings:				
7.5.3		a) Supply and construct 403074: 400x300x74 Bearings Pad to detail as per dwg No. 13247-02/S/004/A	No	12		
	B66.14	Dowels/guides to pipe supports				
		a) Supply and install 420 mm Long x Y20 dowel bars as per Dwg No. 13247-02/S/003/A & R002/A	No	78		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.5.4	66.19	Drainage pipes and weep holes: a) Drainage pipes i) 110 mm dia uPVC pipes to detail as per dwg No. 13247-02/S/003/A	No	2		
	B66.32	Accessories to detail given on dwg no. 13247-02/S/004/A				
7.5.5		a) Precast concrete manhole cover and frame to typical deck access detail	No	2		
7.5.6		b) Step iron to typical deck access detail	No.	16		
		c) Supply and Install cradle liners and steel straps with brackets including bolts sets as per Dwg No. 13247-02/S/003/A	No	39		
7.8	52.00	GABIONS (Section 5200)				
7.8.1	52.02	Surface preparations for bedding of gabions	m ²	40		
	52.03	Gabions - Galvanised and PVC coated baskets, made with hexagonal woven (double twisted) wire mesh type 80. Steel wire to be heavily galvanised to class A with zinc alloy coated wire according to SANS 1580.				
7.8.2		(i) 3.0 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	9		
7.8.3		(ii) 3.0 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	14		
7.8.4		(iii) 3.0 x 2.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	18		
7.8.5		(iv) 2.0 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	8		
7.8.6		(v) 2.0 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	18		
7.8.7		(vi) 2.0 x 2.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	16		
7.8.8		(vii) 1.5 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	5		
7.8.9		(viii) 1.5 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	3		
7.8.10	52.05	Geotextile- as per detail	m ²	120		
TOTAL CARRIED TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
8.0		SECTION 8: ELECTRICAL AND SECURITY				
8.1	ELE - PTA	SECURITY INSTALLATION				
	ELE - PTB - 1,1	CCTV - Cameras				
8.1.1	ELE - PTB - 1,2	Outdoor Infrared IP bullet 720p IP66 AVF SMB PKG	No.	20		
8.1.2	ELE - PTB - 1,3	AUTODOME PTZ 5000 HD 1080P 30X PEND CL OUT	No.	4		
8.1.3	ELE - PTB - 1,4	PTZ Pole Mount Bracket	No.	20		
8.1.4	ELEC - PT2 - 25 (i)	5m Pole	No.	20		
		Control/Server Room				
8.1.5	ELE - PTC - 2,01,3	27U Cabinet - 27U 600 X 1000 Cabinet incl F-27U 600 X 1000 Floor standing Cabinet including Fans and Power Black	No.	1		
8.1.6		Standard Application Server (WW)	No.	1		
8.1.7	ELE - PTB - 1,8	DIVAR IP 6000 2U 2x4TB (R2) Storage	No.	1		
8.1.8		Professional Base Licence	No.	1		
8.1.9		BVMS Professional 7.5 Workstation expansion Licence	No.	1		
8.1.10	ELE - PTB - 1,5	24" Class Full HD IPS LED Monitor	No.	2		
8.1.11		1.5M HDMI MALE - HDMI MALE CABLE	No.	2		
8.1.12		Dual screen Video Display Controller	No.	1		
8.1.13		PC server with Windows& Pro Screen Keyboard and Mouse	No.	1		
8.1.14	ELE - PTB - 1,7	Keyboard Controller INTUIKEY DIGITAL KEYBOARD W/ LCD FOR USE WITH DIVAR DVR AND SYSTEM 4 MULTIPLEXERS.	No.	1		
8.1.15		PSU (220-240VAC/15VDC, 600MA, 50/60HZ)	No.	1		
8.1.16		DATANET UTP CAT6 SOLID GREY	m	200		
8.1.17		RJ45 CAT 6 Connector (Shielded)	No.	50		
8.1.18		Weather-boots for RJ45 6mm FLT	No.	50		
		Control Room - Security Office				
8.1.19	ELE - PTB - 1,5	24" Class Full HD IPS LED Monitor	No.	2		
8.1.20		PC server with Windows& Pro Screen Keyboard and Mouse	No.	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
		Network Field Equipment CCTV				
8.1.21	ELE - PTC - 2,01,3	9U Wall box, Swing Frame, 600mm Deep, Black	No.	12		
8.1.22		X1026P WEB MANAGED, 24X 1GBE AND 2X 1GBE SFP POE	No.	12		
8.1.23	ELE - PTB - 1,6	Fibre Gbix for Switch	No.	20		
8.1.24		DATANET UTP CAT6 SOLID GREY	m	150		
8.1.25		RJ45 CAT 6 Connector (Shielded)	No.	40		
8.1.26		Weather-boots for RJ45 6mm FLT	No.	40		
8.1.27	ELE - PTB - 1,9	Fibre cable and accessories per meter	No.	12300		
8.1.28		Fibre Fusion splicing and accessories per splice	No.	40		
		Trunking				
8.1.29		TRUNKING - YT5 40 x 40 / 3m	m	400		
8.1.30		PVC - 40 x 40 Internal Corner - White	No.	40		
8.1.31		PVC - 40 x 40 Terminal End - White	No.	20		
8.1.32		PVC - 40 x 40 End Cap - White	No.	20		
8.1.33		Sprag 20mm	m	24		
8.1.34	ELE - PTB - 1,12	Labour and Commissioning	Hour	320		
8.2	ELEC - V1A	ELECTRICAL INSTALLATION				
	ELEC PT2 - 7.3	LUMINAIRES				
		Supply, install and connect luminaires mounted as specified, complete with lamps, control gear and all accessories:				
8.2.1		48W LED post top light fitting on 5m mounting height, complete with high impact acrylic diffuser	No	57		
		70W High Pressure top light fitting on 3m mounting height, complete with high impact acrylic diffuser		32		
	ELEC - PT2 - 7.2	CABLES AND TERMINATIONS				
		The supply, delivery and installation of (but excluding trenching, terminations, joints and cable supports) for the following PVC /SWA/PVC 600/1000V Copper Cables				
8.2.2	ELEC - PT2 - 7.2	6 mm² 4-core PVC/SWA/PVC Cable	m	1800		
8.2.3	ELEC - PT2 - 7.2	4 mm² Bare Copper Earth Wire	m	1800		
8.2.4	ELEC - PT2 - 7.2	6 mm² 4-core PVC/SWA/PVC Cable Terminations	No.	2		
TOTAL CARRIED FORWARD						

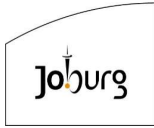
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.2.5	ELEC - PT2 - 7.2	4 mm ² Bare Copper Earth Wire Terminations	No.	2		
	ELEC - PT1 - 10	SLEEVES Supply and installation of PVC sleeves complete with all accessories including couplings, bending and fixings as specified:				
8.2.6	ELEC - PT1 - 10,2	50mm diameter PVC sleeves for electrical/electronic services	m	500		
8.2.7	ELEC - PT1 - 10,2	110mm diameter PVC sleeves for electrical/electronic services	m	500		
	ELEC - PT1 - 8	Cable Trenching Excavations of trenches and levelling bottom and bedding in sifted ground. Backfilling compacting and making good of surface. Trenching of minimum of 450mm width and depth of 600mm				
8.2.8	ELEC - PT1 - 8,1	In soft rock	m ²	100		
8.2.9	ELEC - PT1 - 8,1	In hard rock	m ²	50		
8.2.10	ELEC - PT1 - 8,1	Backfilling		150		
8.2.11	ELEC - PT1 - 8,1	Danger tape	m	500		
		Manholes				
8.2.12		Supply and install in ground 800mmx800mmx600mm deep manhole complete with steel cover to dwgs	No.	22		
8.3	ELEC - PT2 - 21	Transformers - pole mounted Supply and Installation of new transformers on an appropriate structure and secure as required including the termination of cables and conductors, the provision of suitable lugs & all accessories.				
8.3.1	ELEC - PT2 - 21.1	NEW Transformer 50 Kva, 11kV/415V	No	1		
		Medium Voltage Surge Arrestors Supply and install the following surge arrestors, complete with galvanised steel mounting brackets for securing the surge arrestor, nuts, bolts, washers and lock washers as specified. Secure the surge arrestors and brackets to the transformer as specified including the termination of conductors. Discharge current 10kA.				
8.3.2	ELEC - PT2 - 21.5	11V/22Kv, MCOV 19.2kV Surge arrestor, 31mm/kV, inland.	No	3		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.3.3	ELEC - PT2 - 21.4	Medium Voltage Sectionalisers and Links Supply and install link isolators as detailed including the installation of crossarm brackets and the termination of conductors and including the drilling of holes in wooden poles as required. 15K fused links. Fused Links, Single Pole (2.5m X-arm)	No	3		
8.3.4	ELEC - PT2 - 21.5	Neutral Surge Arrestor Supply and install a LV surge arrestor including lugs and galvanised bolts 6kV, 10kA Surge Arrestor	No	2		
8.3.5	ELEC - PT2 - 23	Transformer & Equipment Earthing Supply and install all materials for the complete earthing of transformer structures for ABC networks as specified. Included in the rate shall be all required spikes, insulated copper conductor, galvanised conduits, staples, bare copper, excavations, backfilling, etc. The rate shall allow for all required MV earth electrodes, consisting of four earth spikes in accordance with the Distribution specifications.				
	ELEC - PT2 - 23.1.3	MV Earth	No	1		
	ELEC - PT2 - 7.1	Conductor Take delivery off, safely store on sealed drums with ends adequately secured and transport to site conductor as specified. String conductor as specified including splices, jumper conductor ties, strain clamps, suspension clamps, tensioning, sagging, etc.				
8.3.6	ELEC - PT2 - 21,3	ACSR Hare - 3 Phase - Conductor length Poles and Crossarms Recieve and safely store the following poles. Transport to site of works and install pole in excavated hole, including cutting and scaffing, kicking blocks, bonding, treating, etc. Excavations and compaction are measured elsewhere.	m	3 900		
8.3.7	ELEC - PT2 - 26,2	9m Pole, 140-159mm top diameter MV STRUCTURES Supply and install all material as specified for the construction of the following MV structures. Including bonding of hardware and earthing. All excavations, poles, crossarms and stays are measured elsewhere.	No	20		
8.3.8	ELEC - PT2 - 26,1	Transformer -2-pole platform mounted	No	1		
8.3.9	ELEC - PT2 - 27 (i)	3 Phase - Vertical (600mm spacing) - Strain – Small(1°-30°) Deviation	No	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.3.10	ELEC - PT2 - 28	MV Test (per transformer installation)	No	1		
		Recieve, off load and install the following wooden cross arms.				
8.3.11	ELEC - PT2 - 27 (iii)	2.5m, 140-159mm Diameter	No.	10		
		Stays, Flying Stays and Anti-Climbing Devices				
		The following stays shall be in accordance with the specification and shall include a stay plate				
8.3.12	ELEC - PT2 - 22.2	MV Stay	No	3		
	ELEC - PT1 - 3	Excavations and Compaction				
		Determination of pole positions, excavate, and supply a mechanical boring device if required. The rate shall include backfilling, compaction to 93% MOD AASHTO density, and where necessary the supply and transportation of suitable ground as may be required to receive the desired compaction, except where cement is specified. Any damage to existing services shall be made good by the Contractor at his own expense and to the approval or the PM(C).				
8.3.13	ELEC - PT2 - 25 (i)	Hole for 9m pole - 1.5m deep	No	20		
8.3.14	ELEC - PT2 - 25 (iii)	Hole for MV stay - 1.5m deep	No	3		
	ELEC - PT2 -24	Pole Labels				
		Supply and install labels of all equipments in accordance with the specifications including the provision of all fixing materials. Allow for pick-up, loading/offloading, transport to site. Labels to the city power Standards. Dynatape, masking tape or Hand written with permanent marker type labels are not to be considered for operational labelling under any circumstances.				
8.3.13	ELEC - PT2 -24	Equipment labels	No	1		
		General Items				
		Supply and Install Anti-Climbing Devices as per the latest Standards.				
8.3.14		Anti-Climbing Device. Including the removal of existing spikes. Galvanised wire. Install on trfr str, struts, parallel MV stay wires, recloser str, OOL trfr str, etc, structures where meter boxes or equipment is installed <2m above ground, any str having cable secured by means of strapping <0.5m apart, any climbable pole str, apparatus etc	per str	10		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 1 (BRIDGE 1)
SECTION 8: ELECTRICAL AND SECURITY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	ELEC - PT1 - 5	LV Installation Supply and install the following Distribution Boards complete with all switchgear, accessories as specified on the schematic layouts, all fitted in the factory and tested, including delivery to site and off-loading in accordance with the single lines.: (refer to Dwg No 13247-02/E/ELEC/712)				
8.3.15	ELEC - PT1 - 5	Main kiosk	No.	1		
8.3.16	ELEC - PT1 - 5	EK 1	No.	1		
	ELEC - PT2 - 7,2	Cables and Terminations The supply, delivery and installation of (but excluding trenching, terminations, joints and cable supports) for the following PVC /SWA/PVC 600/1000V Copper Cables				
8.3.17	ELEC - PT1 4,5	16mm 4core cu cable	m	750		
8.3.18	ELEC - PT1 4,5	16mm 4core cu cable termination	No.	2		
8.3.19	ELEC - PT1 4,5	10mm BCEW	m	750		
8.3.20	ELEC - PT1 4,5	10mm BCEW termination	No.	4		
8.4		Guard House Supply and install prefabricated 5m L x 3m W guard house structure complete with toilet, windows Installed on a 150mm thick slab.	P/sum	1	40000.00	R 40 000.00
8.5		Fencing Supply and install 1.8-metre-high clear view fence panels equivalent or similar to clear view fence on posts at positions depicted in plan on drawing No. 13247-02/C/SEW/300-D	m	900.00		
8.5.2		Supply and install 4-metre-wide Double Leaf Gates 1.8metre-high security locks	No.	4.00		
8.5.3		Extra over items 8.5.1 & 8.5.2 for supply and installing 730mm high ripper blade concertina coil anti-scale topping or similar approved	m	900.00		
8.9	SANS 1200 A 8.5	Provisionary Sums				
8.9.1		City Power design	P/sum	1	30 000.00	R 30 000.00
8.9.2		50KVA (80A) Connection Fee	P/sum	1	250 000.00	R 250 000.00
8.9.3		Overheads, charges and profit on items 8.9.1 & 8.9.2	%	280000		
TOTAL CARRIED FORWARD TO SUMMARY						



Contract: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No.1 (BRIDGE 1)
Volume 1: Tender and Contract
SUMMARY



SUMMARY OF BILL OF QUANTITIES

SECTION	DESCRIPTION	AMOUNT
SECTION 2	SITE CLEARANCE	R
SECTION 3	MEDIUM PRESSURE PIPELINE	R
SECTION 4	DIVERSION AND RE-ENTRY CHAMBERS	R
SECTION 5	COMMISSION / DE-COMMISSION BYPASS	R
SECTION 6	REPAIRS ON BRIDGE DECK, HANDRAILS AND SEWER CONCRETE PIPELINE	R
SECTION 7	DIVERSION BRIDGE	R
SECTION 8	ELECTRICAL AND SECURITY	R
TOTAL TO TENDER SUMMARY		R

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 2: SITE CLEARANCE AND EARTHWORKS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
2.0	SANS 1200C	SECTION 2: SITE CLEARANCE				
2.1		CLEAR SITE				
2.1.1	8.2.1	Clear and grub the working space and provide a pipe laying platform, an access road, pipe storage strip and pipe storage mounds alongside the trench for pipe laying operations	ha	0.76		
2.1.2	8.2.2	Remove and grub large trees and tree stumps of girth:				
		a) over 1m and up to and including 2m	No	2		
		b) over 2m and up to and including 3m	No	2		
2.1.3	PSC 8.2.2.1	Penalty for unauthorized removal or damage of indigenous trees along the route	Sum/tree	1	-12500	Rate Only
2.1.4	PSC 8.2.5	Take down existing fences, stockpile and re-instate after construction works	Sum	1		
2.1.5	8.2.10	Remove topsoil to nominal depth of 150mm and stockpile on pipeline route only	m³	460		
2.1.6	PSC8.2.11	Remove, store, preserve and replant selected trees along the diversion pipeline	No	1		
2.1.7	8.2.8	Demolish and remove structures/buildings and dismantle steelwork.	Sum	1		
2.1.8	8.2.9	Transport materials and debris to unspecified sites and dump (Provisional) (10km maximum haulage)	m³.km	2500		
2.2	SANS 1200D 8.3.3	EARTHWORKS Restricted Excavation				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose (including shoring and or bracing of trench sides):				
		3.8m wide and total trench depth for pipes 2.1m diameter				
2.2.1		i) Exceeding 0.0m but not exceeding 2.0m	m³	25		
2.2.2		ii) Exceeding 2.0m but not exceeding 3.0m	m³	110		
2.2.3		iii) Exceeding 3.0m but not exceeding 4.0m	m³	110		
2.2.4		iv) Exceeding 4.0m but not exceeding 5.0m	m³	8625		
	8.3.2	b) Extra over items 2.2.1 to 2.2.4 incl. for, (Provisional as approved by the Engineer):				
2.2.5		i) Intermediate excavation	m³	570		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 2: SITE CLEARANCE AND EARTHWORKS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
2.2.6	SANS 1200DB	ii) Hard rock excavation, using mechanical and non-blast methods Excavation	m³	10720		
2.2.7	8.3.2	a) Excavate and dispose of unsuitable material from trench bottom in rock and marshy areas. (Provisional as approved by the Engineer)	m³	360		
2.2.8	8.3.3	Excavation Ancillaries				
	8.3.3.1	Make up deficiency in backfill material (Provisional as approved by the Engineer)				
2.2.9		(a) From other necessary excavations on site	m³	50		
2.2.10		(b) by importation from designated borrow pits	m³	10		
2.2.11		c) By importation from commercial or off-site sources selected by the Contractor (Including haulage). Provisional as approved by Engineer)	m³	7085		
2.3	SANS 1200DB	Bulk Excavation				
2.3.1	8.3.2	Excavate in all materials for Scour Valve chambers and structure, backfill, compact and dispose of surplus/unsuitable material for:	m³	30		
2.3.2	PSDB 8.3.7	Accommodation of Traffic	L/Sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
3.0	SANS 1200LB	SECTION 3: MEDIUM PRESSURE PIPELINE				
3.1		BEDDING				
	8.2.1	Provision of Bedding from Trench Excavation.				
3.1.1		(a) Selected granular material	m³	160		
3.1.2		(b) Selected fill Material	m³	180		
	8.2.2	Supply only of bedding by importation				
	8.2.2.1	i) From other necessary excavations				
3.1.3		(a) Selected granular material	m³	80		
		(b) Selected fill Material	m³	100		
	8.2.2.3	ii) From commercial sources				
3.1.4		(a) Selected granular material	m³	3250		
		(b) Selected fill Material	m³	3700		
3.2	SANS 1200L	MEDIUM PRESSURE PIPELINE				
	PSL 8.2.1	Supply, handle, lay, joint, bed and test GRP pipe complete with couplings				
3.2.1		2100mm diameter GRP PN 6 Pipe	m	412		
3.2.2	PSL 8.2.16	Collect from supplier and deliver to site (50 km distance one-way) 6 m length(2.77 tonnes each) x 2100mm diameter GRP PN 6	No	58		
	PSL 8.2.17	Handle, lay, joint, bed and test GRP pipes supplied in item 3.2.2 complete with couplings.				
3.2.3		2100mm diameter GRP PN 6	m	348		
		b) Extra over items 3.2.3 above for:				
3.2.4		Replacement of damaged pipe rubber seals. The rate shall include the cost to supply, remove and replace the damaged rubber seal with the new seal.	Prov/Sum	1	R10 000.00	R10 000.00
3.2.5		Payment of 20% of cost of GRP PN 6 to Flowtite (For 348m of GRP from the Employer)	Prov/Sum	1	R1 695 510	R1 695 510.00
3.2.6		Percentage adjustment to item 3.2.3	%	1695510		
3.2.7	8.2.9	a) Hydraulic pressure testing of constructed GRP between CH640 - CH940 according to the manufacturer's guideliness and specifications and provision of report to the Employer's Agent.	m	300		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
3.2.8		LEAK REPAIRS TO CONSTRUCTED GRP SECTION (CH640 -CH940) The rate shall cover the cost to excavate in all materials for the trench, locate and repairs leaks, re-test, backfill, compact and dispose of surplus /unsuitable material. All labour, plant, material, equipment and overheads shall be included within activities.	Prov/Sum	1	R100 000.00	R100 000.00
3.2.9	8.2.1	Supply, handle, lay, joint, bed and test 160mm diameter Class 9 uPVC pumping pipeline.	m	520		
	PSL 8.2.2	Extra-over item 3.2.1 for specials				
3.2.10		(a) 2100mm diameter 0.2-30 deg. GRP elbow	No	8		
3.2.11		(b) 2100mm diameter 31-60 deg. GRP elbow	No	2		
3.2.12		(c) 2100mm diameter 61-90 deg. GRP elbow	No	2		
3.2.13		(d) 2100mm diameter x 160mm GRP scour tee as per detail on drawing no. 13247-02/C/SEW/308-02	No	1		
3.2.14		(e) 2100 mm diameter steel Stub end flange adaptor as per detail A on drawing no. 13247-02/C/SEW/306-02	No	2		
3.2.15		(f) 1.0 m length x 2100 mm diameter single end flange(drilled to SANS 1123-250/3) GRP pipe as per detail on drawing no. 13247-02/C/SEW/306-02	No	2		
	8.2.2	Extra-Over Item 3.2.7 for Specials complete with couplings.				
3.2.16		a) 11.25° Bend	No	1		
3.2.17		b) 22.50° Bend	No	1		
3.2.18		d) 45° Bend	No	1		
3.2.19		e) 90° Bend	No	2		
3.2.20		f) 150mm diameter Gate valve, Fittings and pipework inside scour chamber as per detail on drawing no. 13247-02/C/SEW/308-02	Sum	1		
3.3	8.2.11	Thrust & Anchor blocks:				
3.3.1		1) Class 20 MPa/19 mm concrete	m³	85		
		2) Construct Anchor blocks Complete to the details on drawing no. 13247-02/S/018/A	m³	15		
3.3.2	SANS 1200G 8.2.1	Rough Vertical formwork to concrete thrust & anchor blocks	m²	100		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 3: MEDIUM PRESSURE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
3.3.3	8.3.1	Reinforcement				
3.4	SANS1200L	b) High-tensile Steel Bars	kg	825		
3.4.1	8.2.13	Valve chambers				
3.4.2	PSL8.2.13.1	Scour valve chamber complete with pipe fitting and specials to detail as per drawing No. 13247-02/C/SEW/308-02	No	1		
3.4.3	PSL8.2.13.2	Supply and install pump to drain diversion pipeline after completion of repair works.	No	1		
3.4.4	PSL8.2.13.3	Operate the pump to clean and clear grit and debri collected in the pipe diversion pipeline during and on completion of construction.	Sum	1		
3.5	SANS 1200LD	De-establish pump installation after completion of works.	Sum	1		
3.5.1	PSLD 8.2.1.1	Raising and lowering of Existing Manholes				
3.5.2	PSLD 8.2.1.2	Temporary Raising of Existing Manholes to 2.5m height and dismantling as per Dwg No. 13247-02/C/SEW/309-02	P/sum	1	R100 000.00	R100 000.00
3.6	SANS 1200DB	Seal and strap down manhole covers to prevent leakages	No	4		
3.6.1	8.3.6.1	Finishes				
3.6.2		Reinstate road complete with all courses to match original specification				
3.6.3	8.3.10	b) Asphalt of thickness 30mm in roadway	m ²	60		
3.6.4	8.3.11	d) 60mm concrete interlocking blocks in parking	m ²	65		
3.7	SANS 1200LG	PIPE JACKING (Dwg No. 13247-02/C/SEW/305-03)				
3.7.1	8.2.1	Jacking Establishment				
3.7.2		a) Fixed Charges	Sum	1		
		b) Time-related charges (period to be stated by the Contractor)	Sum	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
3.7.3	8.2.6	Supply and Install 3000 OD 100D In-Wall Joint Concrete Pipe sleeves by Pipe Jacking Method to accommodate 2100mm ID GRP pipes, Complete with excavations	m	2.5		
3.7.3.1		E/O item 3.7.3 for installing 3000 OD 100D In-Wall Joint Concrete Pipe (from site storage) sleeves by Pipe Jacking Method to accommodate 2100mm ID GRP pipes, Complete with excavations.	m	2.5		
3.7.3.2		Payment of 20% (3000 OD 100D In-Wall Joint Concrete Pipe sleeves material to the Supplier)	Prov/Sum	1	R 2 427.55	R2 427.55
3.7.3.3		Percentage adjustment to item 3.7.3.2 above for overheads, charges and profit	%	R2 427.55		
3.7.4	PSL 8.2.1	Extra-over item 3.2.1 for installing 2100 ID GRP PN 6 pipes in the jacked concrete pipe sleeve	m	20		
3.7.5	8.2.10	Standing time for Pipe jacking crew and equipment.	Hrs	24		
	8.2.8	Extra-Over 3.7.3 for excavation in rock				
3.7.6		a) using pneumatic tools or other techniques where blasting is not permitted	m³	10		
	8.2.9	Grouting of voids Filling of cement/sand mix ration 1:2 plasticiser, to fill the void between the outer sleeve surface with excavation face and between the GRP pipe with annulus of the jacked pipe				
3.7.7		a) Provision and establishment of equipment on site and removal on completion	Sum	1		
		b) Operation of equipment	Days	1		
		c) Materials used	m³	5		
	SANS 1200DB	Excavation				
3.7.8	8.3.3.1	Backfill in an embankment on sewage diversion pipe at entry and exit chambers from imported fill compacted to 93% Mod AASHTO density as shown on drawing 13247-02/C/SEW/301-05	m³	1200		
TOTAL CARRIED FORWARD TO SUMMARY						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 4: DIVERSION AND RE-ENTRY CHAMBER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
4.0		SECTION 4: DIVERSION AND RE-ENTRY CHAMBERS				
4.1	SANS 1200C	SITE CLEARANCE				
4.1.1	8.2.1	Clear and grub area around the two chambers and create space for placing the removed Precast U-sections.	m ²	200		
4.1.2	PSC 8.2.12	Remove cover slabs over the entry/exit chambers, store and restore as required (6 No x 0.2 m tck x 1.2 m x 5m)	Sum	1		
4.1.3	PSC 8.2.12	Remove cover slabs over the entry/exit chambers, store and restore as required (6 No x 0.12 m tck x (aver. 1.58 m x 2.9m, aver. 2.9 m x 2.3m & 3.4mx1.5m)	Sum	1		
4.2	SANS 1200G	CONCRETE (STRUCTURAL)				
4.2.1	SANS 1200 LD 8.2.12	Design, supply and install 2.5m height adjustment watertight temporary panels to the diversion and entry chambers to accommodate additional required head as per concept on drawing number 13247-02/C/SEW/306-02	Sum	1		
4.2.2	SANS 1200 C 8.2.8	Break out up to 600mm thick brick plug inside the 2 x 1800 diameter flange adaptors and dispose off- site	m ²	3		
4.2.3	PSC 8.2.14	Saw cut through existing concrete wall surface at the exit and re-entry chambers to create side weir as per detail on drawing No. 13247-02/C/SEW/306-02	Sum	1		
4.2.4	PSC 8.2.15	Break out and spoil saw-cut concrete wall section, mass concrete infill and precast U-sections	m ³	30		
4.2.5	PSC 8.2.12	Remove Precast U-sections from chamber and store at platform next to chamber	No	6		
4.2.6	SANS 1200 C 8.2.8	Demolish 600 mm tck reinforced concrete wall, remove the embedded 1800 mm diam flange adaptors, spoil rubble, modify openings and install new a 2100mm diam flange adaptor ex Item 3.2.13 on exit and re-entry chambers as per dwg no. 13247-02/SEW/306-02	Sum	1		
	8.2	Formwork (to Steel flange (Stub) area)				
4.2.7	8.2.2	Smooth	m ²	3		
4.2.8	8.4.3	Cast in-situ 30Mpa concrete stub with reinforcement as per detail in Dwg No. 13247-02/C/SEW/306-02	m ³	1		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 4: DIVERSION AND RE-ENTRY CHAMBER

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	8.3.1	Reinforcement (to Steel flange (Stub) area)				
4.2.9		a) Mild Steel Bars	kg	5		
4.2.10		b) High-tensile Steel Bars	kg	10		
	SANS 1200 GE	PRECAST CONCRETE (STRUCTURAL)				
4.2.11	8.2.1	Manufacture complete reinforced Precast U-sections as detailed in Dwg No. 13247-02/C/SEW/306-2 with 40MPa concrete to replace any broken sections(provisional)	No	2		
4.2.12	SANS 1200 GE 8.2.2	Erect Precast U-sections after completion of repair work to bridge or pipe line	No	2		
4.2.13	SANS 1200 LE 8.2.5	Cast in-situ 15 Mpa concrete infill that was broken in item no 4.2.4	m³	10		
4.2.14	SANS 1200 GE 8.2.2	Erect precast roof slabs from (item 4.1.2), grout in and seal with 50mm 20Mpa concrete topping.	L/sum	1		
4.2.15	SANS 1200 GE 8.2.5	Complete design, fabricate, supply and install main steel sluice gates and diversion gates complete to concept detail as per dwg No.13247-02/C/306-2, including sewage control and diversion. Contractor's handling fee included in the P/Sum.	P/Sum	1	R3 000 000	R3 000 000.00
TOTAL CARRIED FORWARD TO SUMMARY						

CONTRACT NUMBER:JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 5: COMMISSION / DE-COMMISSION BYPASS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
5.0	SANS 1200A	SECTION 5: COMMISSION / DE-COMMISSION SEWERS				
5.1.1	PSA 8.8.10	Provide labour and plant to open and close sluice gates at the upstream and downstream of the existing concrete pipeline	sum	1		
5.1.2	PSA 8.8.11	Operate,maintain, inspect and monitor the operation of the diversion system for the duration of the sewage diversion	sum	1		
5.1.3	PSA 8.8.12	Provide labour, plant and materials required to flush the diversion sewer with water and pump out the residual sewage from the diversion through the scour chamber	sum	1		
5.1.4	PSA 8.8.13	Dismantle all temporary works associated with the operation of the siphon pipeline	sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND SEWER CONCRETE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
6.0	OLTO 1200 P	SECTION 6: REPAIRS ON BRIDGE DECK, HANDRAILS AND SEWER CONCRETE PIPELINE				
		Temporary access structures and work platforms				
		Access and Platform to (height range indicated below)				
		i) Design, supply and erect at the following structural elements (Abutments, piers, decks, parapets/balustrades/deck edges) and height ranges inclusive of dismantling and moving to the next structural element				
		a) 0 m up to 5,0 m	lump sum	1		
		b) Exceeding 5. 0 m up to 10,0 m	lump sum	1		
		c) Exceeding 10. 0 m up to 20,0 m	lump sum	1		
		d) Exceeding 20. 0 m up to 30,0 m	lump sum	1		
		e) Exceeding 30.0 m up to 40,0 m	lump sum	1		
		f) Exceeding 40.0 m up to 50,0 m	lump sum	1		
		g) Exceeding 50.0 m up to 60,0 m	lump sum	1		
		h) Exceeding 60.0 m up to 70,0 m	lump sum	1		
		ii) Dismantle and remove from location or structure				
		a) 0 m up to 5,0 m	lump sum	1		
		b) Exceeding 5. 0 m up to 10,0 m	lump sum	1		
		c) Exceeding 10. 0 m up to 20,0 m	lump sum	1		
		d) Exceeding 20. 0 m up to 30,0 m	lump sum	1		
		e) Exceeding 30.0 m up to 40,0 m	lump sum	1		
		f) Exceeding 40.0 m up to 50,0 m	lump sum	1		
		g) Exceeding 50.0 m up to 60,0 m	lump sum	1		
		h) Exceeding 60.0 m up to 70,0 m	lump sum	1		
	123.03	Proprietary cementitious repair compound Repair system 1 (cl 12305 (c)(iii)) to:				
		(i) Spalls to piers & bridge deck	litres	200		
	124.04	Establishment on site for crack injection	lump sum	1		
	124.05	Crack injection with epoxy resin to cracks in abutments and piers	m	250		
6.1		BRIDGE DECK				
		Bridge Deck Joints				
	128.01	Remove old joint seals and clean joints	m	348		
	6.1.1 128.03b	Supply and seal expansion joints with approved bridge joint sealant	l	1798		
	6.1.2 123.03c	Supply and install angle irons and plates on expansion joints	ton	0.75		
6.1.3		Assess and rehabilitate bridge and sewer pipe expansion joints	P/sum	1	R500 000	R500 000.00
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND SEWER CONCRETE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
6.2		Handrails				
6.2.1	128.05	Remove all existing rails and stanchions to waste.	m	1734		
6.2.2	128.06	Supply and install 1.1 or 1.2m high concrete balustrades to manufacturer's specifications and details on Dwg No. 13247-02/S/018/A	m	1608		
6.2.3		Payment of Handrails (Stanchions and Balustrades) on Site to the Supplier	Prov/Sum	1	R205 000	R205 000.00
		Percentage adjustment to item 6.2.3 above	%	R205 000		
6.2.4		Install Handrails material supplied by the Employer and install 1.1 or 1.2m high concrete balustrades to manufacturer's specifications and details on Dwg No. 13247-02/S/018/A.	m	126.00		
		CONCRETE PIPE REPAIRS				
6.3		External Cracks Repairs				
6.3.1	124.04	Establishment on site for crack injection	L/Sum	1		
6.3.2	124.05	Supply approved epoxy and inject cracks on the outside of the concrete outfall sewer and bridge elements (greater 0.5 mm crack width)	m	3 000		
6.3.3	124.07	Supply and apply crystalline protective coating to seal micro-cracks on the outside of the concrete outfall sewer and bridge elements (less than 0.5 mm crack widths)	m	11 000		
6.4		Internal Repairs				
6.4.1	PSA 8.9.6	Provision of access, lighting and ventilation in the pipeline for the duration of the internal pipe repairs.	Sum	1		
6.4.2	PSC 8.2.13	Drain, flush sewer and hose down internal face of the concrete pipe using high pressure water jetting to allow for a clean working environment	Sum	1		
6.4.3	PSA 8.9.4	Inspections and measurements of damage using technology	P/Sum	1	R400 000	R400 000.00
6.4.4	PSA 8.9.5	Visual inspections and measurements of damage by visual assessments	P/Sum	1	R200 000	R200 000.00
6.4.5	125.02	Preparation of Concrete Surface	m ²	9650		
6.4.6	122.03	Cutback concrete surface to specified or ordered depth	m ³	190		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND SEWER CONCRETE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
6.4.7	125.01	Establishment on site for sprayed concrete work	L/Sum	1		
6.4.8	125.03	Application of sprayed cementitious mortar or 40MPa/10mm concrete to repair scour and internal pipe damage to woodfloat finish, including wet-to-dry epoxy bonding primer	m³	250		
6.4.9	125.03	Apply a 15mm thick sacrificial layer on the internal pipe diameter (2890mm Ø) using 40MPa 100% Calcium Aluminate cementitious structural rehabilitation concrete or similar approved	m²	9400		
6.5		Insulation and Cladding				
6.5.1	126.02	Supply and install 50mm thick Polyurethane sprayed-in-place insulation foam bonded to pipe per detail on dwg No.13247-02/C/SEW/306-02 or similar approved to manufacturer's specification	m²	10 850		
6.5.2	126.03	Provide pipe cladding protection by: i) Trial sample panels (glass fibre reinforced polyurethane coating & insulation)	m²	20		
6.5.4	126.04	iii) Using durable glass fibre reinforced polyurethane coating to manufacturer's specifications or similar approved.	m²	10 850		
6.5.5	PSC	Remove and dispose old metal sheet cladding and polystyrene insulation	m²	6 000		
6.5.6	126.01	Clean and prepare external concrete pipe surface to receive the insulation installation to manufacture's specification	m²	10 850		
6.6	128.13	CAT LADDER				
6.6.1		Supply and erect platforms and cat ladder (2 per platform) sets fixed to the bridge deck to details on Dwg No.13247-02/S/018-A	No	4		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
7.0	COLTO	<u>SECTION 7: BY-PASS SEWER BRIDGE / DIVERSION BRIDGE</u>				
		<u>FOUNDATION FOR STRUCTURES (Section 6100)</u>				
7.1	61.02	Excavations				
		a) Excavating soft material situated within the following successive depth range:				
7.1.1		(i) 0m up to 2m	m³	10		
7.1.2		(ii) Exceeding 2m up to 4m	m³	50		
7.1.3		(iii) Exceeding 4m up to 6m	m³	50		
7.1.4		(iv) Exceeding 6m up to 8m	m³	50		
	61.03	Access and drainage				
7.1.5		a) Access	L/Sum	1		
7.1.6		b) Drainage	L/Sum	1		
7.1.7	61.04	a) Backfill to excavations utilising materials from excavations	m³	160		
		b) Backfill to excavations utilising imported materials from commercial sources	m³	15		
	61.07	Overbreak in excavation in hard material	m²	10		
7.1.8		Allow for inspection of installed anchors by design specialist	P/Sum	1	40 000.00	R40 000.00
7.1.9		Allow for intervention works instructed by design specialist	P/Sum	1	50 000.00	R50 000.00
7.1.10	B75.08	Completing existing anchor lock-in , thrust plate installation and recess grouting	No	36		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.2	COLTO	FALSEWORK, FORMWORK AND CONCRETE FINISH(Section 6200)				
		a) Class F1 surface finish to:				
7.2.1		.01) Bases	m ²	105		
	62.02	Vertical formwork to provide:				
7.2.2		b) Class F2 surface finish to:				
7.2.3		.03) Deep Beams	m ²	170		
7.2.4		.04) End Retaining Walls	m ²	82		
	62.03	Horizontal formwork to provide:				
		b) Class F2 surface finish to:				
7.2.5		.04) Deck, roof beams & slabs	m ²	1610		
	62.05	Permanent formwork:				
7.2.6		a) To form voids of:				
		i) 2220 mm dia in deck end walls	No.	2		
7.2.7	62.06	Formwork to form open joints				
		i) Deck span ends	m ²	60		
	B62.10	Unformed surface finishes				
7.2.8		a) Wood-floated (Class U2)				
		i) Deck	m ²	356		
		ii) Beams	m ²	170		
		b) Rough Finish (Class U1)				
		i) Bases	m ²	55		
CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.3	63.01	REINFORCEMENT(Section 6300)				
7.3.1		.01) Bases				
		ii) High-tensile Steel Bars	t	0.28		
7.3.3		.03) Deck slab				
		i) Mild Steel Bars	t	0.54		
		ii) High-tensile Steel Bars	t	14		
7.3.4		.04) Deep Beams on deck & End Walls				
		i) Mild Steel Bars	t	0.5		
		ii) High-tensile Steel Bars	t	37.05		
7.4	64.0	CONCRETE FOR STRUCTURES (Section 6400)				
	64.01	Cast in situ concrete:				
		a) Class 30/19 in :				
7.4.1		i) End Retaining Walls	m³	10		
7.4.2		ii) Bases	m³	70		
7.4.3		iii) Deck	m³	144		
7.4.5		v) Deep Beams	m³	400		
	64.02	Manufacturing precast concrete members:				
7.4.6		.i) Manufacture precast concrete pipe supports as per Dwg No. 13247-02/S/003/A & R021/A	No	20		
		.ii) Supply and Install cradle liners and steel straps with brackets including bolts sets as per Dwg No. 13247-02/S/003/A & R021/A	No	22		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	64.03	Transporting and erecting precast concrete members				
		a) Concrete pipe supports in position as per Dwg No. 13247-02/S/003/A approx. mass =2.5 tonnes	No	20		
		b) Deck cover slabs (planks) to final position per Dwg No. 13247-02/S/004/A approx. mass =1.42 tonnes	No.	74		
	66.00	NO-FINES CONCRETE, JOINTS, BEARINGS, BOLT GROUPS FOR ELECTRIFICATION, AND PARAPETS AND DRAINAGE FOR STRUCTURES (Section 6600)				
7.5	66.06	Filled joints:				
7.5.1		i) Expansion joints filled with 20mm closed cell polystyrene and 20x20mm approved joint sealant as detailed on drawing No. 13247-02/S/004/A	m ²	100		
		ii) Expansion joints filled with 74mm closed cell polystyrene as detailed on drawing No. 13247-02/S/004/A	m ²	20		
7.5.2	66.08	Sealing joints with:				
		a) Sealant: 20x20mm approved joint sealant as detailed on drawing No. 13247-02/S/004/A	m	50		
7.5.3	66.11	Proprietary bearings:				
		a) Supply and construct 403074: 400x300x74 Bearings Pad to detail as per dwg No. 13247-02/S/004/A	No	10		
	B66.14	Dowels/guides to pipe supports				
		a) Supply and install 420 mm Long x Y20 dowel bars as per Dwg No. 13247-02/S/003/A & R021/A	No	40		
7.5.4	66.19	Drainage pipes and weep holes:				
		a) Drainage pipes i) 110 mm dia uPVC pipes to detail as per dwg No. 13247-02/S/003/A	No	6		
7.5.5	B66.32	Accessories to detail given on dwg no. 13247-02/S/004/A				
		a) Precast concrete manhole cover and frame. to typical deck access detail	No	2		
7.5.6		b) Step iron to typical deck access detail	No.	16		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.8	52.00	GABIONS (Section 5200)				
7.8.1	52.02	Surface preparations for bedding of gabions	m ²	40		
	52.03	Gabions - Galvanised and PVC coated baskets, made with hexagonal woven (double twisted) wire mesh type 80. Steel wire to be heavily galvanised to class A with zinc alloy coated wire according to SANS 1580.				
7.8.2		(i) 3.0 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	9		
7.8.3		(ii) 3.0 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	14		
7.8.4		(iii) 3.0 x 2.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	18		
7.8.5		(iv) 2.0 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	8		
7.8.6		(v) 2.0 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	18		
7.8.7		(vi) 2.0 x 2.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	16		
7.8.8		(vii) 1.5 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	5		
7.8.9		(viii) 1.5 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	3		
7.8.10	52.05	Geotextile- as per detail	m ²	120		
TOTAL CARRIED TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
8.0		SECTION 8: ELECTRICAL AND SECURITY				
8.1	ELE - PTA	SECURITY INSTALLATION				
	ELE - PTB - 1,1	CCTV - Cameras				
8.1.1	ELE - PTB - 1,2	Outdoor Infrared IP bullet 720p IP66 AVF SMB PKG	No.	20		
8.1.2	ELE - PTB - 1,3	AUTODOME PTZ 5000 HD 1080P 30X PEND CL OUT	No.	4		
8.1.3	ELE - PTB - 1,4	PTZ Pole Mount Bracket	No.	20		
8.1.4	ELEC - PT2 - 25 (i)	5m Pole	No.	20		
		Control/Server Room				
8.1.5	ELE - PTC - 2,01,3	27U Cabinet - 27U 600 X 1000 Cabinet incl F-27U 600 X 1000 Floor standing Cabinet including Fans and Power Black	No.	1		
8.1.6		Standard Application Server (WW)	No.	1		
8.1.7	ELE - PTB - 1,8	DIVAR IP 6000 2U 2x4TB (R2) Storage	No.	1		
8.1.8		Professional Base Licence	No.	1		
8.1.9		BVMS Professional 7.5 Workstation expansion Licence	No.	1		
8.1.10	ELE - PTB - 1,5	24" Class Full HD IPS LED Monitor	No.	2		
8.1.11		1.5M HDMI MALE - HDMI MALE CABLE	No.	2		
8.1.12		Dual screen Video Display Controller	No.	1		
8.1.13		PC server with Windows& Pro Screen Keyboard and Mouse	No.	1		
8.1.14	ELE - PTB - 1,7	Keyboard Controller INTUIKEY DIGITAL KEYBOARD W/ LCD FOR USE WITH DIVAR DVR AND SYSTEM 4 MULTIPLEXERS.	No.	1		
8.1.15		PSU (220-240VAC/15VDC, 600MA, 50/60HZ)	No.	1		
8.1.16		DATANET UTP CAT6 SOLID GREY	m	200		
8.1.17		RJ45 CAT 6 Connector (Shielded)	No.	50		
8.1.18		Weather-boots for RJ45 6mm FLT	No.	50		
		Control Room - Security Office				
8.1.19	ELE - PTB - 1,5	24" Class Full HD IPS LED Monitor	No.	2		
8.1.20		PC server with Windows& Pro Screen Keyboard and Mouse	No.	1		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 8: ELECTRICAL AND SECURITY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
		Network Field Equipment CCTV				
8.1.21	ELE - PTC - 2,01,3	9U Wall box, Swing Frame, 600mm Deep, Black	No.	12		
8.1.22		X1026P WEB MANAGED, 24X 1GBE AND 2X 1GBE SFP POE	No.	12		
8.1.23		Fibre Gbix for Switch	No.	20		
8.1.24	ELE - PTB - 1,6	DATANET UTP CAT6 SOLID GREY	m	150		
8.1.25		RJ45 CAT 6 Connector (Shielded)	No.	40		
8.1.26		Weather-boots for RJ45 6mm FLT	No.	40		
8.1.27	ELE - PTB - 1,9	Fibre cable and accessories per meter	No.	12300		
8.1.28		Fibre Fusion splicing and accessories per splice	No.	40		
		Trunking				
8.1.29	ELE - PTB - 1,12	TRUNKING - YT5 40 x 40 / 3m	m	400		
8.1.30		PVC - 40 x 40 Internal Corner - White	No.	40		
8.1.31		PVC - 40 x 40 Terminal End - White	No.	20		
8.1.32		PVC - 40 x 40 End Cap - White	No.	20		
8.1.33		Sprag 20mm	m	24		
8.1.34		Labour and Commissioning	Hour	320		
8.2	ELEC - V1A	ELECTRICAL INSTALLATION				
	ELEC PT2 - 7.3	LUMINAIRES				
		Supply, install and connect luminaires mounted as specified, complete with lamps, control gear and all accessories:				
8.2.1		48W LED post top light fitting on 5m mounting height, complete with high impact acrylic diffuser	No	57		
		70W High Pressure top light fitting on 3m mounting height, complete with high impact acrylic diffuser	No	32		
	ELEC - PT2 - 7.2	CABLES AND TERMINATIONS				
		The supply, delivery and installation of (but excluding trenching, terminations, joints and cable supports) for the following PVC /SWA/PVC 600/1000V Copper Cables				
8.2.2	ELEC - PT2 - 7.2	6 mm² 4-core PVC/SWA/PVC Cable	m	1800		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 8: ELECTRICAL AND SECURITY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.2.3	ELEC - PT2 - 7.2	4 mm ² Bare Copper Earth Wire	m	1800		
8.2.4	ELEC - PT2 - 7.2	6 mm ² 4-core PVC/SWA/PVC Cable Terminations	No.	2		
8.2.5	ELEC - PT2 - 7.2	4 mm ² Bare Copper Earth Wire Terminations	No.	2		
	ELEC - PT1 - 10	SLEEVES Supply and installation of PVC sleeves complete with all accessories including couplings, bending and fixings as specified:				
8.2.6	ELEC - PT1 - 10,2	50mm diameter PVC sleeves for electrical/electronic services	m	500		
8.2.7	ELEC - PT1 - 10,2	110mm diameter PVC sleeves for electrical/electronic services	m	500		
	ELEC - PT1 - 8	Cable Trenching Excavations of trenches and levelling bottom and bedding in sifted ground. Backfilling compacting and making good of surface. Trenching of minimum of 450mm width and depth of 600mm				
8.2.8	ELEC - PT1 - 8,1	In soft rock	m ³	100		
8.2.9	ELEC - PT1 - 8,1	In hard rock	m ³	50		
8.2.10	ELEC - PT1 - 8,1	Backfilling	m ³	150		
8.2.11	ELEC - PT1 - 8,1	Danger tape	m	500		
		Manholes Supply and install in ground 800mmx800mmx600mm deep manhole complete with steel cover to dwgs.				
8.2.12			No.	22		
8.3	ELEC - PT2 - 21	Transformers - pole mounted Supply and Installation of new transformers on an appropriate structure and secure as required including the termination of cables and conductors, the provision of suitable lugs & all accessories.				
8.3.1	ELEC - PT2 - 21.1	NEW Transformer 50 Kva, 11kV/415V	No	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.3.2	ELEC - PT2 - 21.5	Medium Voltage Surge Arrestors Supply and install the following surge arrestors, complete with galvanised steel mounting brackets for securing the surge arrestor, nuts, bolts, washers and lock washers as specified. Secure the surge arrestors and brackets to the transformer as specified including the termination of conductors. Discharge current 10kA. 11V/22Kv, MCOV 19.2kV Surge arrestor, 31mm/kV, inland.	No	3		
8.3.3	ELEC - PT2 - 21.4	Medium Voltage Sectionalisers and Links Supply and install link isolators as detailed including the installation of crossarm brackets and the termination of conductors and including the drilling of holes in wooden poles as required. 15K fused links. Fused Links, Single Pole (2.5m X-arm)	No	3		
8.3.4	ELEC - PT2 - 21.5	Neutral Surge Arrestor Supply and install a LV surge arrestor including lugs and galvanised bolts 6kV, 10kA Surge Arrestor	No	2		
8.3.5	ELEC - PT2 - 23.1.3	Transformer & Equipment Earthing Supply and install all materials for the complete earthing of transformer structures for ABC networks as specified. Included in the rate shall be all required spikes, insulated copper conductor, galvanised conduits, staples, bare copper, excavations, backfilling, etc. The rate shall allow for all required MV earth electrodes, consisting of four earth spikes in accordance with the Distribution specifications. MV Earth	No	1		
8.3.6	ELEC - PT2 - 7.1	Conductor Take delivery off, safely store on sealed drums with ends adequately secured and transport to site conductor as specified. String conductor as specified including splices, jumper conductor ties, strain clamps, suspension clamps, tensioning, sagging, etc. ACSR Hare - 3 Phase - Conductor length	m	3 900		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 8: ELECTRICAL AND SECURITY

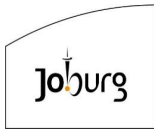
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.3.7	ELEC - PT2 - 26,2	Poles and Crossarms Recieve and safely store the following poles. Transport to site of works and install pole in excavated hole, including cutting and scafing, kicking blocks, bonding, treating, etc. Excavations and compaction are measured elsewhere. 9m Pole, 140-159mm top diameter	No	20		
8.3.8	ELEC - PT2 - 26,1	MV STRUCTURES Supply and install all material as specified for the construction of the following MV structures. Including bonding of hardware and earthing. All excavations, poles, crossarms and stays are measured elsewhere. Transformer -2-pole platform mounted	No	1		
8.3.9	ELEC - PT2 - 27 (i)	3 Phase - Vertical (600mm spacing) - Strain – Small(1°-30°) Deviation	No	1		
8.3.10	ELEC - PT2 - 28	MV Test (per transformer installation)	No	1		
8.3.11	ELEC - PT2 - 27 (iii)	Recieve, off load and install the following wooden cross arms. 2.5m, 140-159mm Diameter Stays, Flying Stays and Anti-Climbing Devices The following stays shall be in accordance with the specification and shall include a stay plate	No.	10		
8.3.12	ELEC - PT2 - 22.2	MV Stay	No	3		
	ELEC - PT1 - 3	Excavations and Compaction Determination of pole positions, excavate, and supply a mechanical boring device if required. The rate shall include backfilling, compaction to 93% MOD AASHTO density, and where necessary the supply and transportation of suitable ground as may be required to receive the desired compaction, except where cement is specified. Any damage to existing services shall be made good by the Contractor at his own expense and to the approval or the PM(C).				
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 8: ELECTRICAL AND SECURITY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
8.3.13	ELEC - PT2 - 25 (i)	Hole for 9m pole - 1.5m deep	No	20		
8.3.14	ELEC - PT2 - 25 (iii)	Hole for MV stay - 1.5m deep	No	3		
	ELEC - PT2 -24	Pole Labels Supply and install labels of all equipments in accordance with the specifications including the provision of all fixing materials. Allow for pick-up, loading/offloading, transport to site. Labels to the city power Standards. Dynatape, masking tape or Hand written with permanent marker type labels are not to be considered for operational labelling under any circumstances.				
8.3.15	ELEC - PT2 -24	Equipment labels General Items Supply and Install Anti-Climbing Devices as per the latest Standards.	No	1		
8.3.16		Anti-Climbing Device. Including the removal of existing spikes. Galvanised wire. Install on trfr str, struts, parallel MV stay wires, recloser str, OOL trfr str, etc, structures where meter boxes or equipment is installed <2m above ground, any str having cable secured by means of strapping <0.5m apart, any climbable pole str, apparatus etc	per str	10		
	ELEC - PT1 - 5	LV Installation Supply and install the following Distribution Boards complete with all switchgear, accessories as specified on the schematic layouts, all fitted in the factory and tested, including delivery to site and off-loading in accordance with the single lines.: (refer to Dwg No 13247-02/E/ELEC/712)				
8.3.17	ELEC - PT1 - 5	Main kiosk	No.	1		
8.3.18	ELEC - PT1 - 5	EK 1	No.	1		
	ELEC - PT2 - 7,2	Cables and Terminations The supply, delivery and installation of (but excluding trenching, terminations, joints and cable supports) for the following PVC /SWA/PVC 600/1000V Copper Cables				
8.3.19	ELEC - PT1 4,5	16mm 4core cu cable	m	750		
8.3.19	ELEC - PT1 4,5	16mm 4core cu cable termination	No.	2		
TOTAL CARRIED FORWARD						

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 2 (BRIDGE 2)
SECTION 8: ELECTRICAL AND SECURITY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
8.3.20	ELEC - PT1 4,5	10mm BCEW	m	750		
8.3.21	ELEC - PT1 4,5	10mm BCEW termination	No.	4		
8.4		Guard House				
8.4.1		Supply and install prefebricated 5m L x 3m W guard house structure complete with toilet, windows Installed on a 150mm thick slab.	P/sum	1	R 50 000.00	R 50 000.00
8.5		Fencing				
8.5.1	PSMM 8.6.1	Supply and install 1.8-metre-high clear view fence panels equivalent or similar to clear view fence on posts at positions depicted in plan on drawing No. 13247-02/C/SEW/301-5	m	900		
8.5.2		Supply and install 4-metre-wide Double Leaf Gates 1.8metre-high security locks	No.	4		
8.5.3		Extra over items 8.5.1 & 8.5.2 for supply and installing 730mm high ripper blade concertina coil anti-scale topping or similar approved	m	900		
8.9	SANS 1200 A 8.5	Provisionary Sums				
8.9.1		City Power design	P/sum	1	R30 000.00	R 30 000.00
8.9.2		50KVA (80A) Connection Fee	P/sum	1	R250 000.00	R 250 000.00
8.9.3		Overheads, charges and profit on items 8.9.1 & 8.9.2	%	280000		
TOTAL CARRIED FORWARD TO SUMMARY						



Contract: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No.2 (BRIDGE 2)
Volume 1: Tender and Contract
SUMMARY



SUMMARY OF BILL OF QUANTITIES

SECTION	DESCRIPTION	AMOUNT
SECTION 2	SITE CLEARANCE	R
SECTION 3	MEDIUM PRESSURE PIPELINE	R
SECTION 4	DIVERSION AND RE-ENTRY CHAMBERS	R
SECTION 5	COMMISSION / DE-COMMISSION BYPASS	R
SECTION 6	REPAIRS ON BRIDGE DECK, HANDRAILS AND SEWER CONCRETE PIPELINE	R
SECTION 7	DIVERSION BRIDGE	R
SECTION 8	ELECTRICAL AND SECURITY	R
TOTAL TO TENDER SUMMARY		R

CONTRACT NUMBER: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No 3 (BRIDGE 3)
SECTION 2: SITE CLEARANCE AND EARTHWORKS

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
2.0	SANS 1200C	SECTION 2: SITE CLEARANCE				
2.1		CLEAR SITE				
2.1.1	8.2.1	Clear and grub the working space and provide a pipe laying platform, an access road, pipe storage strip and pipe storage mounds alongside the trench for pipe laying operations	ha	0.93		
2.1.2	8.2.2	Remove and grub large trees and tree stumps of girth:				
		a) over 1m and up to and including 2m	No	2		
		b) over 2m and up to and including 3m	No	2		
	8.2.7	Dismantle and remove to stockpile or disposal				
		01) Pipelines not encased in concrete:				
		i) Up to 500 mm dia	m	10		
		ii) Over 500 mm dia	m	220		
2.1.3	PSC 8.2.2.1	Penalty for unauthorized removal or damage of indigenous trees along the route	Sum/tree	1	-12500	Rate Only
2.1.4	PSC 8.2.5	Take down existing steel palisade, hand rails and fences, stockpile and re-instate after construction works	m	200		
2.1.5	8.2.10	Remove topsoil to nominal depth of 150mm and stockpile on pipeline route only	m³	529		
2.1.6	PSC8.2.11	Remove, store, preserve and replant selected trees & shrubs along the diversion pipeline	No	20		
2.1.7	PSC 8.2.16	Removal of man-made surfaces to stockpile or disposal				
		i) Tennis court surfaces and astro turf	m²	40		
		ii) Precast retaining blocks	m²	50		
		iii) Grassing	m²	1500		
		iv) Concrete paving slabs (450 x 450mm)	m²	30		
		v) Kerbs used to form stairs	m²	20		
2.1.8	8.2.8	Demolish and remove structures/buildings and dismantle steelwork.				
		i) Stormwater manholes and grid inlets on 600 mm diameter pipes	No	5		
		ii) Up to 2.4 metre high x 230mm brick boundary wall	m	480		
		iii) Up to 2.4 metre high steel palisade fence	m	50		
	PSC8.2.15	Break out Concrete or brickwork and make good				
		a) Existing Concrete lined V-drain (appr. dimensions 1.1m deep x 2m wide)	m	130		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
2.1.9	8.2.9	Transport materials and debris to unspecified sites and dump (Provisional) (10km maximum haulage)	m ³ /km	2500		
	PSC 8.2.17	Backfilling and reinstatement of man-made surfaces				
2.1.10	PSC 8.2.17.2 (a)	Backfilling and reinstatement footways and Play courts				
		i) Grassing	m ²	1000		
		ii) Concrete paving slabs (450 x 450mm)	m ²	20		
		iii) Kerbs used to form stairs	m ²	15		
2.1.11	PSC 8.2.17.2 (b)	Backfilling and reinstatement footways and Play courts				
		i) Astro turf	m ²	20		
		ii) Tennis court surfacing	m ²	20		
		iii) Grassing	m ²	1000		
		iv) Concrete paving slabs (450 x 450mm)	m ²	10		
		v) Kerbs used to form stairs	m ²	5		
2.1.12	PSC 8.2.19	i) Reinstatement of concrete block retaining walls	m ²	50		
		ii) Reinstatement of masonry dwarf walls	m	30		
		iii) Reinstatement of the Concrete lined V-drain to original condition (apr. dimensions 1.1m deep x 2m wide)	m	130		
2.1.13		Construct boundary wall complete per detail on Dwg No 13247-02/S019/A	m	500		
2.2	SANS 1200D 8.3.3	EARTHWORKS Restricted Excavation				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose (including shoring and/or bracing of trench sides): 3.8m wide and total trench depth for pipes 2.1m diameter				
2.2.1		i) Exceeding 0.0m but not exceeding 2.0m	m ³	140		
2.2.2		ii) Exceeding 2.0m but not exceeding 3.0m	m ³	410		
2.2.3		iii) Exceeding 3.0m but not exceeding 4.0m	m ³	1940		
2.2.4		iv) Exceeding 4.0m but not exceeding 5.0m	m ³	6860		
2.2.5		iv) Exceeding 5.0m	m ³	3275		
	8.3.2	b) Extra over items 2.2.1 to 2.2.5 incl. for, (Provisional as approved by the Engineer):				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
2.2.6		i) Intermediate excavation	m³	2127		
2.2.7		ii) Hard rock excavation, using mechanical and non-blast methods	m³	4963		
		SANS 1200DB Excavation				
2.2.8	PSDB8.3.1.2	Saw cut, remove and dispose of concrete (un-reinforced)	m²	75		
2.2.9	PSDB8.3.1.3	Remove and temporarily store of paving block units	m²	200		
2.2.10	PSDB8.3.1.5	Remove and temporarily store all types of kerbing	m	20		
2.2.11	8.3.2	a) Excavate and dispose of unsuitable material from trench bottom in rock and marshy areas. (Provisional as approved by the Engineer)	m³	353		
	8.3.3	Excavation Ancillaries				
2.2.12	8.3.3.1	Make up deficiency in backfill material (Provisional as approved by the Engineer)				
2.2.13		(a) From other necessary excavations on site	m³	50		
2.2.14		(b) by importation from designated borrow pits	m³	10		
2.2.15		c) By importation from commercial or off-site sources selected by the Contractor (Including haulage). Provisional as approved by Engineer)	m³	1500		
2.3	1200DB	Bulk Excavation				
2.3.1	8.3.2	Excavate in all materials for Scour Valve chambers and structure, backfill, compact and dispose of surplus/unsuitable material for:	m³	30		
2.3.2	PSDB 8.3.7	Accommodation of Traffic	L/Sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
3.0	SANS 1200LB	SECTION 3: MEDIUM PRESSURE PIPELINE				
3.1		BEDDING				
	8.2.1	Provision of Bedding from Trench Excavation.				
3.1.1		(a) Selected granular material	m³	100		
3.1.2		(b) Selected fill Material	m³	100		
	8.2.2	Supply only of bedding by importation				
	8.2.2.1	I) From other necessary excavations				
3.1.3		(a) Selected granular material	m³	50		
		(b) Selected fill Material	m³	50		
	8.2.2.3	II) From commercial sources				
3.1.4		(a) Selected granular material	m³	1750		
		(b) Selected fill Material	m³	1965		
3.2	SANS 1200L	MEDIUM PRESSURE PIPELINE				
	PSL 8.2.1	Supply, handle, lay, joint, bed and test GRP pipe complete with couplings				
3.2.1		2100mm diameter GRP PN 6 Pipe	m	929		
3.2.2	8.2.1	Supply, handle, lay, joint, bed and test 160mm diameter Class 9 uPVC pumping pipeline.	m	375		
	PSL 8.2.2	Extra-over item 3.2.1 for specials				
3.2.3		(a) 2100mm diameter 0.2-11.25 deg. GRP bends with couplings	No	4		
3.2.4		(b) 2100mm diameter >11.25-22.5 deg. GRP bends with couplings	No	5		
3.2.5		(c) 2100mm diameter >22.5-45 deg. GRP bends with couplings	No			Rate Only
3.2.6		(d) 2100mm diameter x 160mm GRP scour tee as per detail on drawing no. 13247-02/C/SEW/308-02	No	1		
3.2.7		(e) 2100 mm diameter steel Stub end flange adaptor as per detail A on drawing no. 13247-02/C/SEW/306-02	No	2		
3.2.8		(f) 1.0m m length x 2100 mm diameter GRP Flange Spigot Connector(drilled to SANS 1123-250/3) as per detail on drawing no. 13247-02/C/SEW/306-02	No	2		
	8.2.2	Extra-Over Item 3.2.2 for 160 mm diam. uPVC Specials complete with couplings.				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
3.2.9		a) >3-11.25° Bend	No	1		
3.2.10		b) >11.5 - 22.50° Bend	No	2		
3.2.11		d) 45° Bend	No	1		
3.2.12		e) 90° Bend	No	1		
3.2.13		f) 150mm diameter Gate valve, Fittings and pipework inside scour chamber as per detail on drawing no. 13247-02/C/SEW/308-02	Sum	1		
3.3	8.2.11	Thrust & Anchor blocks:				
3.3.1		1) Class 20 MPa/19 mm concrete	m³	85		
		2) Class 25 MPa/19 mm concrete (Anchor Blocks) as per Dwg No.13247-02/S019/A	m³	15		
3.3.2	SANS 1200G 8.2.1	Rough Vertical formwork to concrete thrust & anchor blocks	m²	100		
	8.3.1	Reinforcement				
3.3.3		b) High-tensile Steel Bars	kg	825		
3.4		Valve chambers				
3.4.1	8.2.13	Scour valve chamber complete with pipe fitting and specials to detail as per drawing No. 13247-02/C/SEW/308-02	No	1		
3.4.2	PSL8.2.13.1	Supply and connect 150 mm diameter mobile pump to drain diversion pipeline on completion of repair works.	No	1		
3.4.3	PSL8.2.13.2	Operate the pump to clean and clear grit and debris collected in the pipe diversion pipeline during and on completion of construction.	Sum	1		
3.4.4	PSL8.2.13.3	De-establish pump installation on completion of works.	Sum	1		
3.5	SANS 1200LD	Raising and lowering of Existing Manholes				
3.5.1	PSLD 8.2.13.1	Temporary Raising of Existing Manholes to 2.5m height and dismantling as per Dwg No. 13247-02/C/SEW/309-02	P/sum	1	80 000.00	R80 000.00
3.5.2	PSLD 8.2.13.2	Seal and strap down manhole covers to prevent leakages	P/sum	1	30 000.00	R30 000.00
3.6	SANS 1200DB	Finishes				
	8.3.6.1	Reinstate road complete with all courses to match original specification				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
3.6.1		b) Asphalt of thickness 30mm in roadway	m ²	20		
		b) Re-instatement of concrete, complete	m ²	75		
		c) Re-instatement of bricks and pre-cast concrete units, complete	m ²	220		
	SANS 1200D					
3.6.3	8.3.10	Topsoiling embankments and reinstatement of trenched areas	m ²	11000		
3.6.4	8.3.11	Grassing embankments and trenched areas with veld grass	m ²	11000		
3.7	SANS 1200DB	Excavation				
3.7.1	8.3.3.1	Backfill in an embankment on sewage diversion pipe at entry and exit chambers from imported fill compacted to 93% Mod AASHTO density as shown on drawing 13247-02/C/SEW/312-A	m ³	1200		
3.8	SABS 1200 LE	STORMWATER DRAINAGE				
	8.2.1	Collect from stockpile and lay concrete pipe culverts on class B bedding				
3.8.1		a) 600mm diameter	m	220		
3.8.2		E/o item 3.8.1 for supplying & laying new pipes	m	30		
	8.2.8	Supply and install manholes and the like:				
3.8.3		a) Brickwork Manholes shown on Dwg No 13247-02/C/SEW/309-2 standard depths 1.5 to 2 metres	No	2		
3.8.4		b) Brickwork Grid-inlets shown on Dwg No 13247-02/C/SEW/309-2 standard depths 1.5 to 2 metres	No	2		
3.8.5		c) Brickwork Field-inlets shown on Dwg No 13247-02/C/SEW/309-2 standard depths 1.5 to 2 metres	No	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
4.0		SECTION 4: DIVERSION AND RE-ENTRY CHAMBERS				
4.1	SANS 1200C	SITE CLEARANCE				
4.1.1	8.2.1	Clear and grub area around the two chambers and create space for placing the removed Precast U-sections.	m ²	200		
4.1.2	PSC 8.2.12	Remove cover slabs over the entry/exit chambers, store and restore as required (6 No x 0.2 m tck x 1.2 m x 5m)	Sum	1		
4.1.3	PSC 8.2.12	Remove cover slabs over the entry/exit chambers, store and restore as required (3 No x 0.12 m tck x (aver. 1.58 m x 2.9m, aver. 2.9 m x 2.3m & 3.4mx1.5m)	Sum	1		
4.2	SANS 1200G	CONCRETE (STRUCTURAL)				
4.2.1	SANS 1200 LD 8.2.12	Design, supply and install 2.5m height adjustment watertight temporary panels to the entry chamber to possible accommodate additional required head as per concept on drawing number 13247-02/C/SEW/306-02	Sum	1		
4.2.2	SANS 1200 C 8.2.8	Break out up to 600mm thick brick plug inside the 2 x 1800 diameter flange adaptors and dispose off-site	No	2		
4.2.3	PSC 8.2.14	Cut opening through existing concrete wall and make good surfaces at the exit and re-entry chambers to create side weir as per detail on drawing No. 13247-02/C/SEW/306-02	Sum	1		
4.2.4	PSC 8.2.15	Break out and spoil concrete wall section, mass concrete infill and precast U-sections	m ³	30		
4.2.5	PSC 8.2.12	Remove Precast U-sections from chamber and store at platform next to chamber (approx.5.2 tonnes each)	No	6		
4.2.6	SANS 1200 C 8.2.8	Demolish up to 600 mm tck reinforced concrete wall, remove the embedded 1800 mm diam flange adaptors, spoil rubble, modify openings and install new a 2100mm diam flange adaptor ex Item 3.2.7 on exit and re-entry chambers as per dwg no. 13247-02/SEW/306-02	Sum	1		
4.2.7	SANS 1200G 8.2 8.2.2	Formwork (to Steel flange (Stub) area) Smooth		3		
4.2.8	8.4.3	Cast in-situ 30Mpa concrete to steel stub area with reinforcement as per detail in Dwg No. 13247-02/C/SEW/306-02	m ³	1		
4.2.9	8.3.1	Reinforcement (to Steel flange (Stub) area) a) Mild Steel Bars	kg	5		
4.2.10		b) High-tensile Steel Bars	kg	10		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	SANS 1200 GE	PRECAST CONCRETE (STRUCTURAL)				
4.2.11	8.2.1	Manufacture complete reinforced Precast U-sections as detailed in Dwg No. 13247-02/C/SEW/306-02 with 40MPa concrete to replace broken sections (provisional)	No	2		
4.2.12	SANS 1200 GE 8.2.2	Erect Precast U-sections after completion of repair work to sewer internally	No	2		
4.2.13	SANS 1200 LE 8.2.5	Cast in-situ 15 Mpa concrete infill that was broken in item no 4.2.4	m³	10		
4.2.14	SANS 1200 GE 8.2.2	Erect precast roof slabs from (item 4.1.2), grout in and seal with 50mm 20Mpa concrete topping.	L/sum	1		
4.2.15	SANS 1200 GE 8.2.5	Complete design, fabricate, supply and install main steel sluice gates and diversion gates complete to concept detail as per dwg No.13247-02/C/306-02, including sewage control and diversion	P/Sum	1	3 000 000.00	R3 000 000.00
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
5.0	SANS 1200A	SECTION 5: COMMISSION / DE-COMMISSION SEWERS				
5.1.1	PSA 8.8.10	Provide labour and plant to open and close sluice gates at the upstream and downstream of the existing concrete pipeline	sum	1		
5.1.2	PSA 8.8.11	Operate, maintain, inspect and monitor the operation of the diversion system for the duration of the sewage diversion	sum	1		
5.1.3	PSA 8.8.12	Provide labour, plant and materials required to flush the diversion sewer with water and pump out the residual sewage from the by-pass through the scour chamber	sum	1		
5.1.4	PSA 8.8.13	Dismantle all temporary works associated with the operation of the by-pass pipeline	sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND SEWER CONCRETE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
6.0	COLTO 1200 PS	SECTION 6: REPAIRS ON BRIDGE DECK, HANDRAILS AND SEWER CONCRETE PIPELINE				
		121.01 Temporary access structures and work platforms				
		Access and Platform to (height range indicated below)				
		i) Design, supply and erect at the following structural elements (Abutments, piers, decks, parapets/balustrades/deck edges) and height ranges inclusive of dismantling and moving to the next structural element				
		a) 0 m up to 5,0 m	lump sum	1		
		b) Exceeding 5. 0 m up to 10,0 m	lump sum	1		
		c) Exceeding 10. 0 m up to 20,0 m	lump sum	1		
		d) Exceeding 20. 0 m up to 30,0 m	lump sum	1		
		ii) Dismantle and remove from location or structure				
		a) 0 m up to 5,0 m	lump sum	1		
		b) Exceeding 5. 0 m up to 10,0 m	lump sum	1		
		c) Exceeding 10. 0 m up to 20,0 m	lump sum	1		
		d) Exceeding 20. 0 m up to 30,0 m	lump sum	1		
		Proprietary cementitious repair compound Repair system 1 (cl 12305 (c)(iii)) to:				
		(i) Spalls to piers & bridge deck	litres	200		
6.1	COLTO 1200 PS	124.04 Establishment on site for crack injection	lump sum	1		
		124.05 Crack injection with epoxy resin to cracks in abutments and piers	m	250		
		BRIDGE DECK				
		Bridge Deck & Concrete Pipe Joints				
		128.01 Remove old joint seals and clean joints	m	750		
		6.1.1 128.03b Supply and seal expansion joints with polysulphide bridge & concrete pipe joint sealant	l	2000		
		Handrails				
		6.2.1 128.05 Remove all existing steel rails and stanchions to waste.	m	2000		
		6.2.2 128.06 Supply and install 1.1 or 1.2m high concrete balustrades to manufacturer's specifications and details on Dwg No. 13247-02/S019/A	m	2200		
		CONCRETE PIPE REPAIRS				
6.3	COLTO 1200 PS	External Cracks Repairs				
		6.3.1 124.04 Establishment on site for crack injection	L/Sum	1		
6.3. 2		124.05 Supply approved epoxy and inject cracks on the outside of the concrete outfall sewer and bridge elements (greater 0.5 mm crack width)	m	500		
TOTAL CARRIED FORWARD						

SECTION 6: REPAIRS ON BRIDGE, HANDRAILS AND SEWER CONCRETE PIPELINE

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
6.3.3	124.07	Supply and apply crystalline protective coating to seal micro-cracks on the outside of the concrete outfall sewer and bridge elements (less than 0.5 mm crack widths)	m ²	500		
6.4		Internal Repairs				
6.4.1	PSA 8.9.6	Provision of access, lighting and ventilation in the pipeline for the duration of the internal pipe repairs.	Sum	1		
6.4.2	PSC 8.2.13	Drain, flush outfall sewer and hose down internal face of the concrete pipe using high pressure water jetting to allow for a clean and safe working environment (8152 m ² face area)	Sum	1		
6.4.3	PSA 8.9.4	Inspections and measurements of damage using technology	P/Sum	1	350 000.00	R350 000.00
6.4.4	PSA 8.9.5	Visual inspections and measurements of damage by visual assessments	P/Sum	1	200 000.00	R200 000.00
6.4.5	125.02	Preparation of Concrete Surface	m ²	8152		
6.4.6	122.03	Cutback concrete surface to specified or ordered depth	m ³	190		
6.4.7	125.01	Establishment on site for sprayed on concrete work	L/Sum	1		
6.4.8	125.03	Application of sprayed cementitious mortar or 40MPa/10mm concrete to repair scour and internal pipe damage to woodfloat finish, including wet-to-dry epoxy bonding primer	m ³	250		
6.4.9	125.03	Apply a 15mm thick sacrificial layer on the internal pipe diameter (2750mm Ø) using 40MPa 100% Calcium Aluminate cementitious structural rehabilitation concrete or similar approved	m ²	8152		
6.5		Insulation and Cladding				
6.5.1	126.02	Supply and install 50mm thick Polyurethane sprayed-in-place insulation foam bonded to pipe per detail on dwg No.13247-02/C/SEW/306-02 or similar approved to manufacturer's specification	m ²	50		
		Provide pipe cladding protection by:				
6.5.2	126.03	i) Trial sample panels (glass fibre reinforced polyurethane coating & insulation)	m ²	20		
6.5.3	126.03	ii) Using aluminium sheets to match existing	m ²	500		
6.5.4	126.01	Clean and prepare external concrete pipe surface to receive the insulation installation to manufacture's specification	m ²	500		
6.6	128.13	Cat Ladders				
6.6.1		Supply and erect platform and cat ladders (2 per platform) fixed to the bridge deck to match existing ones per Dwg No. 13247-02/S019/A	No	4		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
7.0	COLTO	SECTION 7: BY-PASS SEWER BRIDGE				
		<u>FOUNDATION FOR STRUCTURES (Section 6100)</u>				
7.1	61.02	Excavations				
		a) Excavating soft material situated within the following successive depth range:				
7.1.1		(i) 0m up to 2m	m³	380		
		(ii) Exceeding 2m up to 4m	m³	140		
		(iii) Exceeding 4m up to 6m	m³	65		
		(iv) Exceeding 6m up to 8m	m³	45		
		b) Extra over subitem 7.1.1 for excavation in hard material irrespective of the depth	m³	65		
	61.03	Access and drainage				
7.1.2		a) Access	L/Sum	1		
		b) Drainage	L/Sum	1		
7.1.3	61.04	a) Backfill to excavations utilising materials from excavations	m³	585		
		b) Backfill to excavations utilising imported materials from commercial sources	m³	15		
7.1.4	61.07	Overbreak in excavation in hard material	m²	10		
7.1.5	61.08	d) Foundation fill consisting of mass concrete, 15Mpa	m³	10		
		e) Concrete screed, 50 mm thick, class 15/19 Concrete	m³	15		
7.1.8	61.09	Establishment on the Site for the drilling of holes for foundation anchors	L/Sum	1		
7.1.9	61.10	Moving to and setting up the equipment at each hole to be drilled	No.	54		
7.1.10	61.11	Drilling of holes of:				
		i) 115 mm dia for foundation dowels	m	270		
7.1.11	61.12	Grouting for anchor bars with Epoxy 30Mpa	kg	10		
7.1.12	61.13	Dowel Bars (Steel Tendons: yield strength of 950MPa)				
		i) 36mm Diameter Galvanised Thread Bar 950 – 6m Long (Type C)	No.	12		
		ii) 50mm Diameter Galvanised Thread Bar 950 – 8m Long (Type B)	No.	24		
		iii) 50 mm Diameter Galvanised Thread Bar 950 – 9m Long (Type A)	No.	18		
TOTAL CARRIED FORWARD						

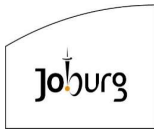
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.1.13		Allow for checks, inspections and approvals by specialist designer	P/sum	1	50 000.00	
7.1.14	B75.07	Proof testing of selected anchors				
		i) Type A Anchor	No	6		
		ii) Type B Anchor	No	6		
		iii) Type C Anchor	No	6		
7.2	COLTO	FALSEWORK, FORMWORK AND CONCRETE FINISH(Section 6200)				
	62.02	Vertical formwork to provide:				
		a) Class F1 surface finish to:				
7.2.1		.01) Bases	m²	95		
		b) Class F2 surface finish to:				
7.2.2		.01) rectangular on Pier above & below ground	m²	350		
		.02) Curved on Pier above & below ground	m²	110		
7.2.3		.03) Deep Beams	m²	1970		
7.2.4		.04) End Retaining Walls	m²	85		
	62.03	Horizontal formwork to provide:				
		b) Class F2 surface finish to:				
7.2.5		.04) Deck, roof beams & slabs	m²	950		
	62.05	Permanent formwork:				
7.2.6		a) To form voids of:				
		i) 2220 mm dia in deck end walls	No.	2		
		ii) 650 mm dia (manhole) in deck end top tie slab	No.	2		
		iii) 450 mmx 450 mmx150mm thrust plate recesses on pier bases	No.	50		
		iv) Supply & install 125 mm X 600mm length diameter sleeves to bases for anchor bars	No.	50		
7.2.7	62.06	Formwork to form open joints				
		i) Deck span ends	m²	50		
	B62.10	Unformed surface finishes				
7.2.8		a) Wood-floated (Class U2)				
		i) Deck	m²	910		
CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
		ii) Beams	m ²	275		
		b) Rough Finish (Class U1)				
		i) Bases	m ²	45		
		c) Smooth Finish (Class U3)				
		i) Pier Bearing Area	m ²	20		
7.3	63.01	REINFORCEMENT(Section 6300)				
7.3.1		.01) Bases				
		ii) High-tensile Steel Bars	t	11.9		
7.3.2		.02) Piers				
		ii) High-tensile Steel Bars	t	14.4		
7.3.3		.03) Deck slab				
		i) Mild Steel Bars	t	0.9		
		ii) High-tensile Steel Bars	t	36.5		
7.3.4		.04) Deep Beams on deck & End Walls				
		i) Mild Steel Bars	t	0.8		
		ii) High-tensile Steel Bars	t	120.0		
7.4	64.0	CONCRETE FOR STRUCTURES (Section 6400)				
	64.01	Cast in situ concrete:				
		a) Class 30/19 in :				
7.4.1		i) End Retaining Walls	m ³	12		
7.4.2		ii) Bases	m ³	60		
7.4.3		iii) Deck	m ³	365		
7.4.4		iv) Piers	m ³	175		
7.4.5		v) Deep Beams	m ³	820		
	64.02	Manufacturing precast concrete members:				
7.4.6		.i) Manufacture precast concrete pipe supports as per Dwg No. 13247-02/S/010/A & R013/A	No	41		
		iii) Manufacture precast concrete deck cover slabs (planks) as Dwg No. 13247-02/S/011/A	No	120		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
	64.03	Transporting and erecting precast concrete members				
		a) Concrete pipe supports in position as per Dwg No. 13247-02/S/010/A approx. mass =2.5 tonnes	No	41		
		b) Deck cover slabs (planks) to final position per Dwg No. 13247-02/S/011/A approx. mass =1.42 tonnes	No.	120		
	66.00	NO-FINES CONCRETE, JOINTS, BEARINGS, BOLT GROUPS FOR ELECTRIFICATION, AND PARAPETS AND DRAINAGE FOR STRUCTURES (Section 6600)				
7.5	66.06	Filled joints:				
7.5.1		i) Expansion joints filled with 20mm closed cell polystyrene and 20x20mm approved joint sealant as detailed on drawing No. 13247-02/S/011/A	m²	50		
		ii) Expansion joints filled with 74mm closed cell polystyrene as detailed on drawing No. 13247-02/S/011/A	m²	25		
	66.08	Sealing joints with:				
7.5.2		a) Sealant: 20x20mm approved joint sealant as detailed on drawing No. 13247-02/S/011/A	m	100		
	66.11	Proprietary bearings:				
7.5.3		a) Supply and construct 403074: 400x300x74 Bearings Pad to detail as per dwg No. 13247-02/S/011/A	No	10		
	B66.14	Dowels/guides to pipe supports				
		a) Supply and install 420 mm Long x Y20 dowel bars as per Dwg No. 13247-02/S/010/A & R013/A	No	82		
	66.19	Drainage pipes and weep holes:				
7.5.4		a) Drainage pipes i) 110 mm dia uPVC pipes to detail as per dwg No. 13247-02/S/010/A	No	2		
	B66.32	Accessories to detail given on dwg no. 13247-02/S/011/A				
7.5.5		a) Precast concrete manhole cover and frame. to typical deck access detail	No	2		
7.5.6		b) Step iron to typical deck access detail	No.	16		
7.5.7		c) Supply and Install cradle liners and steel straps with brackets including bolts sets as per Dwg No. 13247-02/S/010/A & R013/A	No	41		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
BROUGHT FORWARD						
7.8	52.00	GABIONS (Section 5200)				
7.8.1	52.02	Surface preparations for bedding of gabions	m ²	40		
	52.03	Gabions - Galvanised and PVC coated baskets, made with hexagonal woven (double twisted) wire mesh type 80. Steel wire to be heavily galvanised to class A with zinc alloy coated wire according to SANS 1580.				
7.8.2		(i) 3.0 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	9		
7.8.3		(ii) 3.0 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	14		
7.8.4		(iii) 3.0 x 2.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	18		
7.8.5		(iv) 2.0 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	8		
7.8.6		(v) 2.0 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	18		
7.8.7		(vi) 2.0 x 2.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	16		
7.8.8		(vii) 1.5 x 1.5 x 1.0 m with 2.7 mm diameter mesh wire	m ³	5		
7.8.9		(viii) 1.5 x 1.0 x 1.0 m with 2.7 mm diameter mesh wire	m ³	3		
7.8.10	52.05	Geotextile- as per detail	m ²	120		
TOTAL CARRIED TO SUMMARY						

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
8.0		SECTION 8: ELECTRICAL AND SECURITY				
8.1		Fencing				
	PSMM 8.6.1	Supply and install 1.8-metre-high clear view fence panels equivalent or similar to clear view fence on posts at positions depicted in plan on drawing No. 13247-02/C/SEW/302-D	m	900.00		
8.1.1		Supply and install 4-metre-wide Double Leaf Gates 1.8metre-high security locks	No.	4.00		
8.1.2		Extra over items 8.5.1 & 8.5.2 for supply and installing 730mm high ripper blade concertina coil anti-scale topping or similar approved	m	900.00		
8.1.3	PSA 8.9.7	Relocating electrical and security installation onto the new boundary wall of the Dainfern Valley Estate	P/Sum	1	R 1 000 000.00	R 1 000 000.00
TOTAL CARRIED FORWARD TO SUMMARY						



Contract: JW14455
DIEPSLOOT SEWAGE AQUEDUCT: BILL No.3 (BRIDGE 3)
Volume 1: Tender and Contract
SUMMARY



SUMMARY OF BILL OF QUANTITIES

SECTION	DESCRIPTION	AMOUNT
SECTION 2	SITE CLEARANCE	R
SECTION 3	MEDIUM PRESSURE PIPELINE	R
SECTION 4	DIVERSION AND RE-ENTRY CHAMBERS	R
SECTION 5	COMMISSION / DE-COMMISSION BYPASS	R
SECTION 6	REPAIRS ON BRIDGE DECK, HANDRAILS AND SEWER CONCRETE PIPELINE	R
SECTION 7	DIVERSION BRIDGE	R
SECTION 8	ELECTRICAL AND SECURITY	R
TOTAL TO TENDER SUMMARY		R

Johannesburg Water (SOC) Ltd



CONTRACT JW14455

VOLUME 1

CONTRACT

PART 3:

SCOPE OF WORK

Employer		Contractor	
Witness:		Witness:	

C3 PREAMBLE TO SCOPE OF WORK

GENERAL

The Standard Specification for all associated civil work shall be the SANS 1200 – 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 A: PROJECT SPECIFICATION covers a general description of the project, the facilities available and the requirements to be met.

Portion B: VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS covers variations to the standardized specifications and particular specifications which are applicable to the contract.

Portion C: PARTICULAR SPECIFICATIONS.

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.

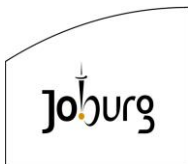
Employer		Contractor	
Witness:		Witness:	

ABBREVIATIONS AND DEFINITIONS

For the purpose of this Contract the following abbreviations shall have the associated meaning:

BEE	:	Black Economic Empowerment
BLOCK	:	Shall mean a sub-division of a super-block into smaller manageable water loss districts
BS	:	British Standard
CE	:	Civil Engineering
CESA	:	Shall mean the Consulting Engineer South African
CETA	:	Shall mean the Construction Education and Training Authority
CIDB	:	Construction Industry Development Board
CLO	:	Shall mean Community Liaison Officer
CoJ	:	City of Johannesburg
CONTRACT	:	Shall mean an identified super-block or part thereof of the Project where a Contractor is appointed
HDI and HDC	:	Shall mean historically disadvantage individuals and companies
CONTRACT AREA	:	shall mean the area within the boundary of the Project Area with suburbs listed under the contract scope in Portion 1 of these Project Specifications that is normally defined as a super-block
COP	:	Code of Practice for Work within the Road Reserve
ECSA	:	Employers' Agent ing Council of South Africa
EDA	:	Enterprise Declaration Affidavit
ERF Connection	:	Shall mean a water connection from the secondary mains to property boundary
EMP	:	Environmental Management Plan
EPWP	:	Expanded Public Works Programme
Ext	:	Extension
GCC	:	General Conditions of Contract
GRP	:	Glass Reinforced Pipe
GIS	:	Geographic Information System
ID	:	Internal Diameter
JRA	:	Johannesburg Road Agency
JW	:	Johannesburg Water (SOC) Ltd
KI	:	Kilolitres
l	:	Litres
LOCAL	:	Shall mean within firstly the suburb/s of a defined super-block or block and subsequently within the boundaries of the project
LOS	:	Level of Service
MI	:	Megalitres
Mod AASHTO	:	Modified American Association of State Highway and Transportation Officials
QAS	:	Shall mean quality assurance system
QCF	:	Quality Control Foreman
SABS	:	South African Bureau of Standards
SANS	:	South African National Standard
SERVICE PROVIDER	:	Shall mean either a consultant or contractor appointed to provide a particular service, i.e. investigations, design, labour provision and/or construction.
SMME	:	Shall mean small, medium and micro enterprises

Employer		Contractor	
Witness:		Witness:	



SOP	:	Standard Operating Procedure
STAND	:	Shall mean a demarked portion of property as per drawing/s provided by JW and shall exclude many stands designated for purposes other than human occupancy business trade etc.
uPVC	:	Unplasticised Polyvinyl Chloride
AC	:	Asbestos Cement
WISA	:	Shall mean water institution of South Africa
VAT	:	Shall mean Value Added Tax in terms of the Value Added Tax Act 89 of 1991 as amended.
ERF CONNECTION	:	Shall mean on property sewer connection on any point

GENERAL

For the purpose of this Contract the following shall have the associated meaning:

- a) Unless inconsistent with the context, an expression which denotes:
- i) any gender includes the other genders;
 - ii) a natural person includes a juristic person and vice versa; and
 - iii) the singular includes the plural and vice versa.

Employer		Contractor	
Witness:		Witness:	

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Employer		Contractor	
Witness:		Witness:	

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Witness:		Witness:	

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Employer		Contractor	
Witness:		Witness:	

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Employer		Contractor	
Witness:		Witness:	

PORTION A: PROJECT SPECIFICATION

PS1 DESCRIPTION OF THE WORKS

PS1.1 EMPLOYER'S OBJECTIVES

The Employer's objectives, as a water and sanitation service provider for the City of Johannesburg (CoJ) on the project, are to:

- a) To construct the sewage pipe diversion system and river crossings pipe bridges.
- b) To divert the sewage into the by-pass pipeline using low pressure flow.
- c) To investigate the extent of internal scour/damage of the existing aboveground pipeline on the highlevel bridge and to repair the determined internal damage and lining.
- d) To inspect and establish defects on the bridge sewage pipe externally and the supporting high level sewer bridge.
- e) To repair the bridge sewage pipe externally, bridge deck and columns, handrails, fencing, gates and locks, spot-lights and bridge deck joints.
- f) To procure and reinstate the pipe external insulation and cladding with suitable material available on the market.
- g) To install security measures on the rehabilitated facility to render it safe and secure from intruders.

PS1.2 OVERVIEW OF THE WORKS

This contract comprises:

- a) Construction of an underground 2100 ID GRP sewage pipe bypass to existing link exit and entry chambers situated at the upstream and downstream of the high-level bridge ends together with appurtenant works like low level pipe bridge river crossing, scour chamber, sewage return pipeline, access roads and end connections of the sewer pipe bypass.
- b) Isolate the existing bridge sewage pipe sections by installing sluice gates at the upstream and downstream ends of each bridge to direct sewage into the exit and entry chambers and maintaining the flow in the by-pass sewer pipe.
- c) Clear and clean the bridge sewage pipe internally to allow human and inspection equipment access.
- d) Undertake internal sewer pipe inspection and agree scope of internal sewer repairs with the Engineer.
- e) Provide all temporary works for a successful:
 - internal inspection and assessment of the bridge sewer pipe,
 - verification of internal dimensions of the exit and entry chambers for the design of sluice gates
 - operation of the by-pass pipeline
 - execution of all project works
- f) Carryout internal sewage pipe and pipe joint repairs as required
- g) Re-instate sewage flow in the bridge sewer pipe
- h) Carry-out inspections of the sewer pipe externally and the high-level above ground bridge substructure and superstructure.
- i) Undertake structural repairs to the pipeline externally and to the supporting bridges.
- j) Procure and install specified insulation and protective cladding over the bridge sewage pipe.
- k) Carry-out bridge sewage pipeline security installations comprising fencing, cabling, cameras, illumination, and guard room.

PS1.3 EXTENT OF THE WORKS

The Works to be completed under this Contract consists of:

- a) By-pass outfall sewage pipe construction

The Works entails the following:

- i. Construction of an underground 2100 ID GRP sewage pipe bypass line to link exit and entry chambers situated at the upstream and downstream of the high-level bridge ends together with appurtenant works like low level pipe bridge river crossing, scour chamber, sewage return pipeline, access roads and end connections at:
 - Bridge 1: 741.499 metres sewage pipe bypass

Employer		Contractor	
Witness:		Witness:	

- Bridge 2: 982.749 metres sewage pipe bypass
- Bridge 3: 934.712 metres sewage pipe bypass

The primary activities shall include:

- Pipeline route setting-out
- Route hoarding with fence and shade cloth,
- Location, exposing and protection of existing services and structures,
- Relocating clashing services,
- Relocating a clashing existing boundary wall of Dainfern Valley Estate (northbank of Bridge 3) including attached security infrastructure and demolition of remaining offending wall.
- Route clearance and trench excavations,
- Provision and maintenance of access to all sections of work,
- Dealing river water at river crossing,
- Construction of low-level pipeline bridge, comprising foundation excavation, foundation pilling, reinforced concrete piers, abutments and wingwalls, installation of elastomeric bearings, bridge deck, pipe supports, precast concrete cover slabs and drainage.
- Provision of materials, GRP pipes, fittings (GRP bends and specials), couplings, and scour chamber construction materials,
- Construct GRP pipeline complete with bends, fittings and specials, bedding, backfill, compaction, concrete thrust blocks and testing
- Bed, lay, pipes sections, including a 160 mm diameter uPVC scour effluent return pipeline, backfilling, compaction and tests,
- Hydraulic testing of both the GRP & uPVC pipelines,
- Breaking into and construction of flange adaptors for pipe end connections at the exit and re-entry chambers and
- re-instatement to pre-intervention state surface finishing or top soiling, leveling and debris removal.
- Re-statement of cleared fences, stormwater infrastructure, plants, paving, block retaining walls, etc.

b) Outfall sewer pipe internal inspection and repairs

On completion of the sewage by-pass pipeline, internal sewer pipe repairs to the elevated sewer pipe section will follow.

The works shall include:

- Construction of modifications to the entrance and exit chambers,
- Installation of sluice gates at the entrance and exit points of the bridge sewage pipe,
- Installation of a sewage flooding monitoring system and operating it for the duration of the by-pass,
- Construction of temporary extensions to entry chambers and manhole to accommodate effluent, backup, including sealing and securing affected manhole covers to prevent overflows,
- Diversion of the sewage into the by-pass pipeline,
- Gaining access via existing manholes for inspection, cleaning and assessing internal pipe repair scope,
- Provision equipment for accessing the outfall sewage pipe internally and external,
- Cleaning and inspection of the sewer pipe visually and by using special closed-circuit television (CCTV), sonar and/or laser equipment,
- Measurement and reporting on the internal condition of the sewage pipes,
- Repairs to internal sewage pipe scour and re-installation of the sacrificial layer,
- Repairs to sewage pipe joints,
- Repairs to sewage pipes externally, comprising crack sealing and concrete spall repairs,
- Application of insulation material and protective cladding to the sewage pipe externally,
- Regular clearing of debris in the exit and entry chambers and maintenance of sewage flow during construction,
- Final CCTV inspection upon completion,
- Commissioning of the refurbished sewage pipe and decommissioning of the by-pass sewage flow.

Employer		Contractor	
Witness:		Witness:	

c) Bridge repairs

Bridge repairs shall include:

- Provision for suitable access to the full bridge structure for close-up inspections and repair to flaws in the concrete structure,
- Repairs to the bridge concrete elements as appropriate to the assessed defects,
- Repair to bridge expansion joints as relevant to the assessed defects,
- Repair and replacement of bridge hand railing with concrete balustrading,
- Replacement of bridge cat-ladders.

d) Electrical and Security

Electrical and security works will comprise:

- Repairs and installation of security fencing to the bridge approaches and around arch bases,
- Installation of security cameras and alarms,
- Supply of power to the camera and guardroom structures,
- Construction of guardrooms.

e) Miscellaneous Works

- Boundary wall (Dainfern Valley Estate) relocation at Bridge 3 including security and lighting installations,
- Provision of security to the Dainfern Valley Estate during the breach to the boundary wall,
- Environmental, Health and Safety compliance throughout the contract,
- Co-ordination with affected parties throughout the contract,
- Timely reporting as required in the contract.

The contractor must note that this work involves working at height, confined spaces and with hazardous materials. Sufficient allowance shall be made in the relevant rates for all personnel training, certification and equipment required for safe working in this environment.

The Contractor's obligations shall also include strict compliance with any Environmental requirements and/or reports deemed to form part of this Contract as well as any Occupational Health and Safety requirements.

This description of the works is not necessarily complete and shall not limit the work to be carried out by the Contractor under the Contract. Approximate quantities of each type of work are given in the Schedule of Quantities.

PS1.4 LOCATION OF THE WORKS

The aboveground sewer pipe section of the Diepsloot sewage outfall pipeline is situated near the Northern Waste Treatment Works and their relative locations are described as below:

- a) Bridge 1 (750m length) shown in Fig 1 below, is in Diepsloot and is the last pipe bridge before the Northern Treatment Works in an undeveloped space,

The bridge structure comprises a 6.0 metre wide twin beam and slab deck supported on rectangular piers spaced at 20 metre intervals. At highest point the bridge is 26 metres above ground. The internal diameter of the outfall sewer pipe is 2.89 metres and flowing at estimated average peak flow of 7.56m³/s at 1.33 (46%) metre flow depth. However, extreme flooding measuring 14m³/s have previously been measured due to stormwater ingress. There are 2 access manholes on the pipeline positioned at 250 and 510 metres from the diversion (upstream) chamber. The access holes gain direct entry into the pipeline. Drawing No 13247-02/C/SEW/300-D in the book of drawings shows the elevation of the bridge.

Employer		Contractor	
Witness:		Witness:	

- b) Bridge 2 (1030m length) shown in Fig 1 below, is in Diepsloot crossing over Diepsloot River. The south bank is developed with housing/buildings flanking the 22 metre-wide sewer servitude. The north bank is an undeveloped open space.

The bridge structure comprises a 6.0 metre wide twin beam and slab deck supported on rectangular piers spaced at 20 metre intervals. At highest point the the bridge is 40 metres above ground. The internal diameter of the outfall sewer pipe is 2.89 metres and flowing at estimated average peak flow of 7.56m³/s at 1.33 (46%) metre flow depth. However, extreme flooding measuring 14m³/s have been measured due to stormwater ingress. There are 4 access manholes on the pipeline positioned over the end piers to the arch substructure and where the pipe expansion joints are situated. The access holes gain direct entry into the pipeline. Drawing No 13247-02/C/SEW/301-05 in the book of drawings shows the elevation of the bridge and some of the completed linked works in a previous contract.

- c) Bridge 3 (970m length) shown in Fig 2 below, is in Dainfern, crossing over the Jukskei River with part of the bridge running over the Dainfern College grounds (south-bank) and Dainfern Valley Estate(north bank).

The bridge structure comprises a 6.0 metre wide twin beam and slab deck supported on rectangular piers spaced at 20 metre intervals. At highest point the the bridge is 40 metres above ground. The internal diameter of the outfall sewer pipe is 2.79 metres and flowing at estimated average peak flow of 6.96 m³/s at 1.28 (46%) metre flow depth. However, extreme flooding measuring 13m³/s have been measured due to stormwater ingress. There are 4 access manholes on the pipeline positioned over the end piers to the arch substructure and where the pipe expansion joints are situated. The access holes gain direct entry into the pipeline. Drawing No 13247-02/C/SEW/302-D in the book of drawings shows the elevation of the bridge.



Fig 1 Bridges 1&2

Employer		Contractor	
Witness:		Witness:	



Fig 2 Bridge 3

PS1.5 TEMPORARY WORKS

The Contractor shall, as relevant:

- provide hoarding, temporary drainage works, temporary pumps and other equipment as might be necessary for the protection, draining and dewatering of the works; and
- construct and maintain haulage, temporary access and construction roads, subject to the approval by the Employer, and permit the Employer, other affected landowners, other Contractors, statutory bodies or any other person who might require legitimate access to or through the site for the purpose of executing legitimate business, free and unhindered usage of such roads.
- Construction materials laydown areas in approved areas in terms environmental, health and safety requirements.
- Exposing existing services and opening of existing installations (entry and exit chambers, sewer manholes, etc.) for measurement and/or investigations.
- Temporary services connections, Contractor's offices, storage sheds, latrines, barricading of Works shall be in an approved position and subject to the approval of all authorities concerned.
- Safety and security of the Contractors' temporary works shall be at the Contractors' discretion, but always in accordance with stipulated Occupational Health and Safety requirements and approved by the Employer. The Contractor shall also liaise with Curo School, Dainfern College, Dainfern Valley Estate and other affected property owners in the area, to ensure that the security requirements of these owners are met.
- The camp shall be adequately guarded during and outside working hours.
- Include the works required to locate, verify and protect existing services within the works area.
- Be such to ensure no or limited interruption to vehicular and pedestrian traffic; and
- Stormwater and river flow control to allow excavation in the riverbed and approaches
- Sewage diversion into the by-pass and regular debris clearing to ensure unimpeded flow.

Employer		Contractor	
Witness:		Witness:	

- l) Provide emergency over-pumping should the by-pass flow malfunction
- m) Provide, install and operate sewage flood early warning system for the duration of the by-pass sewer pipe operation
- n) Monitoring of the inflow into the diversion pipe to ensure safety of flow throughout construction
- o) Install sewage backup containment extensions to entry chamber, upstream manholes and securing them against overflow.
- p) Any other works necessary for the smooth operation of construction plant, personnel, materials and equipment.
- q) Temporary access structures and work platforms to the aboveground pipeline and bridge elements.
- r) Excavate and expose existing bridge foundations to check possible clashes with syphon pipe route and backfill.
- s) Installations and works required for testing the integrity of various work portions.
- t) The costs for all above activities shall be deemed to be included in the rates

Further the Contractor must ensure that no stockpiling of construction 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 public.

PS 1.6 GEOTECHNICAL INVESTIGATIONS

The following geotechnical report is available:

Consultant	Title	Report Number	Date
GeoZone GeoServices	The Results of a Geotechnical Investigation for the Diepsloot Sewer pipe Upgrade and Bridge Repairs, Gauteng Province.	15-052	28-10-2015
GCS Geotechnical (Pty) Ltd	Dainfern Sewer Pipe Bridges Upgrade: Foundation Investigation for Diversion Bridges: Geotechnical Report.	17-1084R01	19-04-2018

The abovementioned Geotechnical Reports have been included in Part C4: Site Information of this tender document.

PS2 ENGINEERING

PS2.1 DESIGN SERVICE AND ACTIVITY MATRIX

- a) The Employer is responsible for the design of the permanent Works as reflected in the Contract Document unless otherwise stated.
- b) The Contractor is responsible for the design of the temporary Works and their compatibility with their permanent Works.
- c) The Contractor shall supply all details, on marked up drawings, necessary to assist the Employers' Agent in the compilation of:
 - the as built drawings.

PS2.2 EMPLOYER'S DESIGN

The details of the Employers designs are depicted on the Drawings listed below and an outline description of the designs is provided in PS1.2 and PS1.3.

The Contractor undertakes only construction based on designs issued by the Employer's Agent. The Contractor is to follow the specifications, the design and construction drawings as laid out by the Employer's Agent. Where materials other than that proposed by the Employer's Agent is accepted, it will be the sole responsibility of the Contractor to ensure that the associated materials are compatible with the accepted specification and proposed/existing structures.

Employer		Contractor	
Witness:		Witness:	

In the case of the Employer's Agent's acceptance of an alternative proposal, the Contractor shall submit in triplicate to the Employer's Agent for his approval, detailed working drawings of the Contractor's alternative design proposal before any related work is executed.

An extension of Time for Completion of the Contract due to time spent on the alteration of the tender drawings to suit the Contractor's alternative proposals or, due to time spent in obtaining the Employer's Agent's approval of such alternatives, shall not be considered.

Acceptance of an alternative proposal or offer shall not relieve the Contractor of any of his obligations in terms of the Contract. The Contractor's cost of preparation and submission of an alternative proposal shall be deemed to be included in the rates tendered for the execution of the Work.

PS2.3 DRAWINGS

PS2.3.1 Tender drawings

Tender drawings are included in Volume 3 of this Contract Document, based on current available information. Such drawings shall be updated (based on actual site conditions encountered during the execution of the works) and re-issued during the Contract Period as required. The drawings that are listed for tender purposes only are below:

LIST OF DRAWINGS	
DRAWING NUMBER:	DESCRIPTION:
CIVILS	
13247-02/C/SEW/314-A	TYPICAL JW NAME BOARD DRAWING
BRIDGE 1:	
13247-02/C/SEW/300-D	PLAN AND PROFILE: SEWER DIVERSION PIPELINE
13247-02/C/SEW/310-A	BRIDGE 1 SITE PLAN: SEWER PIPELINE BRIDGE
BRIDGE 2:	
13247-02/C/SEW/301-5	PLAN AND PROFILE: SEWER DIVERSION PIPELINE
13247-02/C/SEW/305-3	PIPE JACKING DETAIL
13247-02/C/SEW/311-3	BRIDGE 2 SITE PLAN: SEWER PIPELINE BRIDGE
BRIDGE 3:	
13247-02/C/SEW/302-D	PLAN AND PROFILE: SEWER DIVERSION PIPELINE
13247-02/C/SEW/312-A	BRIDGE 3 SITE PLAN: SEWER PIPELINE BRIDGE
COMMON TO BRIDGES 1, 2 & 3:	
13247-02/C/SEW/304-2	PIPE REPAIR TYPICAL DETAILS
13247-02/C/SEW/306-2	DIVERSION/RE-ENTRY TYPICAL CHAMBER DETAILS
13247-02/C/SEW/307-2	TYPICAL PIPE BEDDING
13247-02/C/SEW/308-2	SCOUR CHAMBER DETAILS
13247-02/C/SEW/309-2	TEMPORARY MANHOLE RAISING, FIELD INLET, GRID INLET, MANHOLE & THRUST BLOCK DETAILS.
STRUCTURES	
BRIDGE 1:	
13247-02/S/001/A	GENERAL ARRANGEMENT (1 OF 2)
13247-02/S/002/A	GENERAL ARRANGEMENT (2 OF 2)
13247-02/S/003/A	SECTIONS AND DETAILS
13247-02/S/004/A	DETAILS
13247-02/S/R/001/A	FOUNDATION AND PIERS REBAR DETAIL

Employer		Contractor	
Witness:		Witness:	

13247-02/S/R/002/A	DECK 1&7 REBAR DETAIL
13247-02/S/R/003/A	DECK 2,3,4,5,6 REBAR DETAIL
13247-02/S/017/A	RE-ENTRY CHAMBER SLAB AND CONCRETE ANCHOR DETAILS
13247-02/S/020/A	RE-ENTRY CHAMBER SLAB REBAR
BRIDGE 2:	
13247-02/S/013/A	GENERAL ARRANGEMENT
13247-02/S/014/A	SECTIONS AND DETAILS
13247-02/S/015/A	DETAILS
13247-02/S/R018/A	FOUNDATION AND ABUTMENT 2, END WALL AND DECK 1 REBAR DETAILS
13247-02/S/R019/A	DECK 2 REBAR DETAIL
13247-02/S/R020/A	DECK 3 REBAR DETAIL
13247-02/S/R021/A	DECK 4 AND PIPE SUPPORT REBAR DETAIL
13247-02/S/018/A	PLATFORM, CAT LADDERS, BALUSTRADE AND CONCRETE ANCHOR DETAILS
BRIDGE 3:	
13247-02/S/008/A	GENERAL ARRANGEMENT (1 OF 2)
13247-02/S/009/A	GENERAL ARRANGEMENT (2 OF 2)
13247-02/S/010/A	SECTIONS AND DETAILS
13247-02/S/011/A	DETAILS
13247-02/S/R013/A	FOUNDATION AND PIERS REBAR DETAIL
13247-02/S/R014/A	DECK 1&6 REBAR DETAIL
13247-02/S/R015/A	DECK 2,3,4,5 REBAR DETAIL
13247-02/S/019/A	PLATFORM, CAT LADDERS, BOUNDARY WALL AND CONCRETE ANCHOR DETAILS
13247-02/S/025/A	BOUNDARY WALL PLAN AND PROFILE
13247-02/S/026/A	BOUNDARY WALL PLAN, PROFILE AND DETAILS
13247-02/S/027/A	BOUNDARY WALL DETAILS
ELECTRICAL	
13247-02/E/ELEC/700/E	BRIDGE 2: TYPICAL GUARDHOUSE LAYOUT-SLEEVES, POWER AND LIGHTING LAYOUTS
13247-02/E/ELEC/701/C	BRIDGE 1: ELECTRICAL INSTALLATION-LIGHTING LAYOUT
13247-02/E/ELEC/702/E	BRIDGE 2: ELECTRICAL INSTALLATION-LIGHTING LAYOUT
13247-02/E/ELEC/703/E	BRIDGE 2: ELECTRICAL INSTALLATION-SLEEVES DETAILS
13247-02/E/ELEC/704/C	BRIDGE 2: MV OVERHEAD RETICULATION LAYOUT (1 OF 3)
13247-02/E/ELEC/705/C	BRIDGE 2: MV OVERHEAD RETICULATION LAYOUT (2 OF 3)
13247-02/E/ELEC/706/C	BRIDGE 2: MV OVERHEAD RETICULATION LAYOUT (3 OF 3)
13247-02/E/ELEC/707-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (1 OF 5)
13247-02/E/ELEC/708-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (2 OF 5)
13247-02/E/ELEC/709-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (3 OF 5)
13247-02/E/ELEC/710-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (4 OF 5)
13247-02/E/ELEC/711-D	ELECTRICAL INSTALLATION-SITE RETICULATION LAYOUT (5 OF 5)
13247-02/E/ELEC/712	MAIN KIOSK, DB-GH AND EK-2 SINGLE LINE DIAGRAMS

Employer		Contractor	
Witness:		Witness:	

PS2.3.2 Construction drawings

On receiving the instruction to commence with construction the Contractor shall receive three (3) sets of construction drawings, of which one (1) set shall be designated locating positions of existing services and one (1) set for as-built records and updated by the Contractor on a daily basis. The latter shall be:

- a) Made available to the Employers' Agent or his duly authorized representative within 24 hours on request
- b) Submitted to the Employers' Agent with the Contractor's request for issue of the Practical Completion Certificate.

PS 2.2.3 Shop drawings

Where an item to be supplied in conformance with this Contract specification has not been designed by the Employers' Agent or Employer, the Contractor shall be required to supply the Employers' Agent with 3 copies of detailed shop drawings prior to delivery of materials, including an electronic copy in drawing format that is compatible with the software packages (AutoCAD or DXF) used by the Employers' Agent and/or Employer.

NOTA BENE: Only on approval of such shop drawings or an amended version thereof, shall the Contractor proceed with the manufacturing, supply and installation of the designed item.

PS3 PROCUREMENT

PS3.1 PREFERENTIAL PROCUREMENT PROCEDURES

PS3.1.1 Requirements

The Contractor's attention is drawn to the following returnable schedules contained section T2.1.4. The schedules in this section contain all requirements regarding preferential procurement.

PS3.2 SUBCONTRACTING

PS.3.2.1 Definitions

Unless inconsistent with the context in these specifications, the following terms, words or expressions shall have the meanings hereby assigned to them:

1. Start-up Enterprises

An enterprise that has been in existence and operating for less than two years.

2. Small Enterprises

An enterprise that has a CIDB grading designation of 1 or 2.

3. Micro Enterprises

An enterprise that has a CIDB grading designation of 3.

4. Locally based SMMEs

Enterprises that have their operational base in the ward in which the project is to be executed or, alternatively, the members of the enterprise are resident in the particular ward. Should a suitable locally based SMME as defined above not be available in the particular ward, then they shall be sourced from adjacent wards.

5. Contract Participation

Employer		Contractor	
Witness:		Witness:	

Contract Participation in terms of this contract is a process by which the Employer implements Government's objectives by setting a target relating to small Contractor development which the Contractor shall achieve as a minimum.

6. **Contract Participation Goal (CPG)**

Contract Participation Goal is the monetary value of the target set by the Employer in the Contract Participation process.

7. **Contract Participation Performance (CPP)**

Contract Participation Performance is the measure of the Contractor's progress in achieving the CPG.

The commitment of the Employer to Government Policy concerning the empowerment of the SMMEs shall be noted and adhered to by the Contractor. It is against this background that Johannesburg Water has made provisions under this contract to ensure that the Contractor impart skills to the SMME within the project area during the project implementation.

The onus is upon the Contractor to handle and manage the procurement process of the Sub-Contractors and once appointed, should be dealt with in accordance with the provisions of Clause 4.4 of the General Conditions of Contract 2015(3rd Edition).

The Contractor shall obtain the written approval of the Employer's Agent before appointing any Sub-Contractor. The Contractor shall be solely responsible for the supervision of and payments to such a Sub-Contractor(s) and the approval of a Sub-Contractor by the Employer's Agent shall not indemnify the Contractor from any of his liabilities in terms of the Contract.

PS.3.2.2 Applicable Legislation

The following Acts, as amended from time to time, are predominant amongst those which apply to the construction industry and are listed here for reference purposes only:

- The Constitution of South Africa;
- Preferential Procurement Policy Framework Act No. 5 of 2000;
- Construction Industry Development Board Act No. 38 of 2000;
- Broad-Based Black Economic Empowerment Act No. 53 of 2003.

PS.3.2.3 Scope

The City of Johannesburg has identified job creation and access to procurement opportunities by Start-ups, Small and Micro enterprises (SMMEs) as an essential requirement towards building an economically viable City.

This tender is subject to the sub-contracting condition as described in this section and must be adhered to by the main contractor. It is also the obligation of the main contractor to impart skills to the subcontractor/s on the project during implementation. Although a minimum subcontracting percentage of the contract value is indicated in the Contract Data, the contractor may increase this percentage at his discretion.

Some specialized work could be subcontracted, including pipe jacking and sluice gates manufacture and installation. The Contractor must take note of Clause 4.4 of General Conditions of Contract 2015 (3rd Edition).

NB: all sub-contractors appointed on this contract must comply with the Central Supplier Database (CSD) requirements, i.e. they must be registered on the CSD.

It is a condition of this contract that the Contractor is required to sub-contract a minimum value of work to SMMEs equal to the subcontracting percentage of the Contract Sum indicated on the Contract Data.

Employer		Contractor	
Witness:		Witness:	

It is a condition of this tender that the Contractor is required to sub-contract a minimum value of work to **SMME** equal to **10%** of the Contract Sum.

The Contractor is to allow for fortnightly certificates from the SMMEs and for payment to the SMMEs to be made within 7 days of certification. To achieve the goals of this policy and to ensure that the SMMEs are treated fairly and given every opportunity to advance their business whilst delivering a successful project, the Contractor is to note the following and provide for any cost that may be associated therewith.

1. The Contractor shall subcontract the local SMME suitable works for items identified by the contractor in the various sections of the Bill of Quantities.
2. The Contractor will be expected to have clearly specified the programme dates to the SMME and these dates are to be included in the contractual agreement between the two parties. The Contractor is to monitor the SMME's progress against the programme and hold progress meetings with the SMME contractors where minutes are to be kept and signed off by both parties.
3. Before site establishment, the Contractor will provide each appointment letter and contractual agreement that the Contractor engages with for each SMME on this Project. The Agreement must include agreed work values agreed upon with the Contractor and SMME.
4. Before site establishment, the Contractor will provide the following for all SMME's:-
 - a) SMME company registration
 - b) SMME CIDB proof of registration.
5. The Contractor is to assess the skills of the SMME and provide the relevant support and training in order for the SMME to complete the works to programme, budget and specification. The Contractor will be expected to provide training to the SMME that will ensure that the SMME's staff is suitably trained to execute the works and that they receive sufficient relevant experience on the project.
6. The Contractor is responsible for safety compliance on the project and will assist the SMME Contractors in all aspects to achieve safety compliance, that will include:
 - a) Assisting the SMME with developing their safety files, legal appointments, etc.
 - b) Assisting the SMME with achieving safety on site.
 - c) Having tool box talks with the SMME Contractor's employees on a daily basis.
 - d) Providing all safety equipment and signage.
 - e) Providing safety training where necessary.
7. The Contractor is to provide all the necessary equipment for the timeous monitoring and the checking of the quality of works as carried out by the SMME. The Contractor will be expected to monitor the SMME's works for quality compliance and provide all the necessary support to the SMME in order to achieve quality requirements. The Contractor is to ensure that if the SMME's quality of works does not achieve specification, the Contractor will assist the SMME to achieve specification and not allow the works to continue until the quality requirements are achieved.
8. The Contractor is to generate monthly reports for the Johannesburg Water SOC. which includes the following:
 - a) Per SMME resources on the site, i.e. supervisors, labour, plant tools and equipment
 - b) Per SMME progress of works on site.
 - c) Per SMME quality control on site.
 - d) SMME expenditure on the project versus target expenditure including payment progress
 - e) Copies of minutes of the SMME and Contractor progress meetings.
 - f) Concerns and improvements to be made.
 - g) Items listed in PS5.11

Employer		Contractor	
Witness:		Witness:	

9. In the execution of the Subcontract Work, the Contractor shall ensure that the Sub-Contractor(s) comply with all relevant legislation and regulations including, but not confined to, the Occupational Health and Safety Act. The Contractor hereby indemnifies the Employer against any loss, damage, or claim for Subcontract Works arising out of the former's failure to comply with instructions issued to him regarding these requirements.
10. The Contractor shall be required to adopt labour intense construction techniques through the SMME allocated work in the Bill of Quantities with the proviso that the Employer's specific objectives regarding time and quality are not compromised. Maximisation of employment shall be the aim on this contract.
11. Together with their tenders, all Contractors are required to submit a comprehensive implementation plan clearly stating the labour content and number of jobs that shall be created. The employment of labour shall be reflected in a programme in sufficient details to enable the Project Manager to monitor and compare it with the implementation plan.
12. The Contractor shall be required to submit employment data on a monthly basis to the Employer's Agent.
13. Contractors are to also note that it is an explicit condition of this Contract that all unskilled labourers on the project are to be employed from the local community. The Contractor shall, in general, maximise the involvement of the local community.
14. The Contractor shall pay once off 10% Preliminary and Generals to the SMME's who are expected to provide their own facilities, equipment and tools to site, and the erection (establishment) on site, the removal upon Contract completion or other of the storage facility and other fixed charged obligation. The payment shall include time-related for the complete monthly costs for the provision and maintenance of the SMMEs facilities, tools and equipment, supervision for the duration of the contract and other time-related obligations on site for the period of contract implementation.

The commitment of the Employer to Government Policy concerning the empowerment of the SMMEs shall be noted and adhered to by the main contractor. It is against this background that Johannesburg Water has made provisions under this contract to ensure that the main contractor impart skills to the local sub-contractors within the project area during the project implementation.

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

1. Valid CIPC registration (i.e. CK, COR)
2. SA ID copies of owners
3. Active CIDB membership: minimum grading 1CE
4. Valid Tax clearance certificate
5. Valid BBBEE certificate
6. COIDA certificate
7. Company Profile including similar experience and skilled personnel CVs
8. Health and Safety Plan

The Contractor is:

- a) to enter into contract with any (selected) sub-contractor(s) in accordance with the requirements of Clause 4.4 in the General Conditions of Contract for Civil Engineering Works (2015), 3rd Edition. The form of contract to be used with sub-contracting SMMEs shall be the SAFCEC General Conditions of Sub-Contract for Civil Works. The number of sub-contractor(s) will be determined by the main contractor depending on the Subcontracting Scope of Work and the amount of work that is to be carried out under this Contract as outlined above and in the Bill of Quantities.
- b) required to utilise local subcontractors (or regional if he fails to find suitable subcontractors from within the project locality)

Employer		Contractor	
Witness:		Witness:	

- c) responsible for all work executed (including QUALITY, CONTRACTUAL LIABILITIES) on his behalf or under his supervision and/or management by all subcontractors, including nominated or selected subcontractors.
- d) To compile and submit a subcontracting plan according to the structure below;

Introduction

- Purpose of the Subcontracting Plan
- Scope of work to be subcontracted
- Number of SMME's to subcontract

Scope of Work

- Detailed scope of work to be undertaken by each SMME inclusive of work packages for each bridge.
- Expected outcomes and deliverables
- CIDB grading of SMME to subcontracted and how the appointment will help the SMME to upgrade their current CIDB grading

Quality Control and Assurance

- Testing and inspection procedures
- Defects correction procedures

Roles and Responsibilities

- Main Contractor's responsibilities to assist SMMEs
- SMME's responsibilities
- Communication structure

Schedule of Timelines

- Anticipated SMMEs appointment dates
- SMMEs work timelines

General Inclusions

Note:

- Local subcontractors are subcontractors from within the project suburb or ward.
- Regional subcontractors are subcontractors from within the region as per the City of Johannesburg's demarcation of the regions.

The Employer must be supplied with a copy of the contract/agreement for records.

PS.3.2.4 Scope of mandatory subcontract works

The Contractor shall be required to employ SMMEs to undertake portions of the Works but not limited to, works hereinafter defined, in accordance with the provisions of the Contract to SMMEs:

- Site Clearance of the pipeline route
- Shallow hand excavations in other than hard or rock material,
- laying of pipes up to 160mm nominal diameter, including the provision of bedding and selected fill materials,
- placing and compaction of bedding and backfill materials,
- disposal of surplus material,
- gabion construction,
- spoiling of building rubble,
- all brickwork and small concrete works,
- site clearance and cleaning,

Employer		Contractor	
Witness:		Witness:	

- j) surface re-instatement,
- k) dismantling and re-instatement of existing fences,
- l) site security,

The Employers' Agent may at his discretion, upon receipt of a written and fully motivated application from the Contractor, and where he deems the circumstances so warrant, and provided always that the Contractor has complied fully and in all respects with the provisions of the Contract pertaining to subletting or has utilized his best endeavor to comply therewith, authorize in writing that the Contractor may employ local residents with the sole intent of executing the job. Training of such residents shall be to suitable levels of skill that enables the Contractor to sub-let appropriate portions of the Works to such local residents, functioning as SMMEs. The Employers' Agent shall not grant such authorization in cases where it may reasonably be concluded on the available evidence that the invitation of further tenders/quotations in accordance with the terms of the Contract, is likely to result in the successful completion of the portions of the Works concerned by local SMMEs. The Employers' Agent shall monitor progress achieved with SMMEs training, and successful completion of this training shall be subject to his approval or instruction.

PS.3.2.5 Subcontracting Procedure

The Contractor shall liaise through the CLO/s and local Ward Committee/s or similar structure/s to recruit and employ local SMME/s. All recruitment and employment shall be through open and transparent processes and procedures, preferably at community public meetings.

The Contractor shall be expected to enter into a contract with the nominated or selected subcontractor(s) in accordance with the requirements of Clause 4.4 the General Conditions of Contract. The Employer must be supplied with a copy of the contract/agreement for records.

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

In the execution of the Subcontract Work, the Contractor shall ensure that the Subcontractor(s) comply with all relevant legislation and regulations including, but not confined to, the Occupational Health and Safety Act. The Contractor hereby indemnifies the Employer against any loss, damage, or claim for Subcontract Works set out for the Diepsloot Sewer Pipeline and Bridges Repairs arising out of the former's failure to comply with instructions issued to him in regard to these requirements.

PS.3.2.6 Performance and Execution of the Subcontract Work

The main contractor must facilitate access to supply sufficient, suitable resources (e.g. equipment, labour, material) to execute all the Subcontract Work including the portion identified by the Employer as outlined in the Scope of Work PS 3.2.

The Contractor shall also ensure that the Subcontractor(s) shall execute the Subcontract Work in accordance with the Scope of Work and Programme to the reasonable satisfaction of the Employer.

PS.3.2.7 Quality of the Subcontract Work

In accordance with the requirements of Clause 4.4 in the General Conditions of Contract for Civil Engineering Works (2015), 3rd edition, it is the responsibility of the Contractor to ensure that the Subcontractor shall be capable of executing the Subcontract Work efficiently and in accordance with the Scope of Work.

PS.3.2.8 Laws and Regulations

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

Employer		Contractor	
Witness:		Witness:	

- Compensation for Occupational Injuries and Diseases Act,
- Unemployment Insurance Act,
- Basic Conditions of Employment Act,

PS.3.2.9 Resources to complete Subcontract Work

Although it is preferred by JW that the Contractor ensure that the Subcontractor(s) supply all required resources such as labourers, equipment, hand tools, power-driven tools if need be, which are required by him for the execution of the Subcontract Work, however the onus is upon the Contractor to determine the extent of resources the subcontractor shall supply to ensure that the works are completed in time. The agreement between the Contractor and subcontractor is the Contractor's responsibility and JW is indemnified from any agreements entered between Contractor and his subcontractor (s)

PS.3.2.10 Payment

The Contractor shall ensure that sub-contractor(s) are paid within stipulated time as per the Agreement with the subcontractor.

PS.3.2.11 Retention Monies

The Employer will deduct Retention money for the overall works including the Subcontract Work at the percentage stated in the Contract Data.

PS.3.2.12 Resolution of Disputes

Should any dispute between the Contractor and the Subcontractor arise out of the provisions of the Subcontract, or the execution of the Subcontract Work, every effort shall be made by the Parties to resolve the matter themselves without the intervention of the Employer. The agreement signed between the contractor and sub-contractor should state dispute resolution procedure, and also address late payment issues should it arise.

PS.3.2.13: SMME Supervisor/Foreman

1. The successful tenderer shall enter into an employment agreement with the SMME Supervisor for all local SMMEs to be identified and appointed on this project. The SMME Supervisor will be required to supervise all the SMMEs on the project as part of JW mandatory requirements. The proposed SMME Supervisor is expected to have at least a Diploma in Civil Engineering or Built Environment Industry and a minimum experience of five (5) years.

Employer		Contractor	
Witness:		Witness:	

PS4 CONSTRUCTION

PS4.1 APPLICABLE STANDARDS

NATIONAL STANDARDS

The Standard Specifications for all associated civil work applicable to this contract shall be:

- SANS 28 : METAL TIES FOR CAVITY WALLS (1986)
- SANS 227 : BURNT CLAY MASONRY UNITS (2007)
- SANS 282 : BENDING DIMENSIONS AND SCHEDULING OF STEEL REINFORCEMENT FOR CONCRETE (2004)
- SANS 523 : LIMES FOR USE IN BUILDING (2007)
- SANS 558 : CAST IRON SURFACE BOXES AND MANHOLE AND INSPECTION COVERS AND FRAMES (1973)
- SANS 674 : 2008
- SANS 920 : STEEL BARS FOR CONCRETE REINFORCEMENT (2005)
- SANS 1024 : WELDED STEEL FABRIC FOR REINFORCEMENT OF CONCRETE (2006)
- SANS 1083 : AGGREGATES FROM NATURAL SOURCES - AGGREGATES FOR CONCRETE (2006)
- SANS 1090 : AGGREGATES FROM NATURAL SOURCES - FINE AGGREGATES FOR PLASTER AND MORTAR (2002)
- SANS 1200A : GENERAL
- SANS 1200 AB : EMPLOYERS' AGENT 'S OFFICE
- SANS 1200 C : SITE CLEARANCE
- SANS 1200 DA : EARTHWORKS (small works)
- SANS 1200 DB : EARTHWORKS (pipe trenches)
- SANS 1200 DK : GABION AND PITCHING
- SANS 1200 DM : EARTHWORKS
- SANS 1200 G : CONCRETE (STRUCTURAL)
- SANS 1200 GA : CONCRETE (small works)
- SANS 1200 GE : PRECAST CONCRETE
- SANS 1200 L : MEDIUM PRESSURE PIPELINES
- SANS 1200 LB : BEDDING (pipes)
- SANS 1200 LC : CABLE DUCTS
- SANS 1200 LD : SEWERS
- SANS 1200 LE : STORMWATER DRAINAGE
- SANS 1200 LG : PIPE JACKING
- SANS 1200 M : ROADS GENERAL
- SANS 1200 ME : SUBBASE
- SANS 1200 MF : BASE
- SANS 1200 MG : BITUMEN SURFACE TREATMENT
- SANS 1200 MH : ASPHALT BASE AND SURFACING
- SANS 1200 MK : KERBING AND CHANNELLING
- SANS 1200 MM : ANCILLARY ROADWORKS
- SANS 62-1 & SANS 719 : PIPES
- SANS 1491-1 : PORTLAND CEMENT EXTENDERS PART 1: GROUND GRANULATED BLAST-FURNACE SLAG (2005)
- SANS 1491-2 : PORTLAND CEMENT EXTENDERS PART 2: FLY ASH (2005)
- SANS 1491-3 : PORTLAND CEMENT EXTENDERS PART 3: SILICA FUME (2005)
- SANS 1882 : POLYMER CONCRETE SURFACE BOXES, MANHOLE AND INSPECTION COVERS, GULLY GRATINGS AND FRAMES (2003)
- SANS 50197-1/ : CEMENT - PART 1: COMPOSITION, SPECIFICATIONS AND CONFORMITY CRITERIA FOR COMMON EN 197-1 CEMENT
- SANS 5831 : PRESENCE OF CHLORIDES IN AGGREGATES
- SANS 5861-2 : CONCRETE TESTS - SAMPLING OF FRESHLY MIXED CONCRETE (2006)

Employer		Contractor	
Witness:		Witness:	

SANS 5862-1 : CONCRETE TESTS - CONSISTENCE OF FRESHLY MIXED CONCRETE - SLUMP TEST (2006)
SANS 5863 : CONCRETE TESTS - COMPRESSIVE STRENGTH OF HARDENED CONCRETE (2006)
SANS 5864 : CONCRETE TESTS - COMPRESSIVE STRENGTH OF HARDENED CONCRETE (2006)
SANS 5865 : CONCRETE TESTS - THE DRILLING, PREPARATION, AND TESTING FOR COMPRESSIVE STRENGTH OF CORES TAKEN FROM HARDENED CONCRETE (1994)
SANS 0268-1 : WELDING OF THERMOPLASTICS – WELDING PROCESSES
SANS 1476:2009: FABRICATED FLANGED STEEL PIPEWORK

These Specifications are not issued with this volume but are available at the Contractor's expense from Standards South Africa:

Office Address:

1 Dr Lategan Road
Groenkloof
PRETORIA

Postal Address:

Private Bag X191
PRETORIA
0001

Telephone:

National: (012) 428 7911
International: + 27 12 428 7911
Email: sales@sabs.co.za

Telefax:

National: (012) 3441568
International: + 27 12 344 1568

For "Workmen's Compensation Act" read "Compensation for Occupational Injuries and Diseases Act, 1993 (Act No.130 of 1993)" wherever it appears. For "Machinery and Occupational Safety Act" and "Mines and Works Act" read "Occupational Health and Safety Act, 1993 (Act 85 of 1993)" wherever they appear. For "maintenance period" read "Defects Liability Period in terms of Clause 1.1.1.13 of the General Conditions of Contract, 2015" wherever it appears

OTHER STANDARDS

Other Standard Specifications for applicable to this Contract shall be:

- a) City of Johannesburg Metropolitan Municipality, Public Road and Miscellaneous By-laws, Code of Practice for work in the road reserve (COP), Latest Version. **NOTA BENE:** Should any requirement of this COP conflict with any requirement of the standardised or particular specifications the requirements of the COP shall prevail. The COP is available at Johannesburg Roads Agency Offices, Wayleaves Department, Contact number: (011) 298 5000
- b) The COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998). The contractor may purchase copies of Volume (i) from the South African Institution of Civil Employers' Agent s.
SAICE Tel : (011) 805-5947
Waterfall Park / Postnet Suite 81 Fax : (011) 805-5971
Howick Gardens/ Private Bag X65
Vorna Valley / Halfwayhouse Contact Person : Angeline Aylward Becker Street/ 1685

PS4.2 PARTICULAR GENERIC SPECIFICATIONS

PS4.2.1 Particular specifications

The following generic particular specifications are included in portion C of this document:

PD: Employment and Training of Labour
PS 1200: Repair of Bridge Structures to COLTO 1200
Performance Specification: Electronic Security Surveillances Installation
Performance Specification: Electronic Services Systems

PS4.2.2 Metric measurement

The metric system of weights and measures shall be used in all instances.

Employer		Contractor	
Witness:		Witness:	

PS4.2.3 Site preparation

Prior to any Works commencement the Contractor shall photograph or video tape entire work area. One copy of which shall be given to the Employers' Agent's authorized representative and one copy shall remain with Contractor for a period of 12 months following the issue of a Completion Certificate. This record shall be used to establish accountability for damages during the execution of the Contract.

No alterations beyond what is required for Works are to be made. Contractor shall confine all activities to designated work areas, to the absolute minimum required.

PS4.2.4 Watching and lighting

The Contractor shall in connection with the ordered Works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or required for the protection of the Works and the materials and equipment utilized therefore or for the safety and convenience of the public or others.

PS4.2.5 Minimum Health and Safety Requirements

This section of the specifications is to be read in conjunction with the Contract Health and Safety specifications, included as Volume 2. The following requirements shall be deemed minimum compliance requirements to ensure the health and safety of the public and workers during the execution of the Contract:

PS4.2.6 Personal safety equipment

The internal conduit inspection and workmen unit shall be provided with:

- a) oxygen deficiency and gas detector apparatus, which shall be regularly serviced and operable.
- b) fresh air breathing apparatus, face mask and demand value, with a sufficient minimum compressed air supply, determined by the duration of manhole and/or conduit entry.
- c) an approved full vertical lift safety harness.
- d) personal equipment per member:
 - i) safety helmet;
 - ii) safety boots;
 - iii) sewer pipe wading boots; and
 - iv) disposable protective gloves.
- e) First Aid Kit suitable to cater for the number of team members.
- f) facilities for washing, including:
 - i) soft soap;
 - ii) disinfectant; and
 - iii) clean water.
- g) radio equipment and cellular phone for on-site and emergency communication.
- h) fire extinguisher
- i) Sufficient lighting
- j) Working at Heights Equipment
- k) Working in Confined Spaces Equipment
- l) Any other equipment as identified in the contractor's risk assessment and hazard mitigation plan.

PS4.2.7 Pipe handling and storage

The pipe manufacturer shall provide packing and shipping procedures for the Employers' Agent's approval. These shall comply with the following requirements.

PS4.2.7.1 Pallets

If used, pallets shall be suitable for transporting the pipes and fittings from the plant to the designated location without causing any damage. The pallets shall not contain any broken planks or extremities that may damage the pipes and fittings.

PS4.2.7.2 Trucking

Where pipes are transported by vehicles, the vehicle bed shall be free from sharp edges or projections and the pipes shall be supported at adequate intervals to prevent movement between the material and its support. Pipes shall not over-hang either end of the trailer.

PS4.2.7.3 Storage

Materials shall be stored in accordance with the pipe manufacturer's recommendations and this specification.

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Witness:		Witness:	

The storage area should have a relatively smooth, level surface free of sharp stones, debris or other materials that could damage the pipe or fittings. Where adequate ground conditions do not exist or when a level gravel bed cannot be prepared, the pipe shall be placed on timber supports evenly spaced along the pipe length. The support size and spacing shall be as advised by the pipe manufacturer.

Stacks shall only contain pipes of one size and wall thickness and shall be constructed in a pyramid, with each successive layer having one less pipe than the layer below. The bottom layer should be braced to prevent movement.

PS4.3 PLANT AND MATERIALS

PS4.3.1 Plant and materials supplied by the Employer

The Employer will supply the following materials at Bridge 2:

- 348m GRP, 126m HANDRAILS (Balustrades and stanchions),
- 74 No. PRE-CAST DECK COVER PLANKS AND
- (1 x No.) 3000 D PIPE JACKING CONCRETE SLEEVE PIPE

No additional allowances other than those already specified in the schedule of quantities shall be allowed for with respect to plant and materials.

PS4.3.2 Materials, samples and shop drawings

Only materials that that have been tested and which have been approved by the SANS shall be used in the permanent Works.

PS4.4 CONSTRUCTION EQUIPMENT

The Contractor is required to provide all equipment necessary to carry out the works as required. No additional allowances other than those already specified in the schedule of quantities shall be allowed for with respect to equipment.

PS4.5 EXISTING SERVICES

PS4.5.1 Known services

Existing known services, both underground and overhead, are indicated on the drawings, but the positions of existing services on the drawings are not guaranteed nor does the Employer or the Employers' Agent accept any liability in this regard. The services indication may not be exhaustive so the contractor will be responsible for identifying all affected services prior to work commencement in the services vicinity.

PS4.5.2 Treatment of existing services

The Contractor must liaise with all relevant local/utility authorities to satisfy himself that all relevant services have been located. At the commencement of the contract, the Contractor must hand excavate a distance 0,5 metre on each side of the located service to expose it. The exposed service shall be identified and recorded on a drawing.

A copy of the drawing with all known services shall be submitted to the Employers' Agent before construction can commence in any road reserve. Once the exposed service is identified and recorded the excavation must immediately be backfilled. Re-excavation by hand at construction stage will not be measured in addition to normal trench excavation.

The Contractor shall retain full responsibility for establishing the exact positions of the various services in advance of any construction work. No allowance for delays or disruption shall be entertained unless the Contractor complies fully with the provisions of this clause regarding the establishment of the exact positions of the various services in advance of any construction work.

PS4.5.3 Use of detection equipment for the location of underground services

The Contractor:

- a) is responsible to provide his own equipment in order to determine the exact location of existing services, and
- b) shall locate and expose existing services by hand.

Employer		Contractor	
Witness:		Witness:	

PS4.5.4 Damage to existing services

The Contractor:

- must make provision for the possible existence of numerous services within and in close proximity to the work areas;
- shall take necessary steps to protect any existing services whatsoever against damage which may arise as a result his operations on site. Adequacy in terms of protection of existing services shall be at the discretion of the Employers' Agent. The Contractor is to make good the protection of and any breakages to existing services;
- must inform the relevant service provider immediately (within 2 hours of the incident) such that procedures for the re-instatement of the service can be effected, should he damage or break an existing service (whether known or unknown);
- shall bear the cost of the repair of damages to any service, the possible existence of which could reasonably have been ascertained by him in good time.

Contractor shall contact the following persons or their successors should there be any disruption, damage or co-ordination required with the relevant services agencies:

• EGOLI GAS	Rianna / Denis	(011) 718 7133
• ESKOM	Mr Christo Louw	(011) 711 2941
• CITY POWER	Mr D Oliver	(011) 490 7000
• CITY PARKS	Mr Mike Griffiths	(011) 407 3722
• JOBURG WATER	William / Thula	(011) 688 1400
• JRA	Mr Theo Molamu	(011) 866 8697
• RAND WATER	Mr Job Kubheka	(011) 682 0911/0433
• NEOTEL	Mr Shane Cannon	(011) 359 1105
• TELKOM	Mr L Ramolobela	(011) 309 9186
• SASOL	Mr B van der Heuvel	(011) 865 8563
• MTN	Shasha le Grange	(011) 912 3289
• DFA / VODACOM	Ms Nadia Verhoog	(012) 345 7520

The Contractor's attention is drawn to Clause PSA 5.4.

Under no circumstance is the Contractor to alter or in any way interfere with existing works or underground services unless authorised by the Employers' Agent.

NOTA BENE: Drawings indicating other existing services in the vicinity of the Works are not guaranteed as being accurate, as all other services may not have been recorded or properly recorded. It shall remain the responsibility of the Contractor to perform preoperational work, to locate existing services in advance of the commencement of the Works.

PS4.6 SITE ESTABLISHMENT

PS4.6.1 General

To facilitate compliance with the General Conditions of Contract the Contractor shall be required to set-up a construction camp. The size and functionality of the site camp shall be in relation to the works site. It is, however, expected that the Contractor would have made themselves aware on whether one or multiple site camps are required for the execution of the complete Contract Works.

The Contractor shall price accordingly and state so in their proposal. For the camp/s, the following shall apply:

- The Contractor shall make arrangements with the relevant authority for a suitable site to establish a construction camp, storage, works offices, workshop/s, kitchen, eating area, and shelters for security personnel.
- The Contractor shall note that only security personnel shall be permitted to remain in the campsite overnight.
- Ablution facilities shall be provided for men and women separately. One toilet per twenty workers shall be provided. Such facilities shall at all times be maintained in a clean and hygienic condition. Toilets shall be screened from public view and their use shall be enforced.

Employer		Contractor	
Witness:		Witness:	

- d) Covered accommodation shall be provided for perishable or corrodible materials, fittings and the like and shall be adequate and suitable for their purpose. In the case of cement stores, they shall be well ventilated, weatherproof and waterproof with appropriate floors to keep the materials dry and freely aerated.
- e) All such accommodation shall be subject to the approval of the Employers' Agent who shall have free access thereto at all times.
- f) Temporary buildings and fencing are to be safe, neat and presentable and the surrounding areas must at all times be kept in a neat, clean and orderly condition for the duration of the Works.
- g) It shall be the Contractor's responsibility to ensure that they are in compliance with all relevant laws and regulations as well as tribal requirements.

PS4.6.2 Site facilities

- a) Source of water supply: It will be the responsibility of the Contractor to make his own arrangements for the supply of water. Potable water is available in the area and the Contractor is to make the necessary arrangements for the provision of a metered point of supply with the Employer. The sum entered by the Contractor in the Bill of Quantities for provision of water shall be deemed to include full compensation for the procurement, transport, storage (where necessary), supply and application of water and for all the work necessary and incidental thereto for the various items of work where water is required for the purposes of the contract. The Employer does not guarantee the availability, sufficiency or continuity of any supply and no claims in this regard will be considered.

The Contractor is to be aware of the fact that this Contract is to be carried close to a built up environment and that, as such excessive dust creation will be considered unacceptable by the local residents. The Contractor is to make provision for regular watering of the works in order to alleviate dust creation. During dry weather, or during periods when dust is created by the construction process, the Contractor will be required to water the works a minimum of twice a day, or as specified by the Employers' Agent. This is a requirement over and above the normal requirement for watering of the works.

- b) Source of power supply: It will be the responsibility of the Contractor to make his own arrangements for the supply of electricity. The sum entered by the Contractor in the Bill of Quantities for the provision of power shall be deemed to include full compensation for the procurement and supply of powers to the works. The Employer does not guarantee the availability, sufficiency or continuity of any supply and no claims in this regard will be considered.
- c) Contractor's camp: A suitable site for the Contractors camp will be identified prior to commencement by the Contractor. The Contractor is to make the necessary arrangements for the payment of services to the Municipality where applicable. The camp site shall be kept clean and tidy, and at the completion of the contract shall be restored to its original condition at the Contractor's own cost, and to the satisfaction of the Employers' Agent. In order to facilitate compliance with the Conditions of Contract and the Specification, the Contractor may establish storage accommodation, works offices, workshops, mess-rooms, kitchens, shelters for watchmen, latrines, ablutions and the like in such positions and under such conditions as may be agreed by the Employers' Agent and indicated in the Addendum to the EMP.

Temporary buildings and fencing are to be neat and presentable and the surrounding areas must at all times be kept in a neat, clean and orderly condition.

The Contractor shall not make any excavation without written permission of the Employers' Agent.

Covered accommodation for perishable or corrodible materials, fittings and the like shall be adequate and suitable for their purpose, and, particularly in the case of cement stores, shall be well ventilated, weatherproof and waterproof with floors raised off the ground, so as to keep the materials perfectly dry and freely aerated. All such accommodation shall be subject to the approval of the Employers' Agent who shall have free access there at all times.

In addition to the above, the Contractor shall provide one toilet per 20 workmen. Portable toilet facilities shall be made available to workers of both male and female genders, the number provided to be in

Employer		Contractor	
Witness:		Witness:	

proportion to the ratio of the sexes. The toilets shall be located in the vicinity of the work site, shall be screened from public view and the use thereof shall be enforced. The Contractor shall, where applicable, make the necessary arrangements for the regular removal of night soil.

The Contractor may not house members of his permanent staff except for a security guard at the site and is to make the necessary arrangements for the transport of his staff members to and from the site on a daily basis. As the Contractor's Camp may be located in close proximity to a residential area, attention to noise levels, particularly after hours, will be essential.

- d) Site facilities required for Employers' Agent and others: The requirements of the Employers' Agent's Site Establishment are detailed in Project Specification PSA and PSAB.

The Contractor shall provide the following office facilities at his main site camp for the Employers' Agent and others:

- Two offices for the Employers' Agent's Representative and meetings
 - Temporary office accommodation to suit his own requirements.
 - Covered parking facilities for two (2) cars for the Employers' Agent's Representative,
- A telephone will not be required for the sole use of the Employers' Agent. However the Contractor shall be responsible for the payment of calls related to the Contract made by the Employers' Agent's Representative, on his own mobile phone, during the course of the Contract. Telefax and a Telkom ADSL or at least 3G line with modem facilities shall be provided on site and be available for the sole use of the Employers' Agent at all times.

PS4.7 SITE USAGE

PS4.7.1 Work on private or state property

The Contractor is to confine his activities strictly to the working area defined as width of the servitude, spoil sites and the direct access roads to these. He shall not encroach upon any roadway except with the prior approval of the Employer, in writing. The Contractor shall, throughout the Contract, take adequate precautions to protect all existing services from damage whether or not they have been pointed out to him.

The Contractor shall, as soon as is practically possible, inform the Employers' Agent of any damages to services and shall not repair any such damage unless instructed to do so. The Contractor shall be responsible for making good, at his own cost and to the satisfaction of the Employers' Agent, all damage caused by him to buildings and other improvements to properties.

Should the Contractor consider that damage to buildings and structures is unavoidable in the execution of any portion of the Works, he shall obtain the approval of the Employers' Agent before proceeding with the work. Where damage is noticed before commencement of work on that erf, this should be reported to the Employers' Agent to prevent a possible liability claim from the owner.

PS4.7.2 Site safety and precautions against nuisance

The Works are to be conducted in an urban area where high volumes of pedestrian and vehicular traffic may prevail. The watching, barricading, lighting and traffic control on site shall be carried out in strict compliance with these specifications. The Contractor shall ensure that all safety measures are strictly adhered to. The Contractor shall ensure that excavations on sidewalks within the road reserves or within the erven, do not at any time present a safety hazard to pedestrians. All excavations that remain open overnight are to be adequately protected.

The Contractor shall provide all safety materials and equipment necessary for barricading and safeguarding the excavations. The safety of staff and labour involved with the Works and the security of installations, plant and equipment is of major concern and need special attention during the execution of the Works.

Plant used on the Works shall be as efficiently silenced as possible and noisy operations will be permitted only between the hours of 07:00 and 17:00. Any work outside normal hours will be permitted only on the written authority of the Employers' Agent. Wherever excavations or loading of material is liable to form dust, an effective method of spraying water over the excavated area and loaded material shall be instilled. Any rock or debris

Employer		Contractor	
Witness:		Witness:	

falling from trucks on the roads shall be removed immediately. Precautions shall be taken to prevent fouling of public roads or private surfaces. The Employers' Agent may order the Contractor to broom off and clean roads or surfaces where debris may constitute a danger to the public or a nuisance to the owners.

PS4.7.3 Work on live sewer pipes

Every effort will be made by the Council to furnish the Contractor with all available information regarding existing reticulation systems. Such information is given in good faith. Actual conditions in the field may, however, vary from the records upon which information is based. The Contractor must allow in his programme for delays when working on live sewer pipes and, as far as possible, such work should not be on the critical path of any programme and every effort must be made to have alternative work available.

PS4.7.4 Work outside normal working hours

In accordance with General Conditions of Contract Clause 5.8.1, certain work may only be done outside normal working hours. Such work shall be undertaken solely at the discretion of the Employers' Agent who shall, from time to time, issue advance orders in writing to the Contractor detailing the work to be undertaken. Work undertaken, as ordered, outside normal working hours shall be measured and paid for at the rates applicable to each and every item carried out as scheduled.

Normal working hours shall be defined as between 07:00 and 17:30 Mondays to Fridays. and also 07:00 to 13:00 on Saturdays. Notwithstanding the foregoing working hours are to be to the satisfaction of the owners of the surrounding properties, and are to be approved by the Employer's Agent

Where the Works are conducted within the road reserve of major arterial roads, the contractor's operations will be restricted to out-of-peak traffic periods (typically 09:00 to 15:30) or as determined by the Traffic Department. The Contractor shall co-ordinate his activities in such a manner that only minor operations that are non-disruptive to traffic are carried out during peak traffic periods. Should the Contractor choose to work outside normal working hours without having been ordered to do so by the Employers' Agent, permission will not be unreasonably withheld but all additional costs arising out of such work shall be entirely to the Contractor's account.

PS4.8 PERMITS AND WAYLEAVES

The Contractor will be required to obtain permits and wayleaves from all the applicable service providers who may have services in the vicinity of the Works. These include the following: Rand Water, Sasol Gas, Egoli Gas, Telkom, Openserve, Eskom, City Power, Johannesburg Roads Agency, Johannesburg City Parks, Johannesburg Water, Vumatel, MTN, Vodacom, Liquid Telkom and the like.

The Employer will assist the Contractor to obtain clearance from the various authorities with services that are likely to be affected by the Contract. It is, however, the Contractor's responsibility to obtain final permit and wayleave approval according to applicable procedures and specifications. In the case of Johannesburg Roads Agency, this will be as per the City of Johannesburg Code of Practice for Work within the Road Reserve. Further, a processing fee per wayleave per project per suburb will be payable to cover the cost of processing and approval of the Johannesburg Roads Agency wayleave applications.

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.

PS4.9 ALTERATIONS, ADDITIONS, EXTENSIONS AND MODIFICATIONS TO EXISTING WORKS

The Contractor is required to verify the accuracy of all drawings and levels provided by the Employers' Agent prior to commencing with any construction activities.

The Contractor shall, on becoming aware of a defect in existing works which will have an impact on the current works, notify the Employer of such a defect without delay.

Employer		Contractor	
Witness:		Witness:	

Where the Works require that alterations, additions, extensions and / or modifications be carried out to existing works or facilities, these shall be carried out strictly in accordance with the requirements of the relevant authorities.

PS4.10 INSPECTION OF ADJOINING STRUCTURES, SERVICES, BUILDINGS AND PROPERTIES

The Contractor shall, before commencing with works which have the potential to damage surrounding structures, services, buildings or property, arrange an inspection with the owners of such structures, services, buildings and property and representatives of local or controlling authorities, as appropriate, to determine the condition of buildings, structures, services, paved surfaces, roads, kerbs, channels and the like, that the works could affect, and document their current condition in sufficient detail to enable disturbances or damage which might be caused by the works to be evaluated. The Contractor shall furnish the Employer with copies of all such documentation and shall be held responsible for any disturbance and damage to such structures, services, buildings and property arising from the performance of the contract as well as any costs involved in refuting or processing such claims.

PS4.11 WATER, SANITATION AND ELECTRICITY FOR CONSTRUCTION PURPOSES

PS4.11.1 Water

The Contractor shall make his own arrangements for the supply and storage of all water required for this contract. The Contractor shall make his own arrangements with the Employer to obtain a potable water metered standpipe connection for which at least 14 days' notice shall be given. The size of the connection provided will be specified in the Water and Sanitation By-laws.

The Contractor may only draw water from fire hydrants through means of a legal, Employer owned, potable water metered standpipe. Failure to use such Employer owned potable water metered standpipes, or using illegal, non- the Employer owned equipment for purposes of drawing water from fire hydrants, will result in the Contractor having to pay an account to the Employer, for an amount determined by the Employer.

The potable water metered standpipe(s) must be made available to the Employer's water inspectors for purposes of reading and inspection, and failure to do so, will result in the immediate withdrawal of such potable water metered standpipe(s). The onus is on the Contractor to return such potable water metered standpipe(s) if they are found to be defective (not registering consumption). Failure to do so will result in an account being levied, payable to and determined by the Employer. Claims for delays caused where standpipe(s) are withdrawn and/or replaced will not be considered. The current water tariffs applicable to the Contract are available from the Employer. Compensation for these costs will be made under the rates and no separate compensation will be made.

PS4.11.2 Sanitation

The Contractor shall provide, maintain, move to positions as required and finally remove proper sanitary accommodation. Sanitary accommodation shall be properly screened and its use strictly enforced. The Contractor shall comply with the Johannesburg Water (SOC) Ltd's Sanitation General By-Laws Section 19(1) and 19(3).

The situation of sanitary accommodation prescribed in terms of the Sanitary General By-Laws shall be approved by the Employers' Agent as being convenient for the person for whose use it is intended. The sanitary accommodation provided must be adequately ventilated, properly disinfected and kept in a thoroughly clean condition at all times.

The Contractor shall bear all costs associated with the provision of sanitary accommodation. Compensation for these costs will be made under the rates and no separate compensation will be made.

PS4.11.3 Power supply

Power shall not necessarily be available at individual sites in the area of the Contract and the Contractor shall make their own arrangements with the relevant authority for the supply of power. The Contractor shall bear all costs associated with the provision of power. Compensation for these costs will be made under the rates and no separate compensation will be made.

Employer		Contractor	
Witness:		Witness:	

PS4.12 SURVEY CONTROL AND SETTING OUT OF THE WORKS

The Contractor will be held responsible for the maintenance of all the cadastral beacons and bench mark pegs on the site that were recorded as existing at the commencement of construction, and for the replacement of any of these pegs that are found to be missing or disturbed upon the completion of the contract. A completion certificate will only be issued after the Contractor has submitted to the Employers' Agent a certificate from a registered land surveyor stating that all pegs are in their correct position.

The Contractor shall, prior to the ordering of pipes or fittings, set out the works in accordance with the drawings / site instructions. The positions of chambers, pipe bends, road crossings and connections to existing sewer pipes shall be clearly marked. The Contractor shall protect and maintain all pegs and markings throughout the Contract. The Contractor shall record the setting out of the works in an approved format and order all materials accordingly. Where discrepancies are identified, these shall be raised with the Employers' Agent and a ruling sought, prior to ordering of material related to the discrepancy.

Employer		Contractor	
Witness:		Witness:	

PS5 MANAGEMENT OF THE WORKS

PS5.1 APPLICABLE SANS 1921 STANDARDS

Some portion of the scope of work is considered routine construction work. It is therefore expected that the Contractor shall make use of the services of small and micro enterprises for portions of the works. These include site clearance, service location and protection, small scale excavation and small scale manhole/chamber construction.

The Standards applicable to this Contract shall be:

SANS 1921-1	2004	Part 1:	General Engineering and construction works
SANS 1921-2	2004	Part 2:	Accommodation of traffic on public roads occupied by the contractor
SANS 1921-5	2004	Part 5:	Earthworks activities which are to be performed by hand
SANS 1914-5	2004	Part 5:	Targeted construction procurement: Participation of targeted labour

PS5.2 PLANNING AND PROGRAMMING

PS5.2.1 Construction roll-out and programming

The Contractor shall programme his work taking account of the following construction roll out procedure:

- Work shall be executed continuously to completion in an area before moving on to the next
- Allow 20 days for SMME recruitment prior to works commencement
- Allow 14 days break in the works when internal sewer pipe inspections and measurements are conducted
- Allow 7 days of testing and commissioning of diversion sewer pipe, flood monitoring system and sewage surcharge structures.
- Allow the rehabilitation of the Bridge 2 aqueduct to be completed prior to commissioning the by-pass pipeline on Bridge 1.
- Consider special programming requirements by the Curo School, Daifern Valley Estate and Dainfern College outlined in the Environmental Management Specifications and current consultations with them.

PS5.2.2 Work plan

Seven days prior to commencing with any part of the Works, the Contractor shall submit to the Employers' Agent, for review and approval, a work plan detailing the procedure and schedule to be used to execute such works, detailing and substantiating any deviation from the originally proposed approach. Further, the work plan shall include a:

- time frame;
- description of all equipment and tools to be used;
- list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable);
- list of sub-contractors, schedule of work activity;
- safety plan (clearly highlighting any potentially hazardous substances to be used);
- traffic control plan (if applicable);
- an environmental protection plan; and
- contingency plans for possible problems.

The approval given by the Employers' Agent shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as prescribed under this Contract

Work plan shall be comprehensive, realistic and based on actual working conditions. Further it shall form the various sub-sections of the overall Contract programme and plan

NOTA BENE: No works shall be allowed to commence without an approved work plan. Any delays to prepare drafts and final work plans (or method statements) and to obtain final approval by the Employer's Agent shall not be considered for extension of time. It is in the interest of the contractor to prepare and submit quality and comprehensive documentation regarding work plans(or method statements) to obtain quick approvals.

Employer		Contractor	
Witness:		Witness:	

PS5.2.3 Planning

The Contractor shall ensure that he:

- a) is well informed with regard to the Employer's overall maintenance programme and avail resources as required to efficiently complete this Contract; and
- b) delivers goods and services timeously to meet the Employer's prevalent performance standards and where applicable to not unnecessarily delay any other contractors, service providers and suppliers.

PS5.2.4 Programming

In order to ensure a clear understanding, at the inception of the Contract, of the programming and documentation format requirements, the Contractor shall appoint a project programmer/ planner for liaison during the Contract. The Contractor shall for the Contract Period provide and regularly update (maximum monthly) a Contract Programme.

The programme shall at minimum contain:

- a) Time Scale (minimum):
 - i) Days, where the period does not exceed three months.
 - ii) Weeks, where the project period exceeds three months.
 - iii) Months, where the period does not exceed one year.
 - iv) Years, where the project period exceeds one year.
- b) Tasks: Where phases or stages are anticipated, this shall be the highest level of division and all tasks related to the successful accomplishment of that phase of the area shall be grouped. Resources allocation and task dependency shall be indicated.
- c) Start and Finish Dates: All tasks shall have specific start and finish dates.
- d) Critical Path: All tasks forming the programme line that will establish any delays in the overall Contract Period shall be clearly indicated and an indication of their sensitivity characteristics shall be provided.
- e) Progress Tracking: The Contractor shall be required to periodically indicate progress per task graphically and on a percentage basis.
- f) Non-working Time: All South African public holidays, weekends and the local traditional annual builder's break shall be incorporated in the programme..

No deviation from the approved sequence of construction shall be accepted without prior written approval.

The programme shall not be in the form of a bar chart only, but shall show clearly the anticipated quantities of work to be performed each month, together with the manner in which the listed plant is to be used, as well as the cashflow for the various sections of work.

The Contractor shall submit to the Employer's Agent for his approval a detailed programme within the period stated in the Contract Data showing the order of procedure and method in which he proposes to carry out the work, his method of measurement of progress as well as the resources that will be allocated to each item or phase of the works. On a fortnightly basis throughout the contract, the Contractor shall submit the accepted programme marked to show actual progress. Quantities proposed for execution during each month must be shown. In addition, the anticipated cash-flow for the Contract, based upon these quantities, shall be shown as per prescribed format as provided by the Employer's Agent. The Contractor must include in his programme all necessary details pertaining to the lead-time required for the supply of materials.

The Contractor shall, whenever required by the Employer's Agent, furnish for his information particulars in writing of the Contractor's arrangements for the carrying out of the works and of the plant and temporary works, which the Contractor intends to supply, use or construct as the case may be. The submission to and approval by the Employer's Agent of such programme, or the furnishing of such particulars will not relieve the Contractor of any duties or responsibilities under the contract.

The Contractor will be expected to progress with the Works in accordance with the approved programme and shall not deviate from the order of execution shown in the programme without the prior approval of the Employer's Agent or his Representative. Should such approval be given, an adjusted programme shall be produced within seven (7) days and submitted to the Employer's Agent for evaluation.

The Contractor must carry out the work at a rate not less than that stated in his programme. Should the work not be executed with diligence and labour specified, meant and intended in and by the terms of the contract,

Employer		Contractor	
Witness:		Witness:	

then the Employer shall institute the remedies under Clause 9.2 of the General Conditions of Contract 2015(3rd Edition).

The Contractor shall provide the Employers' Agent with a method statement indicating the manner and sequence in which he intends to construct the works, for each work area, with the program. In the method statement the Contractor must address at least the following items:

- a) sequence of the works for the relevant works area;
- b) target dates for the tasks identified in sequence of the works for the relevant works area;
- c) materials requirements;
- d) construction Plant to be used;
- e) services affecting construction; and
- f) any factors that could affect construction progress after commencement.

The method statement must be approved by the Employers' Agent before commencement of construction. In order to minimize the impact on traffic, pedestrians and business the Contractor will be required to segment the works in such a manner that no portion of the works is more than one day ahead of the following position. These segments of the works shall be clearly defined in the Contractor's method statement for each work area.

If, during the progress of the work, the quantities of work performed per month fall below those shown on the program or if the sequence of operations is altered, or if the program is deviated from in any other way, the Contractor shall, within one week after being notified by the Employers' Agent, submit a revised programme.

If the programme is to be revised by reason of the Contractor falling behind his programme, he shall produce a revised program showing the modifications to the original programme necessary to ensure completion of the Works or any part thereof within the time for completion. Any proposal to increase the rate of work must be accompanied by positive steps to increase production by providing more labour and plant on the Site, or by using the available labour and plant in a more efficient manner.

Failure on the part of the Contractor to submit or to work according to the program or revised program shall be sufficient reason for the Employer to take steps as provided for in the GCC.

The approval by the Employers' Agent of any programme shall have no contractual significance other than that the Employers' Agent would be satisfied if the work is carried out in accordance to such programme and that the Contractor undertakes to carry out the work in accordance with the programme. It shall not limit the right of the Employers' Agent to instruct the Contractor to vary the program should circumstances make this necessary.

Where the Contractor's programme indicates completion beyond the official contract completion date, and the programme is accepted by the Employer's Agent, such acceptance shall in no way whatsoever indicate the Employer's Agent's acceptance of an extension to the contract period. Nor shall it be acceptable in terms of Clause 5.6.5 of the General Conditions of Contract as notification of an intention to claim. It shall, however, indicate that the Contractor has taken due cognizance of the completion date and of the consequent possible application of penalties.

PS5.3 SEQUENCE OF THE WORKS

The sequence of works to be executed shall be agreed between the Employers' Agent and the Contractor.

Notwithstanding any changes that the Employer's Agent deems necessary the works should include the following in sequence and with rational overlaps and precedence:

- Mobilisation, project planning and control and communications to stakeholders
- Obtaining wayleaves
- Surveys and setting out
- Site clearance for the affected areas

Employer		Contractor	
Witness:		Witness:	

- Traffic control and temporary signage during construction
- Exposing existing services and relocation as necessary
- Searching for services with specialised equipment
- Entry & Exit Chamber Activities
 - Opening and measurement of chamber dimensions
 - Design of sluice gates and drawings
 - Approval of sluice gates design and drawings
 - Chamber modification sub-activities
 - By-pass pipe connections to chambers
 - Installation of sewage overflow containment at chambers and upstream manholes
 - Installation of sluice gates sub-activities
 - Installation of flood monitoring systems
 - Commissioning of by-pass and monitoring
- Bridge Construction Activities
 - Construct access and river flow controls
 - Bridge Foundation excavations
 - Foundation construction sub-activities
 - Pier construction sub-activities
 - Deck construction sub-activities
 - Pre-cast elements construction
- Pipe laying Activities
 - Excavation, trench preparation and compaction
 - Supply, bedding and laying of pipes
 - Provision and installation of valves and chambers
 - Backfilling (blanket layers and top layers including compaction)
 - Thrust block construction
 - Trenchless installations
 - Construction of valve chambers
 - Reinstatement of paved and other areas where affected
 - Testing of the installation
- Aqueduct rehabilitation
 - Access and setting up internal lighting, ventilation and evacuation equipment
 - Clear and clean pipe internally
 - Inspect, record and report on the pipe internal condition
 - Submit report to Engineer for intervention determination
 - Receive and execute internal rehabilitation measures
 - Rehabilitate pipe joints externally
 - Inspect and confirm pipe external repair scope
 - Repair external pipe cracks and defects
 - Install insulation and cladding around pipeline
 - Re-commission the outfall sewer
- Bridge Repair activities
 - Construct access temporary works
 - Inspect and confirm scope of concrete repairs
 - Carry out repair of spalls and cracks

Employer		Contractor	
Witness:		Witness:	

- Inspect and determine joint repair scope
- Undertake bridge joint rehabilitation activities
- Remove existing steel balustrade
- Install replacement concrete balustrade
- Rehabilitate and install bridge joint access platforms and cat-ladders
- Rehabilitate and install bridge inspection mobile cat ladder
- Remove access temporary works
- Security installation activities
 - Power and data cabling installation sub-activities
 - Bridge lighting installation activities
 - Guardroom provision sub-activities
 - Fencing installation
 - CCTV installation sub-activities
 - Commissioning of installation
- Clearing of the site including removal of spoil
- Survey and provision of as-built information to Employer's Agent
- Site hand over and de-establishment

The Contractor shall obtain approval from the Employer's Agent at each stage to proceed with subsequent stages.

PS5.4 SOFTWARE APPLICATION FOR PROGRAMMING

The construction programme shall be completed in Microsoft Projects or compatible software. The construction programme and updated versions thereof shall be made electronically available to the Employers' Agent. The Contractor shall table an updated copy of the approved programme at each site meeting clearly indicating the actual progress versus the scheduled progress.

PS5.5 METHODS AND PROCEDURES

The Contractor shall submit to the Employer's Agent, within a period stated in the Contract Data, a detailed construction programme, detailing the date of commencement and completion of the work activities, dates, duration and extent of traffic accommodation interruption water supply to affected consumers. The detailed programme shall be based on the preliminary programme. Once a detailed programme has been approved, the Contractor shall not deviate from the planned operations. The methods and procedures for the execution of the works shall be in accordance with the standard specifications and the variations and additions thereto.

PS5.6 QUALITY PLANS AND 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 experienced personnel, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the works at all times. Adequate and competent supervision shall be provided to all works including sub-contracted (SMME) portions.

The cost of supervision and process control will be deemed to be included in the rates tendered for the related items of work.

On completion and submission of every part of the Works to the Employers' Agent for examination, the Contractor shall furnish the Employers' Agent with proof of quality in the form of a data pack containing measurements and levels to indicate compliance with the scope of work. Notwithstanding anything contained in this document, any tests that may have been carried out, any consent that may have been given, either directly or implied, and anything that may be construed to the contrary, the Contractor shall remain fully and solely accountable for the Works and for compliance with the specifications and the drawings.

Employer		Contractor	
Witness:		Witness:	

PS5.6.1 Inspection of Works by Local Authority

The Contractor shall afford inspectors from the Local Authority reasonable access to all parts of the site. The Employers' Agent in the presence of representatives of the Local Authority will generally undertake testing of the works. Accordingly, the Contractor shall notify the Employers' Agent at least 24 hours in advance as to when the various sections of work will be available for testing. The Employers' Agent may require the Contractor to submit a weekly schedule of times, based on his programme, that he envisages work to be available for testing.

PS5.6.2 Completion, Commissioning and Correction of Defects

The tendered rates shall include the cost of all activities and tests that may be required in ensuring proper completion and commissioning of the Works, and no additional claims shall be entertained in this respect. This includes the supply of all necessary equipment required for such and / or for inspections by the Employers' Agent and any other relevant authority. Any defect in the Works shall be corrected to the satisfaction of the Employers' Agent.

PS5.7 ACCOMMODATION OF TRAFFIC ON PUBLIC ROADS OCCUPIED BY THE CONTRACTOR

PS5.7.1 Accommodation of traffic

The Contractor shall ensure the safe accommodation of traffic at all areas where the work may impact traffic and shall provide all delineators, watching, lighting, signs and barricades required by the road authorities, and in accordance with the South African Road Traffic Signs Manual.

PS5.7.1.1 Road safety equipment

The Contractor shall provide each work unit or team with:

- an amber-flashing beacon, which shall comply with and be operated in accordance with any governing road vehicle lighting regulations or similar.
- appropriate sized and quantity of road signs, including delineators and cones which shall be displayed at the works area in accordance with the South African Road Traffic Signs Manual, Chapter 13.
- bright coloured overalls, fluorescent over-jackets and belts for each team member for use at all working times during the day or night.

PS5.7.1.2 Traffic Control

The Contractor shall prepare a traffic quality control plan and submit it to the Employers' Agent seven (7) days before commencing with construction on any portion of the Works.

- A traffic control plan shall include detailed diagrams showing the location of all traffic control devices and the length of time for all lane closures, as well as location of any flaggers, as necessary.
- One lane of traffic in each direction must be maintained at all times and local streets may only be closed with prior approval of the Employers' Agent .
- A written method of handling traffic for each different phase of the project shall be submitted and include both vehicular and pedestrian traffic.
- The name and number of the Contractor representatives responsible for traffic control shall be made available to solve traffic problems at each job site location.

For the complete temporary closure of any road affected by the proposed works, the Contractor shall make allowance in his price, in addition to the minimum requirements specified under clause **PS5.7.1.2**, for the following safety equipment:

- Two traffic information signs minimum per road informing the public of the road closure, *i.e. 'ROAD CLOSED' signs displayed on both sides of the closed.*
- Two traffic warning signs minimum per road informing the public that the road has been closed, *i.e. 'NO-ENTRY' signs displayed on both sides of the closed road.*
- One temporary traffic sign indicating a dead-end to the public trying to exit from by means of the closed road.
- The provision of traffic barriers on either side of the close street for preventing the public from accessing the closed road at the construction site, *i.e. plastic 'new jersey' barriers positioned without any spacing and to totally close of the road from kerb to kerb edge.*

Employer		Contractor	
Witness:		Witness:	

- e) Two traffic information signs minimum per road indicating an alternative route or a detour, *i.e.* 'DETOUR by **ALLAN ROAD**' signs displayed at visible positions.
- f) A combination of delineators shall be placed at 5m intervals along the works, as required, to successfully completing the works site isolation.

PS5.7.2 Access to properties

Adequate access shall at all times be maintained to public and private properties unless otherwise arranged and approved. Details of the proposed means of access shall be submitted before any such access is restricted. Claims arising from impeded access shall be the responsibility of the Contractor.

At least 7 days before commencing any work affecting access to a property, the Employers' Agent and the occupier/owner of each such property shall be notified of the Contractor's intention to commence work, the date of commencement, expected duration and arrangements which will be made regarding maintenance of access.

PS5.7.3 Bridges across dangerous excavations

The Contractor shall provide a structurally sound and safe bridge with side rails across dangerous excavations crossing sidewalks to allow pedestrians safe access to such sidewalk. Associated costs for the provision of pedestrian access to sidewalks shall be deemed to have been included under the various excavations or combined activity rates and/or prices in the pricing schedules.

PS5.8 OTHER CONTRACTORS ON SITE

There may be other contractors working within the same area. As such, the Contractor is required to make adequate allowances for such possibilities. No claims with respect to works being carried out by other contractors shall be entertained by the Employer.

PS5.9 TESTING, COMPLETION, COMMISSIONING AND CORRECTION OF DEFECTS

The onus is on the Contractor to produce work that conform in quality and in accuracy of detail to the requirements hereinafter specified. The Contractor must clearly understand that it is not the duty of the Employers' Agent or his representative to act as foreman or surveyor on the Works.

The Contractor shall, at his own expense, provide experienced Construction Manager(s), foremen and surveyors together with all transport, instruments and equipment for supervising, checking and controlling the work.

The act of passing any completed work or accepting materials or goods for payment by the Employers' Agent shall not be construed as signifying approval or acceptance thereof. Failure on the part of the Employers' Agent to reject any defective work or material or goods shall not in any way relieve the Contractor of his obligations under the Contract, nor prevent later rejection when such work or material is discovered. In this regard, it is emphasised that notwithstanding anything contained in this document, any tests that may have been carried out, any consent that may have been given, either directly or implied, and anything that may be construed to the contrary, the Contractor shall remain fully and solely accountable for the Works and for compliance with the specifications and the drawings.

The Contractor shall, when submitting any work to the Employers' Agent for examination, satisfy himself by testing, measurement and otherwise as may be necessary that the work does in fact meet with the requirements of the Specifications. This information shall be submitted with the Contractor's request for examination and the Employers' Agent shall be authorised to decide on the number and type of tests, measurements, etc. required to enable him to judge the quality of the work. The submission of this information shall in no way diminish the authority of the Employers' Agent to conduct such tests as he may consider necessary in order to determine the quality of the work performed by the Contractor, nor shall he be bound to take account of the Contractor's tests, measurements, etc. should he consider these to be either incorrect or not representative.

The Contractor shall, when submitting any work to the Employer's Agent for examination, satisfy himself by testing, measurement and otherwise as may be necessary that the work does in fact meet with the requirements of the Specifications. This information shall be submitted with the Contractor's request for examination and the Employer's Agent shall decide on the number and type of tests, measurements, etc. required to enable him to judge the quality of the work. The submission of this information shall in no way diminish the authority of the

Employer		Contractor	
Witness:		Witness:	

Employer's Agent to conduct such tests as he may consider necessary in order to determine the quality of the work performed by the Contractor, nor will he be bound to take account of the Contractor's tests, measurements, etc. should he consider these to be either incorrect or not representative.

Quality control and completion tests shall be in accordance with the relevant standard and amended specifications and additional specifications.

Quality control and completion tests shall be in accordance with the relevant standard and amended specifications and additional specifications.

The tendered rates shall include the cost of all control testing, and no additional claims shall be entertained in this respect. This includes the supply of all necessary equipment required for these tests and/or inspections by the Employer's Agent.

Should the control testing performed or arranged by the Contractor not meet the requirements of the specification, the Employer's Agent shall have the right to conduct all such testing at the Contractor's expense.

In such a case, the Employer's Agent shall be given at least 72 hours' notice when testing is required. No claims, however, shall be considered in respect of delays resulting from such testing.

Whenever the Employer's Agent conducts control testing on behalf of the Contractor, charges shall be levied. The Employer's Agent may, from time to time, carry out his own check tests on the work performed by the Contractor. Should such check tests show the Contractor's control testing to be such that the quality of the Contractor's work can be called into question, then the Employer's Agent may order further check tests to be carried out on work already completed by the Contractor.

All costs associated with such check tests shall be for the Contractor's account as shall the costs of any other check test whose results do not comply with the specification.

Where the Employer's Agent is required to witness certain control tests, such as the pressure testing of pipelines, and the results of such tests do not comply with the specifications, then charges will be levied against payments to the Contractor in order to recover the costs of the Employer's Agent's presence at the test.

The requirements of the Local Authority, insofar as their witnessing of tests, shall be adhered to.

The Contractor shall carry out sufficient tests to ensure that the contract requirements for all materials incorporated in the works are complied with. The Employer is at liberty to carry out such tests as he deems necessary to determine compliance with the contract requirements and will make available the results of all tests to the Contractor. The Contractor shall keep systematic records of the test results and all worksheets relating thereto.

PS5.10 RECORDING OF WEATHER AND ABNORMAL RAINFALL

If during the time for completion of the works or any extension thereof abnormal rainfall or wet conditions shall occur then an extension of time in accordance with Clause 5.12 in GCC 2015 hereof shall be granted by the Employer calculated in accordance with the formula given below for each calendar month or part thereof.

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

V	Extension of time in calendar days in respect of the calendar month under consideration.
Nw	Actual number of days during the calendar month on which a rainfall of Y mm or more has been recorded.
Nn	Average number of days, as derived from existing rainfall records, on which a rainfall of Y mm or more has been recorded for the calendar month.
Rw	Actual rainfall in mm recorded for the calendar month under consideration.
Rn	Average rainfall in mm for the calendar month as derived from existing rainfall records.

Employer		Contractor	
Witness:		Witness:	

For purposes of the contract Nn, Rn, X and Y shall have those values assigned to them in the Contract Data and/or the Specification.

The total extension of time shall be the algebraic sum of all monthly totals for the period under consideration, but if the total is negative the time for completion shall not be reduced due to subnormal rainfall. Extensions of time for part of a month to be calculated using pro rata values of Nn and Rn.

This formula does not take account of flood damage that could cause further or concurrent delays and will be treated separately as far as extension of time is concerned.

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

The following average rainfall figures are applicable:

INFORMATION SOURCE: South African Weather Service, Pretoria Tel.: 012 367 6014

Y = 10 mm/24 hour day

X = 20 mm

STATISTICAL INFORMATION: RAINFALL STATION LANSERIA WO 05127467, Lat 25.9430, Long 27.9180: 2010 to 2015		
Month	RAINFALL	
	<u>Nn</u>	<u>Rn</u>
	<i>Actual number of days during the calendar months in which a rainfall of more than Y mm has been received</i>	<i>Average monthly rainfall</i>
January	2.0	99.4
February	0.8	33.7
March	1.8	80.0
April	0.4	49.0
May	0.0	2.0
June	0.2	10.2
July	0.0	0.0
August	0.0	2.9
September	0.3	24.4
October	0.5	51.8
November	1.0	75.9
December	3.5	68.5
TOTAL	10.5	497.8

A delay caused by inclement weather conditions will be regarded as a delay if, in the opinion of the Employer's Agent, all progress on an item or items of work on the critical part of the working programme of the Contractor has been brought to halt. Delays on working days only (based on a five day working week) will be taken into account for the extension of time, but the Contractor shall make provision in his programme of work for an expected delay of 10 (ten) working days caused by normal rainy weather, for which he will not receive any extension of time.

Employer		Contractor	
Witness:		Witness:	

Daily records of rainfall and activities within the critical parts affected shall be kept by the Contractor and signed by the Employer's Agent's representative on the site. For this, accurate rain gauging shall be taken at a suitable point on the site, and the Contractor shall, at his own expense, take all necessary precautions to ensure that unauthorised persons do not interfere with the rain gauges. Failure to produce signed copies of the above records on a daily basis to the Employer's Agent's representative on the site after the event having occurred will be deemed to be in breach of this Clause and will not be admissible for purposes of seeking an extension of time.

The Contractor shall be permitted to take his own rainfall measurements on site subject to the Employer's Agent's approval, but access to the measuring gauge(s) shall be under the Employer's Agent's control. The Contractor is to provide and install all the necessary equipment for accurately measuring the rainfall as well as to provide, erect and maintain a security fence plus gate, padlock and keys at each measuring station, all at his own cost.

PS5.11 FORMAT OF COMMUNICATIONS

The Contractor and Employer shall follow the communication protocol through the Employer's Agent and Contractor representatives. Communication media applicable shall be site meetings, telephone, fax, letter and email

All communication shall be in writing and any verbal agreements shall only be binding once confirmed and agreed to in writing. Communication via, registered post, email or facsimile is acceptable.

The Contractor and the Employer shall follow the correct communication protocol applicable to a normal civil engineering contract. The Contractor shall not put into effect any instructions received by him, other than through such protocol.

Should the Contractor be unclear in this regard, he shall obtain a ruling from the Employer's Agent.

The Contractor shall report on a monthly basis for the duration of the Contract to the Employers' Agent on the progress of the Works, the local resource participation and other Project related matters in a prescribed format (3 hard copies and a soft copy).

Progress reporting shall contain tables and graphics (acrobat PDF format) and shall include, but not be limited to;

- a) Sewer pipe and bridge repairs
 - i. Works commencement date
 - ii. Works completion date
 - iii. Variations (detail, time and cost implications)
 - iv. Site agent, foremen, quality manager and safety officer details
 - v. SMMEs allocated
 - vi. length of mains installed
 - vii. Physical progress in comparison with time and financial expenditure
 - viii. number of manholes/chambers completed
 - ix. system testing performed and approved
 - x. length of sewer pipes decommissioned
 - xi. Quality certification
 - xii. Final cost and time implication
 - xiii. Take-over certificate requested (date)
 - xiv. Record information submitted (person and date)
 - xv. Record information approved (person and date)
 - xvi. Take-over certificate issued (date)

- b) Local resources reporting shall include but not be limited to;

Number (labourers, SMMEs and suppliers),

Employer		Contractor	
Witness:		Witness:	

i. Labour:

- Process of recruitment, selection and appointment
- Name and surname
- Gender and age
- Contact details (address, telephone numbers and ward number)
- Contract signed
- Duration of appointment
 - i. Commencement date
- Termination date
- Activity performed
- Classification (Skilled, semi-skilled or unskilled (labourer))
- Time or task rate
- Allocated Supervisor/foreman
- Health and Safety induction undergone
- Training provided
 - i. Trainer details
 - ii. Type of training
 - iii. Duration of training
 - iv. Cost of training
- Performance rating (good, fair, poor)
 - i. For training
 - ii. Work execution
 - iii. Health and safety awareness
- Additional training or supervision to be provided
- Proof of Monthly and cumulative payments, including salaries or wages
- UIF returns
- Certified copy of the contractual agreement not validated older than three months.

ii. SMMEs

- Process of recruitment, selection and appointment
- Company name
- Company contact details (address, telephone numbers and ward number)
- Company registration (also VAT and TAX)
- Company age (months or years)
- Type of company
- Company size (number of permanent employees)
- Name and surname of owner
- Owner contact details (address and telephone numbers and ward number)
- Gender, age and PDI status
- Contract signed
- Duration of appointment
 - i. Commencement date
 - ii. Termination date
- Resources provided (labour and/or plant and/or materials)
- Activity performed
- Classification
- Time or task rate
- Allocated Contractor Supervisor/foreman
- Health and Safety induction undergone
- Training provided
 - i. Trainer details
 - ii. Type of training
 - iii. Duration of training
 - iv. Cost of training
- Performance rating (good, fair, poor)

Employer		Contractor	
Witness:		Witness:	

- i. For training
- ii. Work execution
- iii. Health and safety awareness
- Additional training or supervision to be provided
- Proof of Monthly and cumulative payments , including salaries or wages
- UIF returns
- Certified copy of the contractual agreement not validated older than three months.

iii. Suppliers

- Process of recruitment, selection and appointment
- Company name
- Company contact details (address, telephone numbers and ward number)
- Company registration (also VAT and TAX)
- Company age (months or years)
- Type of company
- Company size (number of permanent employees)
- Name and surname of owner
- Owner contact details (address and telephone numbers and ward number)
- Gender, age and PDI status
- Contract signed
- Duration of appointment
 - i. Commencement date
 - ii. Termination date
- Resources provided (plant and/or materials)
- Activity performed
- Allocated liaison
- Health and Safety induction undergone
- Performance rating (good, fair, poor)
- Monthly and cumulative payments

The report format may be amended from time to time by the Employers' Agent. However, the initial format shall be finalised by the Employers' Agent in association with the Contractor.

PS5.12 KEY PERSONNEL

The Contractor is to provide the Curriculum Vitae's of key personnel to be employed on the project as well as the person's position and responsibilities within the project team. The Contractor shall provide the following minimum key staff:

- a) Contracts Manager
- b) Construction Manager;
- c) Alternative Construction Manager;
- d) Quality Manager/Auditor/Controller;
- e) Health,Safety & Environmental Officer/s;
- f) Environmental Liaison Officer;
- g) Foremen;
- h) Level 5 First Aider;
- i) SMME supervisors;and
- j) Other specialised personnel

On appointment in terms of the new Construction Regulations 2014, the Contractor will be required to appoint a Construction Manager and Safety Officer who are registered with SACPCMP.

Please note that the Contractor will be required to provide key personnel similar to or of higher qualifications and experience as those the Contractor provided for at tender stage.

The key role players involved or associated with the contract are listed below with references made to the General Conditions of Contract.

- The Employer (GCC, Clause 1.1.1.15)

Employer		Contractor	
Witness:		Witness:	

- The Employer's Agent (GCC, Clause 1.1.1.16)
- The Employer's Agent's Representative (GCC, Clause 1.1.1.17)
- The Contractor (GCC, Clause 1.1.1.9)
- The Construction manager (GCC, Clause 4.12.2)
- Responsible person in terms of the OHAS Act

PS5.13 MANAGEMENT MEETINGS

The Employer's Agent shall hold regular site meetings with representatives of the Contractor, and the Employer. Minutes of such site meetings shall be kept and distributed by the Employer's Agent. Senior Contractor management staff attendance shall be compulsory.

The Contractor shall be required to provide reporting with regard to project progress, resources (human, plant and equipment), community issues, environmental and health and safety aspects.

PS5.14 FORMS FOR CONTRACT ADMINISTRATION

The Contractor shall maintain a file which shall contain project information related to project progress, resources (human, plant and equipment), community issues, environmental, health and safety aspects, penalties imposed, claims lodged and outcomes, disputes and resolutions, payment and variations.

PS5.15 DAILY RECORDS

The Contractor shall keep daily site records as required by the Employer or his representative and as specified herein. Daily records shall include labour, plant, materials, rainfall, environmental issues, health and safety issues, daily diary, site instruction book (both in triplicate) and the like. Such records are the property of the Employer and shall be made available to the Employer or his representative within 24 hours from being requested to do so. The records shall be submitted to the Employer's Agent on completion of the contract.

PS5.16 BONDS AND GUARANTEES

In addition to GCC 2015 Clause 8.6, the Contractor shall provide the Form of Guarantee for the due and punctual fulfillment and completion of all the Contractor's obligations under the Contract. No extension of time of the Contract Period of Performance or any variation of the Contract nor the determination of the Contract by the Employer in terms of Clause 10 hereof shall in any way impair or diminish or terminate any liability to the Employer under and by virtue of such Guarantee. The cost of the Surety Bond to be so entered into, shall be at the expense in all respects of the Contractor; the Surety Bond to be released upon issue of the Employer's Agent's Certificate of Completion of the Works, unless otherwise stated in the Contract Data

Should the Contractor, when notified of the acceptance of his offer, fail to provide an approved Guarantee within the stated period, then the Employer may, at his sole discretion:

- Grant the Contractor a further reasonable period in which to provide the bond; or
- Withdraw his acceptance of the tender in which case the Contract shall be deemed to be void, but without prejudice to the Employer's rights to recover whatever damages he may have suffered by virtue of the Contractor's failure to fulfil his obligations.

PS5.17 PAYMENT CERTIFICATES

Measurements will be done continuously between the Employers' Agents Representatives and the Contractor on dates and times agreed on. Dates must be arranged by these parties. The progress of the following items will be recorded hereunder:

- The Contractor will provide a certificate with quantities to the Employers' Agent before or on the 20th of every month.
- If any material on site is claimed, proof of ownership must be provided either by means of the necessary receipts or a letter from the supplier stating that ownership has been transferred to the Contractor upon delivery.
- After the payment certificate has been approved by Employers' 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.

Employer		Contractor	
Witness:		Witness:	

- 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 Employer's Agent or his duly authorized representative.
- The Contractor will be required to submit his payment certificate together with monthly labour returns including copies of certified IDs, individual contracts, proof of payment, timesheets and training returns. No payment certificate will be processed if correct labour returns are not submitted.
- Payment certificates must be completed monthly and submitted before or on the 20th of each month. The Contractor must familiarize themselves with the payment circle under Clause 6.10.4 of the General Conditions of Contract for Construction Works 2015.

PS5.18 INSURANCES PROVIDED BY THE EMPLOYER

The Employer shall provide insurances as required in terms of the General Conditions of Contract and detailed in the Contract Data.

PS6 FEATURES REQUIRING SPECIAL ATTENTION

PS6.1 SECURITY

The Contractor shall be responsible to provide security on site(s) for the duration of the contract:

- a) for his plant, equipment, materials, subcontractors or employees. The Employer shall not be held responsible for any loss or damage(s) suffered by the Contractor as a result of a security incident of any nature.
- b) In areas which have been identified, by the Employer's Agent and/or Employer, as potential high risk areas requiring security during site visits for the duration of the contract. The Contractor shall arrange that the security meet with the Employer's Agent and/or Employer representative at a convenient and safe location and thereafter escort to the necessary areas.
- c) The Contractor shall also ensure that none of his activities on site compromise the safety and security of the Dainfern College, Curo School & Dainfern college premises, or adjacent properties. The Contractor shall liaise with the relevant authorities of these properties and provide security to their satisfaction. The Contractor shall also liaise with them for access to respective properties and for permission to set up the Contractor's camp. The daily access arrangements to site shall be to the satisfaction of the relevant governing bodies of the properties concerned.

PS6.2 WORK OUTSIDE NORMAL WORKING HOURS

The Contractor is permitted to work outside of normal working hours (07h00 to 17h30) only upon obtaining written permission from the Employers' Agent. It is anticipated that all switch-over work (tying new infrastructure into existing) will be completed during hours that will not affect the provision of service to affected communities.

PS6.3 COMMUNITY LIAISON AND COMMUNITY RELATIONS

In all dealings with the community and workers employed from within the community, the Contractor shall take due cognisance of the character, culture and circumstances of the community involved and shall at all times use his best endeavours to avoid the development of disputes and to foster a spirit of co-operation and harmony towards the project. The Contractor shall at all times, keep the Employers' Agent fully informed on all matters affecting the community. The Contractor shall keep the community fully informed of progress and planned interruptions.

PS6.3.1 Community liaison officer

The contractor shall make use of the Community Liaison Officer (CLO), where scheduled, which is to be appointed on behalf of Johannesburg Water, who shall be responsible for liaison between the Contractor/Employers' Agent and the local community. The CLO will be responsible for keeping the community informed on the progress of the project and conversely keeping the Contractor and Employers' Agent informed on relevant community affairs and grievances.

PS6.4 NOTICES AND WARNING TO CONSUMERS

The Contractor shall ensure he maintains service (water, electricity and/or sanitation) provision at all times whilst executing the works where:

Employer		Contractor	
Witness:		Witness:	

- a) The maximum amount of time of no service shall be 8 hours for any property. Any service disruption longer than 8 hours shall be temporary bypassed by methodologies approved by the Employers' Agent or his duly authorized representative.
- b) A Public Notification Program shall be implemented, requiring at minimum that the Contractor shall deliver written notices to each domestic and non-domestic customer affected by the works, 48 hours before commencement of the works, including providing:
 - i) a summary of work to be completed;
 - ii) the time and duration of service interruption; and
- c) a local telephone number to contact the Contractor for inquiries or complaints. All complaints received shall be addressed and resolved within the standard Employer response times and a summary of such complaints and associated actions shall be presented to the Employers' Agent or his duly authorized representatives on a monthly basis.

PS6.5 CONTINUITY OF SERVICE SUPPLY TO CUSTOMERS

The activities of the Contractor shall not unreasonably interfere with the service supply to customers and be executed outside the agreed and notice time frames.

Where the Contractor cannot reasonably re-establish services within times agreed and notice time frames he shall proceed to contact the affected customer and make alternative arrangements that shall be acceptable to the customer and the Employers' Agent.

The associated costs of any customer claim arising from a lack of service provision due to the Contractor's negligence or his disregard for the Employer's SOP or his disregard for the conditions of this Contract, whilst executing activities as per this Contract, shall be solely for his account. The Employer shall have the right to make equivalent monetary deductions from monies owed to the Contractor or from his Guarantee under this Contract and any other active contract(s) with the Employer for this purpose.

PS6.6 REINSTATEMENT OF ASPHALT BY JRA

The JRA shall be given first preference to provide and execute all the reinstatement of asphalt at places where excavation is within the roadway. The Contractor shall make other adequate arrangements where the JRA:

- a) indicated that it will not, for whatever reason, be able to perform such asphalt resurfacing; and
- b) is the cause of delays, where in particular the Contractor shall note that the Employer shall not be liable of any additional extension of time related cost obligations to the Contractor, as he shall be deemed have agreed adequate conditions with the JRA and allowed delays on the part of the Employer.

PS6.7 CONDITIONS AND PROCEDURES FOR SERVICE AGENCIES

The Contractor shall comply with the conditions and procedures of the various affected service agencies, as mandated in their associated wayleaves.

The Contractor shall throughout the Contract take adequate precautions to protect all existing services from damage whether or not they have been pointed out to him. The Contractor shall as soon as practically possible inform the Employer's Agent of any damages to services and shall not repair any such damage unless instructed to do so.

All cables and pipes shall be considered "live" unless confirmed otherwise by the relevant service authority.

PS6.8 LABOUR INTENSIVE CONSTRUCTION

The portions of the Works to be constructed utilising labour intensive construction methods only, shall include but not be limited to:

- a) clearing and grubbing of the Site;
- b) excavation up to 1m deep (in soft and intermediate materials where ordered by the Employers' Agent), spreading, processing and compaction;
- c) backfilling of all pipe trenches to depths up to 1 m;
- d) mixing, transporting, placing and finishing of small concrete works;
- e) spoiling of all materials within distances not exceeding 20 m;
- f) transportation of earthworks for distances not exceeding 20 m;
- g) construction of valve chambers, manholes and the like;

Employer		Contractor	
Witness:		Witness:	

- h) removal of oversized materials;
- i) Installation of all pipes with diameters smaller than 200 mm;
- j) cleaning and tidying up of the Site.

PS6.8.1 Provision of a temporary workforce

The Contractor shall have regard for the stipulation laid down for all Labour Intensive projects that he employs labour from the local community through the local structure that exist for this purpose. The relevant Ward Councillor(s) and/or Community Liason Officer(s) shall be consulted during the process of appointing local labour. The local structure shall assist in identifying available local labour and, where available, semi-skilled labour as well as local sub-contractors. The local structure shall also assist and advise regarding conditions of employment, minimum wages, disputes and disciplinary procedures. The workforce that is employed on site shall consist of local residents where applicable, except for approved key staff, in accordance with Clause 4.11 of the General Conditions of Contract.

The Occupational Health and Safety Act must be adhered to with reference to the safety of any employee irrespective of whether such employee is employed by the Contractor or by a local sub-contractor. Furthermore, a contract of employment must be signed between the Contractor and each of his employees and sub-contractors and between such sub-contractors, and each of the sub-contractor's employees with clear reference to the following conditions:

- a) The minimum agreed wage rate per hour or per day;
- b) The agreed pay rate per unit of production where applicable;
- c) UIF and WCA payments where applicable;
- d) Minimum working hours per day;
- e) Start and end times of a daily shift;
- f) Lunch break times;
- g) Company policy regarding the following:
 - Rain time
 - No work no pay, sick, absent
 - Disciplinary and grievance policies
 - Method of payment
 - Workers' clothing and safety equipment to be issued.

Contractor to comply with the latest Government Gazette: Labour Relations Act, 1995 as set out by the Bargaining Council for Civil Engineering Industry with regard to minimum wage for local labour.

PS6.8.2 Restriction of the utilisation of personnel in the permanently employed construction personnel of the contractor

The Contractor shall limit the utilization on the Contract, of his permanently employed construction personnel to that of key personnel only, as defined below, and shall execute and complete the Works utilizing a Temporary Workforce of local residents, employed directly by the Contractor and/or by his SMMEs or specialist sub-contractors. "Key personnel" means all;

- a) Contractor managers,
- b) site agents,
- c) site clerks,
- d) survey technicians,
- e) quantity surveyors,
- f) trainers,
- g) supervisors,
- h) foremen,
- i) skilled plant operators and the like, and
- j) all other personnel in the permanent employ of the Contractor or his SMMEs or specialist sub-contractors who possess special skills, and/or who play key roles within the Contractor's or his Sub-Contractor's operations.

Employer		Contractor	
Witness:		Witness:	

PS6.9 TRAINING

The Contractor shall provide in-task training of local labour during the construction of the works. In-task training shall consist of training and guidance of team leaders, assistants, and labour in those construction activities where the labour is engaged. The in-task training shall cover all training and guidance required to ensure that the leaders and labour are able to carry out the project tasks in accordance with the requirements of the project specification. The in-task training shall be carried out by the Contractor's own key and skilled personnel.

PS6.10 ADDITIONAL PROTECTION ON ROADWAYS

In the case of construction work across bridgeways and motorways, barricades consisting of 22,5 mm x 40 mm deals painted white, suitable supported and firmly fixed to heavy supports shall be provided at least 15 m in advance of the work. Further road-closed signs shall be prominently displayed. Where only a portion of roadway is closed, delineators, drums or upended pipes (painted white with red stripes) shall be placed along the traffic side at distances no more than twelve (12) metres apart.

In the case of construction or work across or within residential streets or collector roads; road closure signs, delineators (or drums or upended pipes (painted white with red stripes)) shall be placed across the street or road at distances no more than one-and-a-half (1.5) metres apart or plastic barricades. No road or street shall be closed without prior attainment of written approval, by the Contractor, from the local Roads Authority. The Contractor shall maintain such traffic accommodation on a daily basis for the duration of the Contract Period, and shall be solely responsible for any damages claimed as a result of the lack of such maintenance.

No separate payment shall be made for this item and applicable section's tender rates shall be considered to include for traffic accommodation and road protection.

PS6.11 POLITICAL AND COMMUNITY UNREST

The Contractor shall make allowance for all costs which might arise due to the interruption of works and / or standing time in terms of political and / or community unrest on the Contract. Only if a situation give rise to more than four (4) hours per day, for normal working hours only, of non-working progress on the Contract Area will such situation be considered an unrest situation payable to the Contractor under this item. The contractor shall notify the Client or its duly Authorized Representative/s of any unrest situation and shall indicate all active Contract sites affected.

PS6.12 INDEMNITY CERTIFICATE

The Contractor must, on completion of the Works, obtain certificates from all authorities concerned stating that they are satisfied with the condition of all borrow pits, detours, access roads, reinstatements and spoil material on their properties. The certificates must be handed over to the Employers' Agent before the maintenance period starts. The certificates will not exempt the Contractor from any obligations concerning the backfill of trenches, finishing off of borrow pits, access roads, detours etc. This work must still be carried out to the satisfaction of both the Employer and the Employers' Agent .

PS6.13 PROTECTION AGAINST WATER AND STORMS

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, over-pump sewage 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.

PS6.14 NOTICES, SIGNS AND BARRICADES

The Contractor shall erect all barricades during the construction period to safeguard the Works and protect members of the public from any risk associated with the partly completed facilities. The position and contents

Employer		Contractor	
Witness:		Witness:	

of all such barricades must be approved by the Employers' Agent . All barricades, notices and signs shall be provided, erected, maintained and finally removed at the cost of the Contractor.

PS6.15 FINISHING-OFF AND TRIMMING

After completion of the works included under the Contract, the entire construction site (road reserves, private properties etc) shall be finally cleared of all excess earth, stones, boulders, debris and other waste material. All finishing, trimming and clearing previously done in terms of the requirements of the various sections of these Specifications shall be finally completed to the satisfaction of the Employers' Agent . All materials resulting from the finishing and trimming operations shall be disposed of in designated spoil areas on site. The Contractor shall make his own arrangements with owners of properties on which such materials are to be deposited. Disposal shall be carried out in a neat and orderly manner and finished to a smooth level. The Contractor shall allow in his rates for all costs associated with finishing-off and trimming as no separate payment will be made for this operation.

PS6.16 INFORMATION SUPPLIED BY THE EMPLOYERS' AGENT

Certain information included in this document or supplied separately are presented in good faith and no guarantees can be given regarding the accuracy or representativeness thereof. This pertains more specifically to all soil tests, material results and similar information that is necessarily subject to limitations in the test methods and sampling. Natural variations in materials and formations also influence the applicability of certain conclusions. The Employer can therefore not accept any responsibility for the accuracy of any information or for any damage resulting from the fact that the information later proved wrong or not representative. If the Contractor chooses to rely on the information he does so at his own risk.

PS6.17 ACCESS TO SPOIL SITES

No indiscriminate spoiling of material will be allowed. All surplus or unsuitable material shall be spoiled in designated areas as identified and acquired by Contractor. Contractor to be responsible for identification, negotiations and final agreements with relevant authorities, stock pile yards, etc. Waste material, empty cement pockets, pipes, manhole rings, etc, are not to be left lying at the site of operation.

PS6.18 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.

PS6.19 IDENTITY CARD FOR ACCESS TO PROPERTIES

The Contractor shall provide identity cards for all his staff and the staff of all his subcontractors. The identity card must have the following:

- Staff name;
- Identity number;
- Photo;
- Contractor's company logo or name; and
- JW logo.

The staff must carry their identity cards at all times while on site and no staff must access any property without showing his identity card. The cost of providing such identity cards must be included in the preliminary and general contractual requirements.

PS6.20 CHANGES IN THE WORKS SCOPE

No increase or decrease (irrespective of the varying percentage) in the quantity of any work schedule, where such increase or decrease is not as a result of a Variation Order given under the Variation Clause but is the result of the quantities exceeding or being less than those stated in the tender schedule of quantities shall be deemed to be a variation to which this clause applies and no variation order shall be issued. However, the budget limitations shall be noted. Additionally, the Employer reserves the right to vary the scheduled works scope without any tender rates re-negotiations on the part of the Contractor, irrespective of the percentage of variance, as follows for any work included in the Contract:

- a) Increase or decrease the quantity thereof.

Employer		Contractor	
Witness:		Witness:	

- b) Omit portion thereof.
- c) Quality change thereof.
- d) Change the levels, lines, positions of any part thereof.

PS7 HEALTH AND SAFETY FOR CONSTRUCTION WORK

Contractors are to prepare Health and Safety Plans in accordance with Johannesburg Water's Health and Safety Specification (refer to Volume 2: Occupational Health and Safety Specification and Environmental Management Plan for Capital Investment Projects). The legal imperatives for this requirement stem from the Construction Regulations (2014), and more specifically the following:

Regulation 4(1)(a): An Employer shall prepare a documented health and safety specification for the construction work, and provide any principal Contractor who is making a bid or appointed to perform construction work for the Employer with the same

Regulation 4(1) (d): An Employer shall take reasonable steps to ensure that each principal contractor's health and safety plan is implemented and maintained on the construction site.

Regulation 4(2): An Employer shall discuss and negotiate with the principal Contractor the contents of the health and safety plan and thereafter finally approve the health and safety plan for implementation.

Regulation 5(1): A principal Contractor shall provide and demonstrate to the Employer a suitable and sufficiently documented health and safety plan, based on the Employer's documented health and safety specification

PS7.1 PROJECT-RELATED OCCUPATIONAL HEALTH AND SAFETY RISKS

According to the Construction Regulations (2014), a Health and Safety Plan "means a documented plan which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified". Apart from complying with the Health and Safety Specification (Volume 2), specific attention is drawn to the identification and assessment of risks. The tendering Contractors are required to consider inter alia the following risks (where applicable):

Project- and site-specific risks:

- Excavation and safeguarding of pile casing and trenches;
- Working in elevated positions
- Scaffolding
- Working in confined spaces
- Traffic control;
- Plant and machinery operation;
- Existing services;
- Offloading of material;
- Electrical Distribution boards;
- Electrical Installation;
- Making of steel items
- Laying of pipes;

Employer		Contractor	
Witness:		Witness:	

- Placing concrete
- Machine operator;
- Third party exposures;
- Use of portable electrical tools;
- Location of site camp;
- Storage and handling of material;
- Fire prevention and protection;
- Refuelling vehicles/plant;
- Welding;
- Handling hazardous materials
- Handling of compressed gas cylinders.

Safe work and emergency procedures need to be prepared to address the relevant abovementioned risks.

PS7.2 **BARRICADING OF TRENCHES**

The Contractor shall ascertain himself of the nature, volume, stability, depth and possible safety risks of the excavations, before any decision with regards to the method of excavation is made.

Allowance for hand excavation has been made for the location of services. Extreme caution shall be taken when excavating along the route of the new pipe for existing services. Any damages and or repairs to the existing services will be for the Contractor's account.

The length of open excavation must at all times not exceed 100m

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

- Provided with notice boards marked "CLOSED " at each end of closed or partially closed roads,
- The barrier or fence (at least 1m high) shall be suitably wrapped with reflective red and white danger tape or provided with flashing orange lights, placed at 15m intervals along the barricading at night.
- Where the depth of an excavation or the nature of the material excavated renders the sides of the excavation liable to movement that might endanger the works or the workers engaged on the excavation,
 - the sides of the excavation shall be supported by suitable timber or other sheeting adequately strutted and braced, all properly assembled and of sufficient strength and stiffness to prevent movement in the materials supported, or,
 - alternatively,
 - the slope of the excavated face or faces shall be reduced so that any danger to the works or workers is removed. **The contractor is cautioned that battering of excavation slopes will not be always possible due to restrictions in available space along the pipe route so they must wholly price for shored excavation sides.**

Any cavities formed by the fall of rock or earth due to rain, flooding, insufficient timbering or other causes, shall be adequately filled.

The Contractor shall so maintain borrow pits that they do not become a danger to persons or livestock.

Trenches may not be left open during the builder's holidays or for any shutdown period exceeding 5 calendar days. Should the Contractor not comply with this requirement without the written approval of the Employers' Agent; the Employers' Agent shall have the open trenches closed by others at the expense of the Contractor.

Employer		Contractor	
Witness:		Witness:	

Furthermore, all further opening-up of the backfilled excavation and dealing with the excavated material and subsequent making good will all be to the Contractor's cost.

PS7.3 **GUIDE TO RISK ASSESSMENTS**

PS7.3.1 **Nine steps to Effective Risk Assessments**

Step 1	Identifying the current as well as emerging hazard, risks or exposures.
Step 2	Aim to identify major hazards, don't waste time on the minor and detail except if such hazard has the potential be repeat itself on a frequent basis.
Step 3	Involve as many people as possible in the ongoing risk assessment process especially those at risk.
Step 4	Gather all the information and analyze it.
Step 5	Look at what actually could or has occurred including non-routine operations.
Step 6	Use a systematic approach to ensure all hazards are adequately addressed.
Step 7	Assess the risks identified or the risk has occurred by taking into account the effectiveness of current as well as controls under consideration.
Step 8	Ensure the process is practical, realistic, cost and business effective.
Step 9	Always record the assessment in writing including i.e. assumptions, date and why a particular decision has been made.

PS7.3.2 **How serious is it?**

Probability

- A Common
- B Has Happened
- C Could Happen
- D Not Likely
- E Practically impossible

Consequences

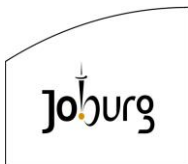
- 1 Fatality or permanent disability.
- 2 Major injury.
- 3 Average Lost Time Injury.
- 4 Minor Injury.
- 5 Medical Treatment or less.

		Probability				
		A	B	C	D	E
Consequence	1	1	2	3	4	5
	2	2	3	4	5	6
	3	3	4	5	6	7
	4	4	5	6	7	8
	5	5	6	7	8	9
Risk rating		Action				
1 - 3 =		Immediate (within 1 week).				
4 - 5 =		Within 1 month.				
6 - 7 =		> 4 weeks.				
8 - 9 =		No action but will consider from time to time.				

PS8 **ENVIRONMENTAL MANAGEMENT**

Tendering Contractors are to adhere to the mitigation measures listed in the EMP (refer to Volume 2: Occupational Health and Safety Specification and Environmental Management Plan for Capital Investment Projects). Environmental mitigation measures are actions needed to align a project implementation phase with environmental control principles, where potential impacts to the natural and social environment are prevented, minimised or remediated. Environmental safeguarding is governed by various sets of legislation, with the most

Employer		Contractor	
Witness:		Witness:	



noteworthy for this project constituting the National Environmental Management Act (No. 107 of 1998) and the National Water Act (No. 36 of 1998).

NOTA BENE: The contractor must note that the Employer's policy requires that all work be wound down in the last 14 days towards the annual shutdown period to render the site safe and secure during the break. This must be taken into consideration in the contractor's programme.

Employer		Contractor	
Witness:		Witness:	

PORTION B1: VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS

INTRODUCTION

Detailed under this section of the Document are the variations to the standardised specifications (SANS1200). The clause numbers hereunder consist of a prefix, such as “PSA” indicating an amendment to SANS 1200A, and a number that represents the number of the clause in SANS 1200A.

SANS 1200A: PRELIMINARY AND GENERAL

PSA GENERAL (1986)

PSA 2 INTERPRETATION

PSA 2.3 DEFINITIONS

a) General

Add the following definitions:

“General conditions: The General Conditions of Contract specified for use with this Contract and the special conditions of Contract as applicable.

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 variation in the value of the Contract amount or the Contract Time of Completion.

Time-related charge: A charge, the amount of which varies in accordance with the Time for Completion of the work, 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.”

Add the following new clause:

“PSA2.9 SUPPORTING SPECIFICATIONS

City of Johannesburg Metropolitan Municipality, Public Road and Miscellaneous By-laws, Code of Practice for work in the road reserve (COP), Latest Version.

Should any requirement of this COP conflict with any requirement of the standardised or particular specifications the requirements of the COP shall prevail.

The COP is available at Johannesburg Roads Agency Offices, Wayleaves Department, Contact number: (011) 298 5000”

PSA 3 MATERIALS

PSA 3.1 QUALITY

Add the following to this sub-clause:

“The Contractor must supply and/or take delivery as necessary, deliver all material and is responsible for the handling, transport and storing of the material. All material, but especially fragile material, must be handled with care and any damaged material must be repaired or replaced according to the Employers’ Agent’s instructions at the Contractor’s expense.

Employer		Contractor	
Witness:		Witness:	

Before material is used the Employers' Agent must approve the manufacturer's published instructions. All material used must carry the appropriate official standardization mark and the Tenderer must produce on request certificates that show that the material comply with this requirement".

PSA 3.3 ORDERING OF MATERIALS

The quantities set out in the Schedule of Quantities have been carefully determined from calculations based on data available at the time and should therefore be considered to be approximate quantities only. Before ordering materials of any kind the Contractor shall check with the Employer's Agent whether or not the scope of the work for which the materials are required is likely to change substantially. No liability or responsibility whatsoever shall be attached to the Employer for materials ordered by the Contractor except when ordered in accordance with written confirmation issued by the Employer's Agent."

PSA 4 PLANT

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."

PSA 5 CONSTRUCTION

PSA 5.1 SURVEY

PSA 5.1.1 Setting out of the works

Delete this sub-clause and replace with the following:

"The Contractor shall set out the works and maintain their correct position, not only according to the Contract Documents but also according to any drawings or orders that he may receive from time to time from the Employers' Agent . The Contractor shall:

- Confirm the levels and coordinates of all benchmarks prior to commencing with construction;
- be held responsible for the accuracy of the setting out for the full period of the Contract;
- use equipment and instruments that can ensure the necessary accuracy;**
- be held responsible for the correction of any error at his own expense; and
- update the plans, which are kept on site so that all the changes approved by the Employers' Agent are reflected on the drawings. These drawings will represent record drawings and must consequently reflect the Works as they are actually built. The cost for this shall be deemed to have been included in all works construction rates. The Contractor must check drawings periodically and after completion of the Contract they shall be handed over to the Employers' Agent."

Employer		Contractor	
Witness:		Witness:	

PSA 5.1.2 Preservation and replacement of beacons and pegs subject to the land survey act

Delete this sub-clause and replace with the following:

“The Contractor’s attention is drawn to the provisions of Sections 35 and 36 of the Land Survey Act, 1927 (Act No 9 of 1927), in terms of which he will be deemed to be responsible for the safety of any survey beacons, survey bench marks and plot boundary pegs encountered on the Site. He shall further be responsible for all costs incurred in the replacement by a Registered Land Surveyor, in terms of the said Act, of any such marks or pegs that are moved or damaged.”

PSA 5.2 WATCHING, BARRICADING, LIGHTING AND TRAFFIC CROSSINGS

Replace the words "traffic crossings" in the heading and in text of this sub-clause with the words "accommodation of traffic"

add the following at the end of the existing clause(s):

“The Contractor shall comply with the requirements of the COP and PS 5.7. This clause shall be applicable for all other parts/sections of the works.

The complete closure of any road shall not be permitted without the prior written consent of the Employers’ Agent .”

PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES

Delete the existing clause and replace with the following:

“The Contractor shall be held responsible for any damage to overhead or underground services and he shall take all necessary measures to protect them. All work or protective measures shall be subject to approval of the authority concerned. In the event of a service being damaged, the Contractor shall immediately notify the authority concerned as well as the Employers’ Agent . The Contractor shall not repair any such service unless instructed to do so.

Timely written notice shall be given by the Contractor to the Employers’ Agent and to the authority or department concerned of the Contractor’s intention to work across or near any existing works or services and such work shall not commence until the necessary permission has been received. The Contractor will not be entitled to claim for any delay in the construction programme caused by compliance with the requirements of this clause. Work across or near any existing works or services shall be carried out in compliance with the requirements of the relevant authority or department.

Where no underground services are shown on the drawing or scheduled, but the possibility of their presence can reasonably be inferred, the Contractor shall ascertain, by exploratory excavations using hand tools, or by specialist equipment for the detection of services as instructed by the Employers’ Agent , whether any such services exist within the relevant section of the Site. The Contractor shall complete such an investigation well in advance of the start of construction work in the said section and he shall submit a report in good time to enable the Employers’ Agent to make whatever arrangements are necessary for the protection, removal or diversion of the services before any construction work commences.

Whilst every effort will be made to ensure that any information relating to underground services is correct, the Employer and Employers’ Agent takes no responsibility for the accuracy, or for the completeness of the information. The Contractor will be held responsible for any damage to services and shall be liable for the cost of making good the damage. All such costs incurred by the Employer will be deducted from monies due to the Contractor.

Manhole covers; valve boxes, hydrants, etc. shall not be covered over and shall be accessible at all times.

After an existing service has been passed in laying the service pipe, but before backfilling has been started, the Employers’ Agent or relevant authority shall be informed in order that they may certify in writing that the service has not been damaged.”

Employer		Contractor	
Witness:		Witness:	

PSA 5.5 DEALING WITH WATER ON WORKS

Add the following paragraph:

"The Contractor shall be deemed to have acquainted himself during tender stage with the groundwater conditions."

PSA 5.7 SAFETY

Add to the Sub-Clause:

"All work and particularly work carried out in the proximity of buildings, bridges, tanks or other structures shall be carried out in compliance with the regulations framed under the Occupational Health and Safety Act, No 85 of 1993 and the Minerals Act, (Act 50 of 1991) (including shoring where necessary) to ensure the safety of structures that are at risk.

The Contractor shall make available for the duration of the Contract safety helmets, gumboots and any other necessary safety equipment for sole use by the Employers' Agent and his representative(s)."

PSA 8 MEASUREMENT AND PAYMENT__

PSA 8.1.2.3 Contractor to Price all Items

Add the following paragraph;

"The grouping of payment items under one all-inclusive rate is prohibited. Each payment item shall have its own rate. Where the Contractor elects not to insert a rate for any particular item, then it shall be deemed to be zero".

PSA8.2.1 Fixed-charge and value related items

Add the following at the end of the existing clause(s):

"Where lump sums are provided for a preliminary and general item or section of the schedule of quantities is provided to cover the Contractor's charges for compliance with the requirements of the conditions and specifications of Contract, **if so required** the Contractor shall provide a lowest-level composition of the various sub-items that result in the total provided sum.

Fixed costs in respect of item 8.3.1 will be paid as follows:

Eighty per cent (80%) of the tendered amount will be paid as soon as the facilities have been established and have been approved. The residual twenty per cent (20%) will be paid as soon as the work is completed, the facilities have been removed and the camp site has been vacated and cleaned.

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."

The amount which is tendered in terms of item 8.3.2 will be paid as follows:

- a) A single amount which is limited to a maximum of fifteen per cent (15%) of the tender price, VAT excluded, as soon as the facilities have been provided and approved.

The residual portion, if any, of the tendered amount for item 8.3.2 will be paid in two separate payments as follows:

- b) The first payment, of ninety per cent (90%) of the amount above fifteen per cent (15%) of the tender price excluding VAT, when the amount certified for payment, including retention, but excluding the current amount of this payment exceeds twenty per cent (20%) of the tender price.

Employer		Contractor	
Witness:		Witness:	

The remaining ten per cent (10%), will be made when the works have been certified as completed and the contractor has fulfilled all his obligations to date in terms of this specification, the General Conditions of Contract and the Special Conditions of Contract”

PSA8.2.2 Time-related items

Add the following at the end of the existing clause(s):

“Where lump sums are provided for a preliminary and general item or section of the schedule of quantities is provided to cover the Contractor's charges for compliance with the requirements of the conditions and specifications of Contract, **if so required** the Contractor shall provide a lowest-level composition of the various sub-items that result in the total provided sum.

Subject to the provisions of 8.2.3 and 8.2.4, payment of Clause 8.4.1 (time related item) will take place in equal monthly amounts, calculated on the tendered amount for the item, divided by the contract period in months, provided the total of the monthly payments which was paid for this specific item does not exceed the proportion that the progress of the works to date bears in relation to the works as a whole. Specific limitations to payments shall occur whenever the ratio of time to expenditure varies by more than 10%. For example, if payment for completed scheduled work is 30% of total scheduled work but more than 40% of time has expired, this pay item shall cease to be active until the difference between the relevant ratios is less than 10%.

Should the Employer grant an extension of time, the Contractor is entitled to an increase in the amount tendered for time related items, and this increase must be kept in the same proportion to the original tender amount as the extension of time is to the original time period of the completion of the works.

Payment for such increased amounts will be considered as full compensation for all time related, provisional and general costs which arise as a result of the extension of time”

PSA 8.3 SCHEDULED FIXED-CHARGED AND VALUE-RELATED ITEMS

The Tenderer shall price for Fixed Charge Preliminary and Generals for Bridges 1 AND 2 under BoQ 2. Fixed Charge Preliminary and Generals in BoQ1 shall cover only laydown areas at Bridge 1.

Laydown Areas.....Unit: Sum

The laydown cost shall cover in full compensation for security, surface stormwater drainage, site levelling and compaction, OHS and Environmental compliance requirements and other associated costs to maintain and keep stored material in good and acceptable quality.

PSA 8.3.1 Contractual Requirements

Add the following at the end of the existing clause(s):

“The Contractor shall provide a lowest-level composition of the sum in the space provided in the bills of quantities”.

PSA 8.3.3 Other Fixed-charge obligations

Add the following at the end of the existing clause(s):

“The Contractor shall provide a lowest-level composition of the sum in the space provided in the bills of quantities”

PSA 8.3.2.1 Facilities for Employers' Agent

Delete the existing clause and replace with the following:

Employer		Contractor	
Witness:		Witness:	

"This rate shall include the complete costs for the provision of the Employers' Agent's facilities (as listed below) to site, the erection (establishment) on site and the removal upon Contract completion or other.....**Unit: Sum**

- i) Name Boards (No 2)
- ii) Communication and two (2) computer laptops for the Civil Engineering Interns
- iii) Offices Facilities (No 1)
- iv) Meeting room (No 1)
- v) Parking Facilities (No 2)
- vi) Survey equipment, assistants and material"

PSA 8.3.2.2 Facilities for Contractor

Delete the existing clause and replace with the following:

"This rate shall include the complete costs for the provision of the Contractor's facilities (as listed below) to site, the erection (establishment) on site and the removal upon Contract completion or other.....**Unit: Sum**

- i) Offices and Storage Sheds
- ii) Water supply-connection by Council, Electric Power supply – connection by Council and Communications
- iii) Dealing with water
- iv) Portable latrines
- v) Tools and equipment
- vi) Workshops
- vii) Security of works
- viii) Access to works
- ix) Plant
- x) Site camp fencing

Add the following new subclauses to clause 8.3

PSA 8.3.5 Additional Contractual Obligations

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.

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 contained in Volume 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.

PSA 8.4 SCHEDULED TIME RELATED ITEMS

PSA 8.4.2.1 Facilities for Employers' Agent

Delete the existing clause and replace with the following:

"This rate shall include the complete costs for the Operation and maintenance of the Employers' Agent 's facilities (as listed below) to site.**Unit: Month**

- i) Name Boards
- ii) Communication
- iii) Offices Facilities
- iv) Meeting room
- v) Parking Facilities
- vi) Survey equipment, assistants and material"

Employer		Contractor	
Witness:		Witness:	

Add the following to the payment description paragraph:

"The sum tendered for item (i) shall provide full compensation for all equipment, assistants and materials provided in terms of these specifications (refer section PSAB: Employers' Agent 's Office) and sub-clause 5.5 of SANS 1200 AB".

PSA 8.4.2.2 Facilities for Contractor

Delete the existing clause and replace with the following:

"This rate shall include the complete costs for the Operation and maintenance of the Contractor's facilities (as listed below) to site. Unit: **Month**

- i) Offices and Storage Sheds
- ii) Water supply-connection by Council, Electric Power supply – connection by Council and Communications
- iii) Dealing with water
- iv) Portable latrines
- v) Tools and equipment
- vi) Workshops
- vii) Access to works
- viii) Plant

PSA 8.4.3 Supervision for duration of Construction

Add the following to this sub-clause:

"The Contractor shall provide a lowest-level composition of the sum in the space provided in the Bills of Quantities & Unit: **Month** "

PSA 8.4.5 Other Time-related obligations

Add the following to this sub-clause:

"The Contractor shall provide a lowest-level composition of the sum in the space provided in the bills of quantities"

Add the following sub-clauses:

"PSA8.4.6 Provide protective safety clothing Unit: **Month**

The rate shall cover the cost for the duration of the Contract to provide safety helmets, gumboots and any other required safety equipment as per PSA 5.7 above.

PSA 8.4.7 On-site security Unit: **Month**

The rate shall cover the cost to provide security for staff and materials for the duration of the Contract. (See PS6.1). The Contractor may employ an independent service provider and the rate shall cover said service including all overheads associated with that service." Rate shall also cover compliance with security requirements, rules and regulations for working within the Area, including identification tags for all construction personnel.

PSA 8.5 SUMS STATED PROVISIONALLY BY EMPLOYER'S AGENT

Amend subclause 8.5.b) 1 and add the following items:

PSA 8.5.2 Provision of photographic records Unit: **ProvSum**

The sum shall be in full compensation for the provision of training to targeted labour according to the specification of the Employer and as approved by the Employer's Agent

PSA 8.5.3 Training of targeted labour..... Unit: **ProvSum**

Employer		Contractor	
Witness:		Witness:	

The sum shall be in full compensation for the provision of training to targeted labour according to the specification of the Employer and as approved by the Employer's Agent

PSA 8.5.4 Training of SMMEs..... Unit: ProvSum

The sum shall be in full compensation for the provision of training to SMMEs according to the specification of the Employer and as approved by the Employer's Agent

PSA 8.5.5 Overheads, Charges and Profit Unit: % = R.....

The sum shall be in full compensation for the contractor's overheads, charges and profit on item 8.5.2, 8.5.3 & 8.5.4 above.

PSA 8.5.6 PROVISION AND GENERAL ITEMS FOR THE SMMES

(a) Fixed and Time-Related P & G's Unit (P/Sum)

The costs shall cover full compensation for fixed and time-related P&G's.

PSA 8.5.7 Contractor's Obligations in respect of SMMEs

(a) Remuneration Supervisor for SMME's Unit: Prov. Sum

PSA 8.5.8 Compensation for Community Liaison period..... Unit: Month

The rate shall cover all monthly costs incurred during the Community liaison period prior to Works Commencement

PSA 8.5.9 Remuneration of Civil Engineering Interns..... Unit: Prov. Sum

The Civil Engineering Interns shall be from the local Community. The payment shall include full compensation for the monthly salary of the Interns.

PSA 8.7 DAYWORK

Dayworks will be paid according to the stipulations of the special conditions of Contract.

PSA 8.7.1 Scope

This section covers the method of measurement and payment for work carried out on a day work basis.

PSA 8.7.1.1 General Requirements

Work will be classified as day work only if the Employer's Agent 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 2015 will be issued at the discretion of the Employer's Agent. 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 Employer's Agent for his approval, and shall submit such receipts or vouchers to the Employer's Agent as may be necessary for proving the amount claimed.

PSA 8.7.1.2 Measurement and Payment - Day works

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

Employer		Contractor	
Witness:		Witness:	

operator (excluding VAT) and shall apply only to vehicles and construction equipment approved in writing by the Employer's Agent. 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 Employer's Agent 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 Employer's Agent 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 2015 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.

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 Employer's Agent and will be paid if and when the need arises.

Employer		Contractor	
Witness:		Witness:	

PSA 8.8 TEMPORARY WORKS

ADDITIONAL PAYMENT ITEMS

Add the following item:

“PSA 8.8.4(e) Excavation to expose bridge bases and check possible encroachments onto the pipeline route.....

The sum shall cover excavations to expose and measure extent of the existing bridge bases encroachments onto the set-out route of the diversion pipeline and reporting to the engineer to enable necessary design adjustments. This work shall be carried out early in the contract and prior to trenching for the diversion pipe.”

“PSA 8.8.5 Cost of Survey

delete the existing subclause and replace with:

a) Survey and setting out works.....Unit: Sum

The tendered rate includes all costs associated with the survey and setting out of all works and adjacent features.”

Add the following item:

“PSA 8.8.7 Supply, Install and monitor early warning for sewage flooding Unit: Sum

The rate shall cover the cost to design, supplying, installing and monitoring, complete to manufacturer's details, flow monitoring equipment fitted with the suitable measuring and alarm system on the upstream of the construction area to Employers' Agent 's approval.

The alarm system should be installed far enough to allow for time for evacuation of the occupied pipeline in the event of a sewage flood that is in excess of the capacity of the diversion sewer pipe, in which case the isolating gates will be opened to allow through flow via the outfall pipeline evading sewage spillage.”

Add the following item:

“PSA 8.8.8 Supply and install hoarding Unit: m

The rate shall cover the cost to supply, install and remove off site after construction of hoarding (no less than 1.8m high) including gates and shade cloth for the construction site perimeter and/or laydown area.”

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.

Add the following item:

“PSA 8.8.9 Demolish existing boundary walls and gates Unit: m

The rate shall cover the cost to demolish and disposal of existing boundary walls and gates in the way of the diversion pipeline.”

Add the following item:

“PSA 8.8.10 Provide labour and plant to operate the entry and exit chamber sluice gates Unit: Sum

Employer		Contractor	
Witness:		Witness:	

The rate shall cover the cost to man, monitor and operate the sluice gates during the operation of the sewage by-pass line and human access to main bridge outfall sewer pipe and in emergency periods.”

Add the following item:

“PSA 8.8.11 Operate, maintain, inspect and monitor the operation of the diversion system for the duration of access and repairs to the main sewer pipe **Unit: Sum**

The rate shall cover the cost to man, monitor and operate the diversion sewer pipe while the main bridge outfall sewer pipe is out of commission, including over-pumping intervention should the gravity flow malfunction and periodic clearing of debris at exit and re-entry chambers.”

Add the following item:

“PSA 8.8.12 Provide labour, plant and materials required to pump out the residual sewage and flush the diversion pipeline with water **Unit: Sum**

The rate shall cover the cost of labour, material and equipment required to clean diversion sewer pipe using flush water and pumping it empty of effluent into the main outfall after decommissioning.”

Add the following item:

“PSA 8.8.13 Dismantle all temporary works associated with the operation of the siphon pipeline **Unit: Sum**

The rate shall cover the cost to remove and de-establish all temporary installations required for the operation of the siphon/diversion pipeline like pumps, surge tanks/shutters, flood warning system, access ladders, gate motors; etc. following the decommissioning of the siphon/diversion pipeline”

Add the following item:

“PSA 8.8.14 Re-construct boundary walls to detail or to match existing..... **Unit: m**

The rate shall cover the cost of labour, material and equipment to construct boundary walls complete as specified or to match existing.”

PSA 8.9 ADDITIONAL PAYMENT ITEMS

Add the following item:

“PSA 8.9.1 Protection of Survey beacons/stand pegs and submission of certificate from a registered land surveyor confirming non-disturbance of pegs..... **Unit: Sum**

The rate shall cover the cost to provide a registered surveyor to re-instate and certify disturbed or removed beacons/stand pegs as instructed by the Employers’ Agent.”

Add the following item:

“PSA 8.9.2 Items Not Mentioned

Should the Tenderer wish to price any item in connection with the work described in the General Conditions of Contract or the Specifications not specifically mentioned in this Schedule, he is to do so here, giving a brief description with quantities where applicable.”

Add the following item:

“PSA 8.9.3 Compensation in terms of **sub clause 9.1.4** for delays due to the circumstances described in **sub clauses 9.1.1 and 9.1.2** of the general conditions of contract, as amended

..... **Unit: day**

The unit of measurement shall be the number of working days approved by the Employers’ Agent during which the contractor was delayed or prevented from executing the contract. In the event of

Employer		Contractor	
Witness:		Witness:	

delays for part of a working day only, such fractions of a working day shall be added to calculate the total delay.

Payment at the tendered rate shall be in full and final compensation for delays due to the circumstances described in **sub clause 9.1.1 and 9.1.2.**

No payment will be made under this payment item after expiry of the official completion date.”

Add the following item:

“PSA 8.9.4 Inspections and measurements of internal pipe damage using technology.....**Unit: P/Sum**

The rate shall cover the cost to acquire specialist services and equipment to inspect and record the internal condition of the elevated concrete sewage pipe with respect to the extent of internal wear”

Add the following item:

“PSA 8.9.5 Visual inspections and measurements of internal pipe damage**Unit: P/Sum**

The rate shall cover the cost of competent personnel, labour and equipment to conduct internal pipe condition surveys and scope subsequent repairs”

Add the following item:

“PSA 8.9.6 Provision of access, lighting and ventilation in the pipeline**Unit: Sum**

The rate shall cover the cost of plant, labour and equipment to provide access, lighting and ventilation to enable personnel/workforce to enter, conduct repairs, manoeuvre and exit the outfall pipeline as required for the duration of the by-pass operation in compliance with the technical specifications, health and safety requirements.”

Add the following item:

“PSA 8.9.7 Relocating electrical and security installation onto the new boundary wall of the Dainfern Valley Estate**Unit: P/Sum**

The Provisional Sum shall cover the cost of materials, plant, labour, equipment and overheads/profits to relocate electrical and security installation onto the new boundary wall to the satisfaction of the Estate”. This work shall be done by the nominated sub-contractor to be provided by Dainfern Valley Estate in Liasson with the Employer’s Agent.

Employer		Contractor	
Witness:		Witness:	

SANS 1200AB: EMPLOYERS' AGENT 'S OFFICE (1986)

PSAB 3 MATERIALS

PSAB 3.1 NAME BOARDS

Delete and replace the standard clause with the following:

"The Contractor shall supply and erect, at approved sites, five (5) nameboards that shall comply as regards size, painting, decorating and detail, with the recommendations for the standard board of the South African Institution of Civil Employers' Agent s. The Employer, Employers' Agent and Contractor to be painted on the boards shall be as ordered or as shown on a drawing. Typical JW Nameboard drawing provided on drawing no. 13247-02/C/SEW/314-A. Refer to JW Typical drawing no.s "JW100-DET04-S01 and JW100-DET01.1-W01" for more details. The Contractor should produce shop drawings before manufacturing the nameboards for approval by the Employer's Agent and Employer.

Each board shall be made of tempered hardboard of thickness at least 12 mm, so braced on the reverse side as to prevent warping, and mounted on two or more, as necessary, firmly planted poles. 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".

PSAB 3.2 OFFICE BUILDING (S)

Delete and replace the standard clause with the following:

"3.2 (a) Employers' Agent 's Office

The Contractor shall provide and furnish one office for the use of the Employers' Agent . Each office shall consist of one room with a floor area of at least 6 m² and a ceiling height of at least 2.5 m.

Each office shall be weatherproof, shall have a wooden boarded floor that is at least 150 mm above the ground, and shall be provided with a ceiling and a lining to the walls, or equivalent insulation, with an acceptable type of door with a secure lock, and two opening windows of glazed area at least 3 m². Each office shall be well ventilated and shall be so insulated as to provide comfortable working conditions.

The internal furnishings of each office shall include

- i) one trestle table, 2 m long x 1 m wide x 0.9 m high, with a smooth top;
- ii) one table or desk having a top of size at least 1,5 m x 0.9 m and at least one lockable drawer;
- iii) two chairs;
- iv) a lockable upright steel cabinet with three shelves or a steel filing cabinet with four drawers;
- v) an acceptable blind on each window;
- vi) acceptable lighting;
- vii) provision, as detailed in the project specification, for heating in winter and cooling in summer.

The Contractor shall also supply a toilet for the exclusive use of the Employers' Agent .

On completion of the Works, ownership of the buildings and their furnishings shall revert to the Contractor who shall remove them from the Site.

3.2 (b) Meeting Room

The Contractor shall in addition to his facilities further provide at the site camp provide the meeting room for the Employers' Agent . The meeting room shall have adequate seating and table to hold site and other meetings, for 15 people.

3.2 (c) Parking

The Contractor shall provide four (4) shaded parking areas, each 3m x 3m, constructed of a steel tube frame and painted white, with minimum a 50mm layer of 19mm stone laid on the ground.

3.2 (d) Location of the site camp

Employer		Contractor	
Witness:		Witness:	

In addition to the standard requirements:

- i) The location of the office unit shall be selected in consultation with the Employers' Agent .
- ii) The Employers' Agent must approve all internal furniture."

PSAB 4 PLANT

PSAB 4.1 TELEPHONE

Add the following:

"A telephone will not be required for the sole use of the Employers' Agent . However, the Contractor shall be responsible for the payment of the scheduled items to compensate the Employers' Agent 's Representatives for Contract related communications. However telefax facilities shall be provided on site and shall be available for the sole use of the Employers' Agent at all times."

Add the following sub clause:

"PSAB 4.2 COMPUTER FACILITIES

The Contractor shall, for the duration of the Contract, provide the computer equipment complete with printer, wireless data modem and telephone connection including at least 3Gconnection together with the software specified hereunder, for the exclusive use of the Employers' Agent and his staff:

- a) 3 laptop computer (1 for Employer's Agent and two for Civil Engineering Inters)
- b) 1 A3 Colour printer with sufficient ink / toner, capable to scan, print, copy and fax;

The computers shall comply with the following minimum specifications:

- Intel Core i5-4210M
- 4GB DDR3 Memory
- 500GB 7200rpm HDD
- RS232 LCD Display
- Microsoft or similar Wireless keyboard and three-button mouse

Printers shall, unless otherwise approved by the Employers' Agent , be Hewlett-Packard 600 Series DeskJet printers or equivalent compatible.

All computer hardware shall be provided complete with the requisite connecting cables and all interfacing devices and software necessary for its efficient operation as an integral system.

The following software shall be properly installed on the computer, and the original license agreements and disks shall be provided to the Employers' Agent for safekeeping:

- Microsoft Windows 8 Professional 64-Bit
- Microsoft Office 2013 Home & Business – Full Package
- Microsoft Projects 2013
- a .pdf viewer.

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 Employers' Agent 's staff.

The Contractor shall further provide at his own cost, all paper and black ink cartridges and other consumables reasonably required by the Employers' Agent.

All the equipment mentioned above will be handed back to the Contractor at the conclusion of the project."

PSAB 5 CONSTRUCTION

Employer		Contractor	
Witness:		Witness:	

PSAB 5.4 SURVEY ASSISTANTS

The Contractor is to make available two suitable, trained and experienced workmen to be used as survey assistants for the Employers' Agent or his representative during working hours as and when required.

PSAB 5.5 SURVEY EQUIPMENT

The Contractor shall make available on the site the following survey equipment, all in good condition and adjustment.

- (a) 1 Tachometer – 20 second arc
- (b) 1 Automatic level and tripod
- (c) 1 Tachometry staff
- (d) 5m telescopic levelling staff
- (e) 100m steel tape
- (f) 1m spirit level
- (g) 6 ranging rods

The equipment need not be for the sole use of the Employers' Agent, but it shall be available on request.

Employer		Contractor	
Witness:		Witness:	

SANS1200 C SITE CLEARANCE (1982)

PSC 1 SCOPE

PSC 1.1

Add:

Except where noted, all the work covered by this specification shall be done labour intensively.

PSC3 MATERIALS

PSC3.1 DISPOSAL OF MATERIALS

Add the following:

All excavated material which is unsuitable for the use in the permanent works or is unsuitable for local dumping and spreading on site must be removed and dumped at a separate spoil sites by the Contractor, identified by the Contractor to be suitable and legal for this type of dumping.

The Contractor is responsible for all arrangements and all costs for the attainment of suitable spoil site and fulfillment of all associated prescriptions. The individual spoil sites must conform to the environmental management plan for the Contract. All costs shall be included in the tendered rates for respective clearance or excavation items.

PSC 4 PLANT

PSC 4.1

Delete this clause and replace with:

The Contractor shall provide all tools and equipment needed for clearing and grubbing.

PSC5 CONSTRUCTION

PSC5.1 AREAS TO BE CLEARED AND GRUBBED

Add the following:

"Pipeline routes shall be cleared on instruction of the Employer's Agent to a distance of 5 m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations.

All areas to be cleared, if in undisturbed natural surroundings, shall have undulating borders, so as to create a softer look."

PSC 5.2 CUTTING OF TREES

PSC 5.2.1 Protection of persons, animals and structures

Appropriate permission shall be sought to cut down tree.

To this clause add:

PSC 5.2.1.1 Preferred method of removing trees

Where trees are to be cut down and their root systems grubbed out labour-intensively, the following method is recommended:

1. The first team should trim the trees within the area to be cleared. The tree tops should be cut, leaving a trunk about 5 m high. All side branches should be cut off using axes and saws. The timber resulting from the trees should be sawn up into convenient lengths and stacked to one side. Separate piles should be made for leaves and thin branches.
2. Bush and other tough vegetation should be cut down by the second team, to ground level if possible, cut to convenient lengths and stacked.
3. After trees have been trimmed and bushes have been cleared from an area of at least 100 m², the third team can start. Grass, leaf litter and remaining vegetation should be removed at ground level by means of spades or hoes. The resulting debris should be raked to one side and added to the piles of thin branches and leaves.

Employer		Contractor	
Witness:		Witness:	

4. Once a large enough portion of ground is clear, the fourth team should fix a strong rope to the top of the remaining portion of a tree-trunk. Then they should dig a trench around the tree and chop through the roots. The trench should be about one metre deep (less if the tree is small) and the team should attempt to undermine the tree stump. As soon as one tree has been trenched and all accessible roots cut through, a team of labourers should be gathered to pull the tree down by means of the rope. As the tree moves, further roots may become visible and accessible: these roots should be cut free at the level of the base of the hole while the pulling team rests. Progressively the tree trunk is thus brought down, using the leverage of the length of the trunk to tear out as many roots as possible. Once the tree and stump have been brought down, they should be rolled away from the hole and cut into convenient lengths. All major roots must be dug out and removed to the specified depth.
5. Large bushes should be trenched and their root systems removed. The roots of smaller bushes can be dug out together with the grass roots.

The soil dug out of the trenches around trees and large bushes should then be returned to the trenches. Roots should be carefully separated from the soil and only clean soil used for backfill. The tree hole backfill is to be compacted in thin layers as follows: the soil is to be dampened and mixed and then placed into the trenches in layers about 100 mm thick. The soil in each layer shall be compacted with hand stampers until firm. The trenches shall be compacted up to 200 mm below the ground surface. The rest of the soil can then be thrown loose into the trenches.

PSC 5.2.3.2 Protection of Individual trees

Care shall be taken to protect indigenous trees. The Contractor shall replace any tree damaged or removed outside the areas to be cleared and grubbed. A tree is defined as having a trunk diameter of more than 150mm at a height of more than 0,3 m above ground level.

An amount of R2 000,00 will be deducted from moneys due to the Contractor as a penalty for every tree that is damaged or removed unnecessarily and without prior instruction from the Employers' Agent .

PSC 5.3 CLEARING

- c) Delete the content of this clause and replace with:
"the removal and disposal of structures that encroach upon or may otherwise obstruct other work on the Site (see requirements of clause 5.8);"

PSC 8 MEASUREMENT AND PAYMENT

Add the following clauses:

PSC 8.2.2.1 Penalty for unauthorized removal or damage of indigenous trees along the route Unit: Sum/tree

The rate shall cover the cost of unauthorized cutting down or damage of indigenous trees along the pipeline route

PSC 8.2.5 Take down existing fences, stockpile and re-instate after construction works Unit: Sum

The rate shall cover plant, equipment and labour required to take down the fence, sorting and stacking them carefully and preserving them for the duration of the construction and re-instating the fence to the original or better condition.

PSC 8.2.11 Remove, store, preserve and replant selected trees along the diversion pipeline Unit: No.

The rate shall cover plant, equipment and labour required to remove selected trees along the diversion pipeline, store, preserve and replant at designated areas.

Employer		Contractor	
Witness:		Witness:	

PSC 8.2.12 Remove, store and preserve the concrete elements/ precast units and restore

.....Unit:
Sum

The rate shall cover plant, installation of lift hooks, equipment and labour required to lift the units, sorting and stacking them carefully and preserving them and restoring as required during construction.

PSC 8.2.13 Drain, flush sewer pipe and hose down the internal face of the concrete pipe using high pressure water jetting to allow for a healthy and safe working environment

.....Unit: **Sum**

The rate shall cover plant, equipment and labour required to pump, drain, flush and clean the inside of the elevated sewer pipe to allow inspections and repairs to be executed in a healthy and safe working environment.

PSC 8.2.14 Saw cuts through existing concrete surface Unit: m

The item shall cover the costs of making saw cuts as specified in surfaces to provide a clean edge to broken out sections. The quantity measured shall be the net length of cut specified.

PSC 8.2.15 Break out concrete or brickwork and make good Unit: m³

Separate items will be scheduled for different materials and different areas with different working conditions.

The item shall cover all costs associated with breaking out concrete or brickwork in walls and slabs for the purpose of modifying the existing structures, forming new pipe penetrations or for laying pipes below walls or structures. The rate shall include the plant required and removal from site and disposal of the waste material. It shall also cover for making good the broken edges to the Employers Agents satisfaction or rebuilding the wall to a condition approved by the Employers Agent

The quantity measured shall be the net volume of concrete or brickwork required to be removed based on the actual average thickness of the sections to be broken out and the extent of the sections to be broken out shown on the drawings or directed by the Employers Agent. No payment will be made for overbreak.

PSC 8.2.16 Removal of man-made surfaces Unit: m²

The rate shall cover all plant, labour, material, saw cutting (asphalt and concrete), breaking up, lifting, loading, transportation, off-loading surfacing , disposal or storing (where applicable).

a) Footways, driveways, parking and tennis courts

- i) Interlocking concrete segmental paving blocks (all colours)
- ii) Concrete slabs (450 x 450mm)
- iii) Brick paving
- iv) Unreinforced concrete ≤75mm thick
- v) Reinforced concrete ≤75mm thick
- vi) Grassing
- vii) Tennis court surfaces and astro tuff
- viii) Precast retaining blocks

b) Kerbing (all types of kerbing) (Unit: m)

PSC 8.2.17 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

Employer		Contractor	
Witness:		Witness:	

materials in roadways, footways and driveways in accordance with the COP and/or to match existing:

PSC 8.2.17.1 Backfilling and reinstatement of roads..... Unit:m²

a) Scenario C (Foot paths and Play courts)

- i) 150mm base – Recovered material compacted to 93% Mod AASHTO
- ii) 150mm selected subgrade – Insitu material compacted to 90% Mod AASHTO

b) Surfacing

- i) 30mm Bitumen hot –mix: Fine
- ii) 70mm Bitumen hot –mix: BTB

PSC 8.2.17.2 Backfilling and reinstatement footways and Play courts 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:

- 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) 60mm Grey blocks
 - 2) 80mm Grey 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) Astro turf
- ix) Tennis court surfacing
- x) Concrete channelling, including formwork, levelling and compacting 300 x 125mm cast in situ concrete of 15MPa.
- xi) 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

PSC 8.2.19 Reinstatement of existing steel and/or concrete palisade fences, concrete lined open channels, masonry and block retaining walls.....Unit: m² or m

The rate shall cover the full cost for excavation, shaping the open channel excavation, compaction, reinforcement, concreting (min Class 25/19), backfilling and complete reinstatement of the open drain to original condition and finishing. The rate shall cover the cost of reinstating existing masonry walls, plastered or unplastered, precast-concrete retaining block walls and steel palisade fences (including any gates) including plant, labour, material, on-loading, transporting, off-loading and cleaning for the following:

- a) Face brick
 - i) 110mm wall
 - ii) 220mm wall

Employer		Contractor	
Witness:		Witness:	

- iii) 330mm wall
- b) Plastered
 - i) 110mm wall
 - ii) 220mm wall
 - iii) 330mm wall
 - iv) 440mm wall
- c) Steel palisade fences (height up to 2.2m)
- d) Precast concrete retaining block walls

Employer		Contractor	
Witness:		Witness:	

PSD EARTHWORKS

PSD 2 INTERPRETATIONS

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.”

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.”

PSD 3 MATERIALS

PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES

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 Employer’s Agent 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 Employer’s Agent in good time shall entitle the Employer’s Agent to reclassify, at his discretion, such excavated

Employer		Contractor	
Witness:		Witness:	

material.”

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 50 mm sieve.
- (b) The material shall not contain large clay lumps that do not break up under the action of the compaction equipment.
- (c) The liquid limit of the material shall not exceed 40, neither shall the Pi exceed 18.”

PSD 3.3 SELECTION

Add the following subclause:

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.”

PSD 5 CONSTRUCTION

PSD 5.1 PRECAUTIONS

PSD 5.1.1 Safety

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 Employer’s Agent shall be entitled to suspend all work under the Contractor until in the Employer’s Agent’s opinion the Contractor’s

Employer		Contractor	
Witness:		Witness:	

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.

PSD 5.1.1.2 Safeguarding of excavations

REPLACE “Machinery and Occupational Safety Act” *IN SUB-PARAGRAPH (a) 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 1.0 m shall be left clear along the edge of the excavation.

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 Employer’s Agent will require the Contractor to remove the rock material by means of pneumatic or hydraulic breakers, e.g. jack-hammers, wood-peckers and chemical breaking.

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.

PSD 5.1.2 Existing services

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 Employer’s Agent.

Unless otherwise instructed or agreed by the Employer’s Agent, 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 PSA 8.8.4

Payment in respect of reinstating layerworks in roadways will be made in accordance with subclause 8.3.6.1 of SANS 1200 DB.”

Employer		Contractor	
Witness:		Witness:	

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 Employer's Agent 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 minimize the occurrence of any further damage occurring."

PSD 5.1.2.4 Negligence

Delete sub-clause 5.1.2.4

PSD 5.1.3 Stormwater and Groundwater

Add the following to the sub-clause:

"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."

PSD 5.1.4 Nuisance

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 Employer's Agent 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 Employer's Agent) and the return to Site, excavated material for use as backfill or bedding."

Add the following new subclause:

Employer		Contractor	
Witness:		Witness:	

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.”

PSD 5.1.5 Reinstatement and Maintenance of Roads

Add the following to the sub-clause:

“Where crossings have been made, the roads shall be reinstated in accordance with the details specified in subclause 5.9 of SANS 1200 DB.”

PSD 5.1.6 Road Traffic Control

Delete the second sentence of subclause 5.1.6

PSD 5.2 METHODS AND PROCEDURES

PSD 5.2.2 Excavation

PSD 5.2.2.1 Excavation for general earthworks and for structures

“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 rate tendered for item 8.3.5 will be deemed to include the cost of a working width of 600 mm, but the Contractor may excavate a greater working width at no additional cost to the Employer.”

Replace the content 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 90% of modified AASHTO density or to the density of the surrounding material.

Where excavations have been carried out in hard material, the Employer’s Agent may direct the over-excavation to 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 re-trim the excavations if necessary and, unless other remedial measures are agreed to by the Employer’s Agent, 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.”

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.

Employer		Contractor	
Witness:		Witness:	

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 such sites will be made in accordance with the provisions of subclause PSD 8.3.14."

Add the following subclause in subclause 5.2.2:

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 organize 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 Employer's Agent's opinion, unsuitable for use in embankments or backfill as a result of contamination, shall be disposed of in a manner acceptable to the Employer's Agent and shall be replaced by the Contractor with materials acceptable to the Employer's Agent, all at the Contractor's cost."

PSD 5.2.5 Transport for earthworks

Replace the content of subclause 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."

PSD 7 TESTING

PSD 7.2 TAKING AND TESTING OF SAMPLES

Replace the content of this subclause with the following:

"The Contractor shall arrange with the approved independent laboratory by the Contractor to carry out sufficient tests on a regular basis as agreed between him and the Employer's Agent 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 Employer's Agent 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."

PSD 8.3.6 Overhaul

Remove and replace with following:

"All haul shall be free haul"

Employer		Contractor	
Witness:		Witness:	

SANS 1200 DA EARTHWORKS (SMALL WORKS) 1988

PSDA 1 SCOPE

PSDA 1.1 Add:
Except where noted, all the work covered by this specification shall be done labour intensively.

PSDA 3 MATERIALS

PSDA 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES

PSDA 3.1.1 Method of classifying

To this clause add: "Material supplied from commercial sources will not be classified."

PSDA 3.1.2 Classes of excavation

Delete this clause and replace with:

"The classification of excavations shall be according to clause PSDB 3.1 Classification for hand excavation (pipe trenches) of this project specification."

PSDA 4 PLANT

Add a new clause:

PSDA 4.3 COMPACTION EQUIPMENT

No limitations are placed on the Contractor in his choice of compaction equipment.

PSDA 5 CONSTRUCTION

PSDA 5.1 PRECAUTIONS

PSDA 5.1.1 Safety

PSDA 5.1.1.1 Barricading and lighting

Delete this clause and replace with:

"In terms of the Occupational Health and Safety (OH&S) Act, No. 85 of 1993, every excavation by which the safety of persons may be endangered shall be barricaded with a barrier sufficiently strong to contain pedestrians and prevent them from falling into the excavations at times when visibility is low."

Delete a) and b) and insert the following:

"The Contractor shall light and barricade all materials, excavations and objects, which constitute an obstruction or danger to the public as a result of his operations."

In addition to the above, the following shall apply to all excavations:

- 1) Barricading supports shall be portable and self-standing i.e. such as not to disturb the existing surface. Horizontal planks shall be at least 100 mm wide, painted in red and white bands and shall be fixed to the support at heights of 0,45 m, 0,75 m and 1,25 m above the ground.

The system shall be rigid when erected and shall present a neat and orderly appearance. The system of barricading either as specified above or an alternative, must be approved by the Employers' Agent before excavations commence. It should be noted that chevron plastic tape alone, is not regarded as adequate protection around excavations and its use for that purpose shall not be approved. The use of the "fluorescent orange plastic netting" would be considered provided the support system complies with the requirements of the Works, Machinery and Safety Act.

Employer		Contractor	
Witness:		Witness:	

- 2) At night, flashing orange lights shall be placed at each end of every trench under construction and at intervals not exceeding 15m apart along barricades. The proximity of street lights shall not relieve the Contractor of any responsibility in respect of barricading and lighting.
- 3) All signs and barricades shall be inspected every day before the morning and evening peak traffic periods and at least once during the day. The Contractor shall advise the Employers' Agent of the name of the individual appointed to carry out these inspections.
- 4) Warning lights and barricading components which are damaged, disturbed, lost or stolen shall be replaced and repositioned by the Contractor immediately at his own expense. Night watchmen are to be utilized where necessary to guard barricading and lighting from theft and vandalism. The Contractor shall comply with the requirements for barricading of the COP, save where the requirements of the code are varied by Portion 1 and 2 of the Project Specification. Should the Contractor fail to provide adequate lighting, signing and barricading, access to properties, or leaves the site in a dangerous condition, the Employers' Agent shall be entitled to:
 - 1) Suspend all work under the Contract until in the Employers' Agent 's opinion the Contractor's obligation in these respects have been fulfilled.
 - 2) 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 “

PSDA 5.1.1.2 Safeguarding of excavations

In this clause delete the words "Factories, Machinery and Building Work Act, 1941" and replace with "Occupational Health and Safety (OH&S) Act, No. 85 of 1993 and as amended".

In addition to the existing clause, the following shall apply:

- a) Loose ground, materials, tools and appliances shall be kept clear of the edge of the excavations and a pathway at least 1.0m shall be left clear around such edge.

No separate or additional payment shall be made for timbering and shoring and allowance must be made for this work in the Schedule Rates for excavation.

Timbering, shoring, etc. directed to be left in the excavations will be paid for at the scheduled rates.

The Contractor shall be solely and entirely responsible for maintaining excavations in a safe condition and his responsibility shall in no way diminish by any instruction by the Employers' Agent to take additional or improved protection or precautionary measures.

PSDA 5.1.1.3 Explosives

Explosives shall not be used on this project. Non explosive methods shall be used. Hard rock and large boulders shall be drilled at suitable spacing using hand held pneumatic tools and shall be split by means of suitable equipment or expanding materials.

Add a new clause:

PSDA 5.1.1.4 Maximum length of open trench

Employer		Contractor	
Witness:		Witness:	

Unless otherwise permitted by the Employers' Agent , not more than 100 m of trench in one place shall be opened in advance of the completed pipeline that has been backfilled.

PSDA 5.1.6 Excavated material not to endanger or interfere

In addition to the existing clause the following shall apply:

A safe, clear path must be kept open at all times for pedestrians. Equipment, materials and waste must be stored, stockpiled or removed in such a manner that pedestrians are never 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 must be provided.

Where instructed by the Employers' Agent or where the Works impose a danger to traffic or pedestrians, the Contractor shall remove off Site excavated material to temporary stockpiles (approved by the Employers' Agent) and the return to Site, excavated material for use as backfill or bedding.

PSDA 5.1.8 Road Traffic Control

The complete closure of any road is not permitted without the prior written consent of the Employers' Agent .

PSDA 5.2 METHODS AND PROCEDURES

PSDA 5.2.3 Placing

PSDA 5.2.3.2 Restricted backfill and compaction at structures

In the second paragraph:

delete the figures "250" and replace with "120";

delete the word "mechanical" and replace with "hand".

PSDA 5.2.6 Transport for Earthworks

PSDA 5.2.6.1 Freehaul

All haul shall be freehaul.

PSDA 5.2.6.2 Overhaul

Delete and replace with:

All haul shall be freehaul

Employer		Contractor	
Witness:		Witness:	

SANS1200 DB: EARTHWORKS (PIPE TRENCHES) (1989)

PSDB 1 SCOPE

PSDB 1.1 Add:

Except where noted, all the work covered by this specification shall be done labour intensively.

PSDB 2 INTERPRETATION

PSDB 2.1 SUPPORTING SPECIFICATIONS

Add the following sub-clause:

- e) City of Johannesburg Metropolitan Municipality, Public Road and Miscellaneous By-laws, Schedule 2 - Code of Practice for work in the road reserve (COP), Latest Version.

Should any requirement of this COP conflict with any requirement of the standardised or particular specifications the requirements of the COP shall prevail.

PSDB 3 MATERIALS

PSDB 3.1 CLASSES OF EXCAVATION

Delete this clause and replace with:

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 vary in hardness with increasing depth of excavation. Table PSDB 3.1 indicates the categories:

TABLE PSDB 3.1: Classification for Hand Excavation

Category of Material	Consistency		DCP Blows to Penetrate 100 mm	
	Granular	Cohesive	Granular	Cohesive
<u>Soft</u> 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
<u>Intermediate</u> 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
<u>Hard</u> Hard excavation shall be excavation in material that requires prior breaking using mechanical equipment, such as pavement breakers with clay spades, before removal from the trench.	Very dense		16-50	-15

Employer		Contractor	
Witness:		Witness:	

Category of Material	Consistency		DCP Blows to Penetrate 100 mm	
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

PSDB 3.5 BACKFILL MATERIAL

Delete sub-clause (b) of this sub-clause and replace with the following:

The quality of materials used for subgrade in areas subject to traffic loading shall comply with PSDB 5.9.4.

PSDB 3.6 MATERIALS FOR RE-INSTATEMENT OF ROADS AND PAVED AREAS

PSDB 3.6.2 Gravel

Delete these sub-clauses and replace with the following:

Material used in the re-instatement of pavement layers shall fall into either of the following categories:

- Foundation material recovered from the excavation of trenches across existing roadways which, if so instructed by the Employers' Agent, shall be set aside and re-used as sub-base material.
- New material which shall conform to the requirements of:
 - Clause 3.2.1 of SABS 1200 ME for the Sub-base.
 - Clauses 3.2 and 3.3 of SABS 1200 MF for the Base course.
 - Clause 3.2.2 of SABS 1200 ME for the Gravel Wearing Course.

Material used in the backfill underneath the pavement layers shall fall into either of the following categories:

(a) Stabilised backfill

The aggregate used for stabilised backfill shall be a sandy or gravelly material containing particles up to 38 mm and shall not have a plasticity index of more than 10. Aggregate must be obtained from an approved source.

The tendered rate for stabilised backfill shall include full compensation for all material including the Portland cement used at a rate of 6% of the dry mass of the backfill. Wherever pipes cross surfaced streets the backfill must be stabilised.

(b) Soilcrete

Where so ordered and scheduled, the culverts shall be backfilled with soilcrete in lieu of a compacted gravel or lean concrete. Soilcrete shall consist of an approved soil or gravel mixed with 5 % by mass of Portland cement and only sufficient water to give it a consistency that will permit the soilcrete to be placed, using vibrators, so that all voids between the culverts and the sides of the excavation are properly filled. The height to which the backfill in soilcrete is taken shall be as determined by the Employers' Agent and any remaining backfill shall be carried out as described for granular material.

The aggregate used for soilcrete shall be a sandy material but may contain larger particles up to 38 mm and it shall have a plasticity index of more than 10. Material containing detrimental amounts of silt or clay shall not be used for soilcrete. The aggregate shall be obtained from an approved source.

The soilcrete shall be mixed on Site by means of suitable concrete mixers and the water and cement contents shall be carefully controlled. The material shall be placed and then thoroughly compacted by means of vibrators so that all voids are filled. Stones or other approved form work

Employer		Contractor	
Witness:		Witness:	

shall be packed at culvert ends to prevent the soilcrete from flowing outside the required limits. The rate shall cover the cost of constructing soilcrete backfilling complete, including Portland cement calculated at the rate of 5% of the dry mass of the soil used. Overhaul will not be paid on any cement, water or aggregate used for the soilcrete.

PSDB 3.6.4 Asphalt carpet

Delete this sub-clause and replace with the following:

The bituminous surfacing shall be a medium grade hot-mix asphalt.

PSDB 3.7 SELECTION

Delete the second sentence and replace with the following:

The Contractor shall use selective methods of excavating in order to produce material suitable for the bedding cradle or the bedding blanket.

PSDB 5 CONSTRUCTION

PSDB 5.1 PRECAUTIONS

PSDB 5.1.1 General

Add the following to this sub-clause:

The Contractor shall programme his activities in such a way that long sections of trenches do not lie open for undue periods of time, as this poses a security risk. The pipes shall be laid as soon as possible after excavation of the trenches and the trenches then backfilled. Under no circumstances will trenches be left open for more than 1 week.

The Contractor shall inform the Johannesburg Road Agency (JRA) at least 2 days in advance of the actual date on which he proposes to excavate in any road or footway.

PSDB 5.1.3 Accommodation of traffic and access to properties

Delete this sub-clause and replace with the following:

The Contractor shall comply with the requirements of the **COP** and **PS 5.7**.

PSDB 5.1.4 Existing services that intersect or adjoin trenches

Add the following to this sub-clause:

Where it is necessary for a pipeline to pass under existing drains, the Contractor shall carefully excavate and backfill around them. During the course of the work, the drains shall be adequately supported to the satisfaction of the Employers' Agent. Any damage shall be reported without delay and shall be made good by the Contractor before backfilling.

The penalty payable for damaging existing services shall be **R5 000 per offence**, which exclude the cost of the repair of the service that will be for the account of the Contractor.

PSDB 5.4 EXCAVATION

Add the following to this sub-clause:

Where the pipe trench crosses surfaced roads the Contractor shall neatly cut four parallel grooves into and through the "black top" before excavating between the inside 2 grooves. The outside 2 grooves should be 100 from the inside ones. The cost of this operation, where not scheduled separately, will be deemed to have been included in the general rates for excavation.

Pipe trenches shall be excavated in lengths not exceeding 100m, unless approved otherwise by the Employers' Agent.

Employer		Contractor	
Witness:		Witness:	

add the following sub clauses:

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. The deposited material shall be levelled to a neat top profile.
- c) Where there is insufficient space to deposit excavated material alongside the trench the contractor shall cart the material to stockpile away from the trench edge, maintain and cart material back for backfill. The carting distance to and from the stockpile shall be free haul. An extra-over item for such stockpiling is provided in the bills of quantities. The rates for this item shall include all costs associated with dealing with materials in this manner.
- d) 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.
- e) 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 Employer's Agent accordingly in writing, including a report from a professional Employer's Agent or a professional technologist competent in excavations. The report shall include the relevant laboratory tests.
- f) 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.
- g) Without in any way affecting or detracting from the Contractor's responsibility, the Employer's Agent 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.
- h) 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.
- i) Timbering and shoring shall be left in position until the Employer's Agent has authorised their removal.
- j) 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 Employer's Agent or a professional technologist, including the relevant laboratory costs, shall be included in the tendered rates.
- k) 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

Employer		Contractor	
Witness:		Witness:	

made available to an inspector, the Employer, Employer's agent, contractor or employee upon request;

- l) 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."

PSDB 5.5 TRENCH BOTTOM

Delete the existing clause and replace with:

Compaction of the trench bottoms shall be by the way of power-driven plant.

The Contractor shall maintain the floors of completed trenches in good condition. Floors softened or eroded through stormwater, seepage water or otherwise, must be rectified by removal of the softened material and its replacement with approved material firmly compacted in layers not exceeding 150mm in compacted thickness or with 10MPa concrete where directed, at the Contractor's cost.

Accurately located recesses shall be cut into the bedding cradle or trench bottom to accommodate pipe joints and such recesses shall be properly shaped and sized to enable jointing to be carried out without difficulty. For welded joints the recesses shall provide a clear space not shallower than 500mm below the pipes - refer to drawing number LB-2.

The placing of hardcore or concrete screed shall be entirely at the Contractor's cost in any section of the work where softening of floors has been due to the method of excavation or inadequate provision for drainage.

Floors of trenches in bad or waterlogged ground shall be excavated and replaced with hardcore filling, a hardcore base and/or a 20 MPa concrete screed as directed.

- i) Hardcore filling shall consist of 75 – 150 mm stone well rammed and compacted.
- ii) Hardcore base shall consist of 50 – 75 mm stone laid and compacted across the full width of the trench.

Preparation of trench bottoms shall be included in the schedule rates for excavation. Approved granular material imported to the site, or hardcore base, hardcore filling or concrete screed, used on trench floors shall be paid for separately.

PSDB 5.6 BACKFILLING

In addition to the existing clauses, work shall be carried out in accordance with PSDB 5.9 and the COP.

PSDB 5.6.1 General

Add the following to this sub-clause:

Notwithstanding the requirements of sub-clauses 5.6.1 and 5.6.6, no pipe joint or pipe-fitting shall be covered by either the blanket or the backfill prior to the successful completion of the visual inspection and the pressure testing of the relevant section of the pipeline without the written permission of the Employers' Agent.

Insert the following after the first paragraph:

Trenches shall be backfilled level with adjacent surfaces immediately after completion of pipe laying and successful pressure testing (in addition all joints shall be watertight under normal operating conditions).

Employer		Contractor	
Witness:		Witness:	

PSDB 5.6.3 & Disposal of Surplus or Unsuitable Excavated Material

PSDB 5.6.4

Add the following to this sub-clause:

Excavated material from the trench that is unsuitable or has become surplus because of bulking, displacement by the pipe and importation shall be disposed of at approved tipping sites to be located by the Contractor. All unsuitable material shall be spoiled within 48 hours of excavation, failing which the Employers' Agent shall be entitled to suspend work under the Contract.

The prior approval of the Employers' Agent must be obtained before surplus material may be deposited, spread and leveled at agreed sites within the area of the works.

PSDB 5.6.5 Deficiency of Backfill Material

Add the following to this sub-clause:

"All haul distances shall be freehaul distances".

PSDB 5.7 COMPACTION

PSDB 5.7.2 Areas subject to traffic loads

Add the following to this sub-clause:

In areas subject to traffic loading and in constructed footways compaction shall be done in accordance with the requirements specified in this Project Specification and the COP requirements.

PSDB 5.8 CONSTRUCTION IN HEADINGS

In addition to the existing clause the following shall apply:

Generally in soft material the buttresses and portions of ground left for the purpose of supporting the sides of the trenches or headings providing access to private properties, shall be broken down as the refilling and compaction proceeds.

Where excavation for branch pipelines are refilled, after the main pipeline excavations, the materials in the latter shall be stepped or raked back and compacted in 300 mm layers, simultaneously with the refilling of the branch pipelines excavation.

PSDB 5.9 RE-INSTATEMENT OF SURFACES

Insert the following to the existing clause:

Re-instatement of surfaces shall be in accordance with the Project Specification, variations and additions to the SANS 1200 specification and the COP, where the COP will enjoy preference.

The permanent re-instatement of the top 100 mm (or 150 mm in the case of arterial roads) of trenches in surfaced roads and sidewalks will be done by the Roads Directorate, unless instructed otherwise by the Employers' Agent .

The Contractor shall backfill the trenches in accordance with the "Code of Practice for Excavations, Backfill and Re-instatements in the Johannesburg Municipal Area" issued by the Roads Directorate. The Contractor's attention is drawn to the requirements regarding bearing capacity of the materials used at the various levels of backfilling under roadways, and the need for selection and modification of the in-situ materials excavated, or for importing suitable approved materials.

The Contractor will be held responsible for placing and maintaining the temporary top 100 mm (or 150 mm as above) until the permanent surface re-instatement carried out, and for settlement of the trench backfill, excluding that part of the permanent re-instatement is carried out by the Council. It is recommended that the Contractor avails himself of the facilities offered by the Roads Directorate's Laboratory for testing the materials and the compaction of backfill layers as the work progresses. The Contractor shall provide the Employers' Agent with copies of all test results, irrespective of what agency does the testing.

Employer		Contractor	
Witness:		Witness:	

Except where separate provision for payment is made in the Bill of Quantities, the tendered rates shall include for:

- the selection and, where required, modification of excavated materials, or alternatively the importing of suitable approved materials used in trench backfill for re-instatement;
- all testing of the materials and the compaction;
- the provision of copies of the test results;
- the provision and proper maintenance of the temporary re-instatement of the top 100 mm (or 150 mm as stated above) of the trench until the JRA starts to construct the permanent re-instatement, or for a maximum period of twelve weeks after completion of the Work;
- the cost of permanent re-instatement work done by the Roads Directorate.

Should the Contractor fail to reinstate the surface of any trench or any other excavation, other than where re-instatement is to be carried out by the JRA, within two weeks of the conduit concerned having been laid or other work having been approved, the Employers' Agent may, at his discretion, arrange for such re-instatements to be carried out by some other party and the cost of this work shall be deducted from monies due to the Contractor. The Contractor shall not be relieved of any responsibility for defects or claims arising from the condition of any trench reinstated by the other party on the instructions of the Employers' Agent .

PSDB 5.9.2 Re-instatement - private property and commonage

Delete existing clause and replace with the following:

"Re-instatement shall be with the same type of surfacing (including supporting structures; example bedding layers, jointing sand, structural joints, etc) and to at least the same standard and conditions as existed before excavation took place.

Grass sods shall be neatly cut out from grassed areas to be excavated and shall be preserved and kept damp until they can be replaced during the re-instatement. All other material to be used for re-instatement shall be suitably stored for such purpose. Any settlement below original ground level that occurs during the execution of the Contract or the Defects Liability Period shall be made good by and at the cost of the Contractor within a reasonable period as determined by the Employers' Agent ."

PSDB 5.9.4 Bitumen roads and surfaced footways: sub-base and base

In addition to the existing clause the following shall apply:

"No separate payment shall be made for the above procedure, which shall be deemed to be included in the rates and prices tendered. The tendered rates shall allow for the substitution of re-instatement of sub-base and base course layers with material complying with the latest version of the COP. Additional re-instatements necessitated by cover excavation, slips or falls shall be to the account of the Contractor."

PSDB 5.9.5 Bitumen roads and surfaced footways – surfacing

Delete the existing clauses 5.9.5.1 and 5.9.5.2 and replace with the following:

PSDB 5.9.5.1 General

The Contractor shall inform the Employers' Agent in writing when the road or surfaced verges are ready for re-instatement. The scheduled item for re-instatement of surfacing allow for widths 0,20 m greater than the specified trench widths for road crossings. Extra re-instatements necessitated by over excavation, slips or falls shall be to the account of the Contractor.

The Contractor shall not carry out re-instatement of surface trenches in roadways under the maintenance of the JRA, unless otherwise authorised in writing by the JRA and copied to the Employers' Agent . The Contractor, at tendering stage, shall thus obtain rates in consultation with the JRA and shall be responsible for payment to the JRA.

Employer		Contractor	
Witness:		Witness:	

PSDB 5.9.7 Re-instatement of concrete

In addition to the existing Clause 5.9 the following shall apply: All existing concrete surface shall be reinstated to original level and final finish (wood floated or steel floated or other) with unreinforced concrete of 15 MPa (minimum) strength. The reinstated concrete shall also not exceed 125 mm but shall not be less than 50 mm.)

PSDB 5.9.8 Interlocking blocks, paving slabs and bricks

All the existing blocks, slabs or bricks shall be cleaned and re-used. The blocks, slabs or bricks, which have been taken up, shall be stacked in a safe manner without restriction to vehicular or pedestrian traffic. Blocks, slabs or bricks around manhole covers shall be finished level with the manhole cover top. The cost of additional interlocking blocks, paving slabs or bricks required for complete re-instatement, over and above those taken up and stacked, shall be included in the rates tendered for the re-instatement of surfaces.

PSDB 5.9.9 Kerbing

All existing types of kerbing that has been removed shall be cleaned and stacked in a safe manner without restricting to vehicular or pedestrian traffic. The Contractor shall replace all kerbing removed during trenching.

PSDB 7 TESTING

PSDB 7.1 DENSITY TESTS AND IN-SITU SHEAR STRENGTH TESTS

Add the following to this sub-clause:

The JRA laboratory shall carry out quality control testing of compaction densities and in-situ shear strength in road reserves. Any testing by the JRA will not relieve the Contractor of his responsibility to ensure adequate compaction and material quality throughout and the Contractor should therefore carry out his own regular tests. The Contractor shall furnish the Employers' Agent with the originals of all such test results.

In the event that the Contractor does not conduct his own regular compaction and in-situ shear strength tests and relies on the results of the JRA laboratory, the Contractor will be liable for the costs associated with the re-testing of all failed sections of reinstated trench.

If any test result shows that the specified compaction or shear strength requirements have not been met, the Contractor shall at his own expense and within 7 days of receipt of the Employers' Agent's instruction take the following remedial action:

- 2) Backfill material other than structural layers of bituminous roads and constructed footways
 - a) Trench excavations (other than road crossings)
The backfill material shall be removed to a depth of 450 mm for a distance of 2 m on either side of the point at which the test was taken. If the backfill material is suitable, it shall be replaced and re-compacted to the specified densities. Otherwise suitable material shall be imported and compacted and the excess material removed.

Where adjacent test results show that the backfill densities are below specified requirements, the entire length of trench between the points at which the tests were taken shall be re-excavated and re-compacted as required above. Density testing along trench excavations shall be carried out at intervals, as directed by the Employers' Agent.

- b) Trench excavations (road crossings)
As for (a) above save that the backfill material shall be removed to a depth of 450 mm over the full length of the trench.
- c) All other excavations
As for (a) above save that the backfill material shall be removed to a depth of 450 mm over the extent of the excavation.

Employer		Contractor	
Witness:		Witness:	

- 3) Structural layers of bituminous roads and constructed footways
In the case where a structural layer does not meet the shear strength requirements, the structural layer in question shall be removed. If, however, any other layers have been constructed on top of the layer in question, then all such layers shall also be removed at the cost of the Contractor, even if the shear strengths of these layers meet the specification.

- a) Trench excavation (other than road crossings)
The layer shall be removed to its full depth for a distance of 2 m on either side of the point at which the test was taken. If the material is suitable, it shall be replaced and re-compacted to the specified shear strength. Otherwise suitable material shall be imported and compacted and the excess material removed.

Where adjacent test result show that the shear strengths are below specified requirements, the entire length of trench between the points at which the tests were taken shall be re-excavated and re-constructed as required above. In-situ shear strength testing along trench excavations shall be carried out at intervals, as directed by the Employers' Agent .

- b) Trench excavation (road crossings)
As for (a) above save that the layer shall be removed to its full depth over the full length of the trench.
- c) All other excavations
As for (a) above save that the layer shall be removed to its full depth over the extent of the excavation.

- 4) Premix re-instatement

- a) Trench excavations (other than road crossings):
The premix shall be removed for a distance of 1m on either side of the point at which the test was taken and reinstated in accordance with the COP requirement.
- b) Trench excavations road crossings:
As for (a) above save that the premix shall be removed over the full width of the road.
- c) All other excavations:
As for (a) above save that the premix shall be removed over the full extent of the excavation.

The Employer (where the Employer wishes to perform additional control tests) or the JRA shall not be liable for additional costs or delays arising from remedial work required to excavations, which have already been finally reinstated before their test results, become available.

PSDB 7.2 INSPECTION AT INTERMEDIATE STAGES OF CONSTRUCTION

The contractor shall call for an inspection of the works at the following intermediate stages of construction.

- (1) After completion of the trench excavation and preparation of the trench bottom; and before any pipe is laid.
- (2) After the selected backfill material has been placed around the pipe; and before the remainder of the trench is backfilled.
- (3) 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 Employers' Agent or his representative on site. Failure to comply with the provision of this clause shall result in the suspension of work for a period as determined by the Employers' Agent .

PSDB 8 MEASUREMENT AND PAYMENT

PSDB 8.1 BASIC PRINCIPLES

PSDB 8.1.4 All haul shall be freehaul.

Employer		Contractor	
Witness:		Witness:	

PSDB 8.2 COMPUTATION OF QUANTITIES

PSDB 8.2.3 Computation of Quantities

The base widths tabled in SANS 1200 DB clause 5.2 shall be the maximum widths measured for payment.

PSDB 8.3 SCHEDULED ITEMS

Add the following new clauses:

8.3.1 Site Clearance and Removal of Topsoil

Add new items as follows:

PSDB8.3.1.1 Saw cut, remove and dispose of existing asphalt

The rate shall cover saw, cut, removal, handling, transport and proper off-site disposal of all types of existing asphalt and stone crush base up to a maximum thickness of 40 mm. **Unit: m²**

PSDB8.3.1.2 Saw cut, remove and dispose of concrete (un-reinforced)

The rate shall cover saw, cut, removal, handling, transport and proper off-site disposal of existing un-reinforced concrete of maximum thickness 150 mm. **Unit: m²**

PSDB8.3.1.3 Remove and temporarily store of paving block units

The rate shall cover removal, handling, transport and proper storage of all types of existing paving block units for later re-instatement. **Unit: m²**

PSDB8.3.1.4 Remove and temporarily store of grass sods

The rate shall cover removal, handling, transport and proper storage and maintenance of existing grass in sods for later re-instatement. **Unit: m²**

PSDB8.3.1.5 Remove and temporarily store all types of kerbing

The rate shall cover removal, handling, transport and proper storage of all types of existing kerbing for later re-instatement. **Unit: m**

PSDB 8.3.2 (b) Extra-over for intermediate material and rock

The extra-over rates for excavating in, intermediate and rock materials shall cover the additional cost of excavating (using non-blast methods) and handling materials classified as such and shall include the cost of importing suitable bedding and backfill materials and the disposal of unsuitable material to the Contractor's tipping site and the replacement of same with suitable material. **Unit: m³**

PSDB 8.3.3 Excavation ancillaries

PSDB 8.3.3.4 Overhaul

Delete this sub-clause and replace with the following:

Overhaul is not applicable. Hence all distances applicable are considered as free haul distances and no additional payment will be applicable.

PSDB 8.3.5 Existing services that intersect or adjoin a pipe trench

Add the following to the end of the sub-clause:

- (v) notifying and attending upon the proprietor of the service,
- (vi) supporting and protecting the service while the pipeline is installed, inspected, tested and backfilled.

Employer		Contractor	
Witness:		Witness:	

PSDB 8.3.6 Finishing

General

Delete “road”. This clause shall be extended to cover surfaces other than road surfaces,

The width of any trench through an area grassed or paved with bricks or pre-cast concrete units shall be the minimum practicable width, which in the opinion of the Employers' Agent is sufficient. In the case of blocks this minimum area will be the minimum area over which units (whether bricks or pre-cast units) can be removed without requiring cutting.

The Contractor's rate for supply and lay of asphalt must provide for all plant, labour and material costs associated with the work, including inter alia:

The cost of the asphalt and foamed concrete, the collection, transport to site and placing in accordance with the JRA specification. All wastage and overbreak re-instatement costs, including the purchase of the asphalt and foamed concrete.

PSDB8.3.6.1 Replace “parking areas” with “areas other than roadways”.

Add the following new clauses:

PSDB 8.3.6.1a Re-instatement of asphalt surfaces

The rate shall cover supplying, loading, transporting and re-instatement all layers complete to previous levels (or levels to suite proper stormwater drainage), and surfacing by JRA of asphalt surfaced roads to the original condition **Unit: m²**

PSDB 8.3.6.1b Re-instatement of concrete, complete

The rate shall cover loading, transporting and re-instatement complete to previous levels (or levels to suite proper stormwater drainage), and surface finish of 20 MPa (minimum) un-reinforced concrete strength. The reinstated concrete shall also not exceed 150 mm but shall not be less than 50 mm.) **Unit: m²**

PSDB 8.3.6.1c Re-instatement of bricks and pre-cast concrete units, complete

The rate shall cover loading, transporting and re-instatement complete with bricks/pre-cast unit-receival area preparation, compaction (minimum 90%Mod AASHTO density), levelling, 20 mm river sand bedding, laying bricks/units, plaster sand jointing, and compaction. **Unit: m²**

PSDB 8.3.6.1d Re-instatement of grass sods, complete

The rate shall cover loading, transporting, and re-instatement complete with grass-receival area preparation, compaction, levelling, laying sods, topsoiling, and watering (water not from property supply). **Unit: m²**

PSDB 8.3.6.1e Re-instatement of all types of kerbing, completing

The rate shall cover loading, transporting and re-instatement complete with sand-cement bedding, laying units, mortar jointing, haunching, and backfilling, compaction (minimum 90 % Mod AASHTO density) and levelling behind kerbs. **Unit: m**

Employer		Contractor	
Witness:		Witness:	

PSDB 8.3.7 Accommodation of traffic

General

All the requirements of the relevant traffic authorities with regard to traffic signs, accommodation of traffic etc. shall be strictly adhered to.

The Contractor shall programme his works in such a way that disturbance to traffic flow is kept to a minimum with adequate road signage to indicate how the traffic is to be diverted and accommodated.

Access to individual holdings must be maintained on a continual basis unless written agreement to the contrary is obtained from the residents affected. Residents must be informed at least 24 hours in advance if their access is to be closed during normal office working hours (08:30 to 16:30). Access must be made available outside of these hours unless prior arrangements have been made with the individual residents.

No additional payment or extension of time shall be entertained by the Employers' Agent for the accommodation of traffic as all items required shall be accepted to have been covered in the rates and in the time of completion as tendered.

REPLACE THE HEADING AND CONTENTS OF SUBCLAUSE 8.3.7 WITH THE FOLLOWING:

"Accommodation of Traffic.....**Unit: Lump 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 SABS 1200DB (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 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. A detailed breakdown of the required traffic accommodation can be found in the table below:

The tendered Lump Sum shall not be adjusted in the event of any extension of time for completion being granted by the Employers' Agent in accordance with Clause 45 of the Conditions of Contract.

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.."

Employer		Contractor	
Witness:		Witness:	

SANS 1200 F: PILING

PSF 5.1.3.3 Add Additional Clause

The Contractor shall take full responsibility for piling work and shall guarantee that piling work will support the calculated loads laid down by the Employer's Agent without injurious settlement. The actual lengths of piles shall be determined on site by the Contractor in consultation with the Employer's Agent who will give all assistance possible. This does not in any way relieve the Contractor of his responsibility or obligation to provide the specific guarantee.

The Contractor shall indemnify the employer against any injury to or death of any person and all loss or damage to all structures resulting from failure of any pile. In the event of the failure of any pile the Contractor shall make good such pile and all consequent damage at his own expense

The Contractor shall insure in a policy, approved by the Employer's Agent, against risks arising out of the responsibilities, guarantee and indemnities specified. The Contractor shall pay all premiums in respect of this insurance policy. The guarantee shall be for the amount of R 5 000 000.00 (Five Million Rand) and shall be effective for a period of 3 (Three) years from the date of completion of the contract

Add the following the clause:

PSF 7.9 Inspection of adjoining properties

The Contractor shall carry out inspections and evidence collection of properties adjoining the works to ensure that in the event of a claim arising from any of the owners of the adjoining properties for damage to property and the like, the Contractor has substantial evidence to support or refute such claims. The Contractor accepts full liability and responsibility for damage which he causes to adjoining properties, as well as any costs involved in refuting or processing of such claims.

PSF 8.2.27 Inspection of surrounding structures by specialist appointed by the Contractor before and after construction of piles..... Unit: Sum

The tendered rate shall include full compensation for the cost the overhead and all related costs to appoint a specialist with proven similar experience, and for the specialist to complete a full inspection of surrounding structures before and after the construction of the piles.

Employer		Contractor	
Witness:		Witness:	

SANS 1200 G:CONCRETE (1982)

PSG 3 MATERIALS

PSG 3.1 APPROVAL OF MATERIALS

In addition to the existing clause the following shall apply:

The type of brand of cement stated in the Tender Certificate shall not be changed unless the Employers' Agent's prior written approval to do so has been given.

PSG 3.2 CEMENT

PSG 3.2.1 Applicable specifications

Add the following:

All references to 'Ordinary Portland Cement' shall be replaced with 'Portland composite cement (CEM II 32,5)'."

PSG 3.2.2 Alternative types of cement

Replace the contents of this subclause with the following:

"Only Portland composite cement (CEM II 32,5) shall be used.

If the Contractor wishes to use any other type of cement, he shall obtain the Employer's Agent's prior written approval (see 8.1.3.2 and 8.1.3.3). The tendered rates, however, shall be based on the use of Portland composite cement (CEM II 32,5) only."

PSG 3.2.3 Storage of cement

Add the following:

"Cement shall not be stored for longer than 12 weeks without the Employer's Agent's permission."

PSG 3.4 AGGREGATES

PSG 3.4.3 Storage of aggregates

Add the following:

When aggregates of different chloride content are stored on the site, their use in the various classes of concrete shall be strictly controlled."

PSG 3.5 ADMIXTURES

PSG 3.5.1 Approval of admixtures required

Add the following:

- a) Water proofing additive with tracing agent or similar approved.
- b) Minimum dosage 0,8% by weight of cementitious content, with 20 year warranty and all to manufacturers specifications. Concrete to be placed, protected and cured according to SANS 10100-2"

PSG 4 PLANT

PSG 4.1 General

Add the following subclause:

Employer		Contractor	
Witness:		Witness:	

PSG 4.1.1 Minimum plant

The Contractor shall have the following minimum plant available and in sound working order:

- (a) One concrete mixer of sufficient capacity to complete a section of the floor or road between construction joints within 4 hours and without interruption
- (b) Two concrete vibrators, at least one of which shall be powered by an internal combustion engine
- (c) One air compressor
- (d) Suitable and adequate plant to transport concrete and other material and equipment at all stages of construction
- (e) Storage tanks of adequate capacity to ensure that sufficient water will be available before commencement of every major concrete-placing operation.

If the Plant used for placing concrete is electrically or mechanically powered, the Contractor shall also provide some other approved, non-electrically-powered standby means for placing concrete at an adequate rate in the event of a power or mechanical failure of the main Plant."

PSG 4.5 Formwork

PSG 4.5.1 Design

Add the following:

"All formwork, falsework or scaffolding required for any part of the Works shall be designed by the Contractor, and before commencing with the erection of any formwork, falsework or scaffolding, the Contractor shall submit the methods he proposes to use to the Employer's Agent for approval. The Employer's Agent has the authority to order alterations to the design or the sizes of any part of the formwork, falsework or scaffolding. The Contractor shall check the safety and suitability of all such alterations. The fact that the Employer's Agent has approved or altered any part of the formwork or scaffolding shall not be construed as relieving the Contractor of his responsibility with regard to the strength and stability of the formwork, falsework or scaffolding."

PSG 4.5.3 Ties

Add the following: "No plugs, bolts, ties or clamps of any description used to hold the formwork will be allowed to project into or through the concrete unless expressly approved by the Employer's Agent.

Only approved tie-rods consisting of solid rods (that remain embedded in the concrete) and with removable ends shall be used to hold the formwork of the walls. The removable tie-rod ends shall facilitate removal without damage to the concrete, and no permanently embedded parts of such tie-rods shall have less than 50 mm of cover to the finished concrete surface.

The cavities left in the concrete when the tie-rod end cones are removed shall be soundly caulked with a cement mortar to which an approved shrinkage-reducing agent has been added, and shall be neatly finished to a smooth surface uniform with that of the surrounding concrete.

The cost of supplying special tie-rods as well as the filling of cavities left by the tie-rod cones shall be included in the rates tendered for formwork under the appropriate pay items.

On no account shall formwork be secured to reinforcing bars."

PSG 5 CONSTRUCTION

PSG 5.1 Reinforcement

PSG 5.1.2 Fixing

Add the following:

Employer		Contractor	
Witness:		Witness:	

"The Employer's Agent will inspect the reinforcing after it has been fixed in place, the formwork has been cleaned, cover blocks have been positioned, and before concreting commences.

Welding of reinforcing steel will not be permitted."

PSG 5.1.3 Cover

Add the following:

"The distance between pipes in the concrete and the reinforcing steel shall nowhere be less than

(a) 40 mm or

(b) 5 mm plus the maximum size of the coarse aggregate, whichever is the largest."

PSG 5.2 FORMWORK

PSG 5.2.2 Preparation of formwork

In addition to the existing clause, the following shall apply.

"Tapered plugs of wood or other material shall be used on the inside surfaces of formwork at all tie bolts and shall be withdrawn after the removal of the forms. Bolt holes and the recesses formed by the plugs shall be completely filled with cement mortar smoothly and neatly finished flush with the concrete surface. Recesses with smooth interiors shall be roughened adequately to provide bond for the mortar filling.

Inside corners in the formwork shall have 25 mm by 25 mm triangular fillets, unless otherwise detailed or directed.

Construction joints shall be positioned as shown on the Drawings"

PSG 5.2.3 Special Off-form Finishes:

(a) General

No treatment other than treatment of bolt holes, which shall be placed with regularity and precision will be required.

The forms used shall be unblemished and the panels regular. Joints shall be a feature of the pattern and shall be handled with care. The finished concrete shall be accurate to a Degree of Accuracy I.

(b) Semi - Smooth and Smooth

(i) General

Where the concrete is indicated as semi-smooth or smooth the following shall apply:

The cement, fine and coarse aggregates shall be from selected and consistent sources to impart to the concrete an even mix and colour throughout.

Joints in the material of the formwork are to be straight and tight and in uniform and symmetrical pattern to the satisfaction of the Employer's Agent and Architect to whom details must be submitted before formwork is fixed. Nails or screws which will leave marks on the concrete surface must be in straight lines and at regular intervals.

Tubes, grommets, holes or similar devices for holding or spacing formwork shall likewise be in straight lines and at regular intervals.

All aspects of the finish and details likely to cause blemishes in the finished concrete

Employer		Contractor	
Witness:		Witness:	

faces are to be to the satisfaction and approval of the Employer's Agent and Architect.

(ii) Semi-smooth

Formwork described as "semi-smooth" shall be such as to impart to the resultant concrete face a finish that would be obtained from the use of plywood faced shuttering board or special steel forms which are new when concreting commences and are thoroughly cleaned after each use. Where necessary concrete is to be rubbed down with a carborundum stone.

(iii) Smooth

Formwork described as "smooth" shall be such as to impart to the resultant concrete face a smooth face equivalent to "two-coat plaster". Where necessary concrete is to be rubbed down with a carborundum stone.

PSG 5.2.5 Removal of formwork

Add the following subclause:

"PSG 5.2.5.7 The Contractor shall make provision for the continued support of beams and slabs while the formwork is being removed and/or for back propping of beams and slabs."

PSG 5.5 CONCRETE

PSG 5.5.1 Quality

PSG 5.5.1.7 Strength concrete

Add the following to this sub-clause:

The following concrete classes must be used in the following positions unless shown differently on the drawings:

Class 15MPa/19 mm Blinding layer, mass concrete, pipe encasings

Class 30MPa/19 mm All structural concrete

PSG 5.5.3 Mixing

PSG 5.5.3.2 Ready-mixed concrete

Concrete from an approved ready mixed concrete supplier shall be permitted provided it conforms to the specification. The contractor shall take samples for testing from every load delivered to the Site. Such supplier shall be deemed to be a Sub-Contractor in terms of the Contract. The test results shall be acceptable when evaluated in terms of SANS 1200 G-7.3.

PSG 5.5.5 Placing of concrete

PSG 5.5.5.1 *In addition to the existing clause, the following shall apply:*

Concreting shall not commence until approval to do so has been granted, at least 24 hours notice being required. Concrete shall not be placed before the steel reinforcement has been checked and approved. Concreting shall be done during normal working hours and only, in exceptional circumstances, outside such hours.

PSG 5.5.6 Compaction

PSG 5.5.6.1 *Add the following to this sub-clause:*

Only mechanical vibrators will be allowed for compaction, unless the Employers' Agent approves in writing any other method.

Employer		Contractor	
Witness:		Witness:	

PSG 5.5.10 Concrete surfaces

PSG 5.5.10.3 *Add the following to this sub-clause:*

Benching in manholes and channels	steel float finish
Top of manhole covers	steel float finish
All other surfaces	wood float finish

PSG 5.5.15 Records

Add the following new clause:

The Contractor shall maintain written records that provide detailed information in the form of a control chart indicating the compressive strengths of test cubes at 7 days and 28 days, including identification of the section where the concrete was cast and the class of concrete specified.

PSG 7 TESTS

PSG 7.2 TESTING

Add the following new clause:

PSG 7.2.5 Testing by the Employers' Agent

The Employers' Agent may, from time to time, require check tests to be done on concrete cube strengths in addition to the regular tests performed by the Employers' Agent. The results of these tests will also be recorded on the control chart and will form part of the criteria for assessment of concrete quality. If required, a Provisional Sum has been included in the Bill of Quantities for this purpose.

PSG 8.2 SCHEDULED ITEMS

Add the following new clause:

PSG 8.2.7 Semi-Smooth plane Unit : m²

The surfaces to be so formed will be identified in the schedule, (see clause PSG 5.2.3)

Employer		Contractor	
Witness:		Witness:	

PSL MEDIUM-PRESSURE PIPELINES (SANS 1200 L)

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 clause:

PSL 7.3.1.2 Hydrostatic Test

The by-pass pipeline shall be subjected to the following hydraulic test pressure:

- i) Bridge 1: 330 kPa
- ii) Bridge 2: 485 kPa
- iii) Bridge 3: 440 kPa

Add the following new clause:

"PSL 8.2.1 Supply,Handle, Lay, joint, Bed and Test (insert Description) Pipes Complete with Couplings Unit : m

Pipelines will be measured by length overall lengths as laid. No deduction will be made for specials and valves. Separate items will be scheduled for each diameter and each type and class of pipe laid.

The rates shall cover the cost of the provision of the pipes complete with couplings, and the costs of transporting, unloading the pipes and placing them along the trenches, inspecting, bedding, laying, jointing, cutting, testing and, when relevant, disinfecting of the pipes and the joints.

"PSL 8.2.2 Extra-over PSL 8.2.1 for the Supplying, Laying, and Bedding of Specials Complete with Couplings Unit : No.

Add the following new clause:

"PSL 8.2.13.1 Supply, install and test mobile pump to drain diversion pipeline after completion of repair works. Unit : No

The rate shall cover the cost of the provision of a mobile trailer mounted self-priming diesel sewage pump capable of delivering head of 6 bars at 0.038m³/s complete with 150mm diameter suction pipe, couplings and the costs of transporting, unloading the pump, inspecting, installing and testing.

Add the following new clause:

Employer		Contractor	
Witness:		Witness:	

"PSL 8.2.13.2 Operate the pump to clean and clear grit and debris collected in the pipe diversion pipeline during and on completion of construction Unit : Sum

The rate shall cover the cost of the provision of labour for operation of the pump to clean and clear grit and debris collected in the pipe diversion pipeline during and on completion of construction.

Add the following new clause:

"PSL 8.2.13.3 De-establish pump installation after completion of works Unit : Sum

The rate shall cover the cost of provision of labour and means of transport, dismantling of pump and transportation after completion of works."

Add the following new clause:

"PSL 8.2.16 Collect from supplier and deliver to site (state distance one-way) ... m length(stated weight) x mm diameter (pipe type) Unit : Number

The rate shall cover the cost of provision of labour, loading & offloading equipment and of transporting, the pipes from the supplier to site. Pipes to be handled in terms of PS4.2.7."

Add the following new clause:

"PSL 8.2.17 Handle, lay, joint, bed and test (describe) pipes supplied (describe) complete with couplings.....Unit: m"

The rate shall cover the cost of provision of labour, plant & equipment to handle, lay, joint, bed and test free issue pipes to SANS 1200 specification"

Employer		Contractor	
Witness:		Witness:	

PSLB BEDDING (SANS 1200 LB)

PSLB 3 MATERIALS

PSLB 3.1 Selected granular material

The maximum aggregate size, not to exceed 6mm. Material should not be free draining and shall have a permeability that is lower than that of the in-situ soil.

PSLB 3.3 Bedding class

All flexible pipes should be laid on bedding as shown on drawings except where special protection is required.

All rigid pipes shall be laid on class B bedding as shown on drawings.

PSLB 3.4 Supply of bedding material

Selected bedding material can be obtained from trench and other necessary excavations. No borrow pits are available on site and none will be allowed. Indications are that a substantial amount of trench excavation will be suitable for bedding.

All bedding and backfill material shall, after compaction, be less permeable than the in-situ surrounding soil in all areas.

Employer		Contractor	
Witness:		Witness:	

PSLD SEWERS (SANS 1200 LD)

PSLD 3 MATERIALS

PSLD 3.5 MANHOLES, CHAMBERS, ETC

PSLD 3.5.2 Precast concrete sections

add the following:

Sectional spun-concrete cylinders shall be manufactured from dolomitic aggregate.

PSLD 3.6 MARKER POSTS

replace the words "Project Specification" with "Drawings".

PSLD 5.9 CONNECTING SEWERS

PSLD 5.9.1 Location and details

delete the following from the first paragraph:

"or required in terms of the Project Specifications."

delete the second paragraph.

PSLD 8 MEASUREMENT AND PAYMENT

PSLD 8.2 SCHEDULED ITEMS

PSLD 8.2.11 Connection to existing sewer at

replace this item with the following:

"PSLD 8.2.11 Connection to existing sewer Unit : Sum

The tendered sum shall include full compensation for excavation, making an opening in the existing manhole, installing new pipes in the new opening, for breaking out and modifying the channelisation inside the manhole to suit the new pipe layout, ensuring the water tightness of the new connection, supplying all the necessary materials, removing surplus material and debris, all labour and equipment required to make the connection, and liaison with the Client or local authorities."

add the following item:

"PSLD 8.2.13 Breaking into existing sewer and building a new manhole.....Unit : number

The tendered rate shall include full compensation for excavation, building a new manhole over the sewer pipe, breaking into the existing sewer pipe, building the channelisation under wet conditions, ensuring the water tightness of the new connection, supplying all the necessary

Employer		Contractor	
Witness:		Witness:	

materials, removing surplus material, all labour and equipment required to make the connection, and liaison with the Client or local authorities."

add the following item:

"PSLD 8.2.14 Direct connection to existing sewer Unit : Sum

The tendered sum shall include full compensation for excavation, making an opening in the existing sewer pipe, connecting new pipes on the existing sewer pipe, ensuring the watertightness of the new connection, supplying all the necessary materials, removing surplus material and debris, all labour and equipment required to make the connection, and liaison with the Client or local authorities."

add the following item:

**"PSLD 8.2.13.1 Temporary raising of existing manholes to 2.5m height Unit :
P/sum**

The tendered sum shall include full compensation for provision of shutters, erection to specified height and sealing to prevent leakages and dismantling on completion.

add the following item:

**"PSLD 8.2.13.2 Seal and strap down manhole covers to prevent leakages Unit :
P/sum**

The tendered sum shall include full compensation for the sealing with mortar of manhole covers and mounting of strapping down bars to prevent leakages.

Employer		Contractor	
Witness:		Witness:	

PSMM ANCILLARY ROADWORKS ((SANS 1200 MM))

Add the following:

PSMM 1 SCOPE

This specification covers material requirements and installation of security fencing and gates for the project.

- a) Work includes
Furnish and install fence and gates, and accessories as required.
- b) Submittals
 - i Certificate of compliance for materials and coatings.
 - ii Shop drawing for gates.
 - iii Quality control program shall be submitted to the Employers' Agent for review prior to commencement of any work.

PSMM 3.4 MATERIALS (HIGH SECURITY FENCES AND GATES)

PSMM 3.4.1 Post, Panel, Toppings and Anti-Burrow

PSMM 3.4.1.1 General

- a. All steel materials shall be of good commercial quality, galvanized steel.
- b. All pipes shall be galvanised (one piece without joints).Furnish moisture proof caps for all posts.
- c. Zinc coating shall be smooth and essentially free from lumps, globs, or points.
- d. Miscellaneous material shall be galvanized

FENCE DESIGNATION	DIM 'A'	DIM 'B'	DIM 'C'	POST SIZE DIM 'D'
1800mm	1800mm	2400mm	290mm 3100mm 3300mm	Taper: 85 x 45mm Depth: 85mm
2100mm	2100mm	2700mm	3200mm 3400mm 3600mm	Taper: 85 x 45mm Depth: 85mm
2400mm	2400mm	3000mm	3500mm 3700mm 3900mm	Taper: 85 x 45mm Depth: 85mm
3000mm	3000mm	3600mm	4100mm 4300mm 4500mm	Taper: 85 x 45mm Depth: 85mm

PSMM 3.4.1.2 Post

- a) Post shall be 2.4 long Taper Locking Post.
- b) Post width shall be 85mm – tapering to 45mm with a depth of 85mm.
- c) Post shall include 'Locking Recess Mechanism' to secure panel edge.
- d) Post shall be sealed with a UV stabilized polymer cap.
- e) Post finish shall be Galvanized.

Employer		Contractor	
Witness:		Witness:	

- f) Post foundation shall be 600mm x 400mm² 15Mpa concrete

PSMM 3.4.1.3 Panel

- a) Panel shall be of 3,305m width and 1.8m in height.
- b) Panel aperture size (centres) shall be 76.2mm x 12.7mm.
- c) The panel shall be reinforced with 4 x 50mm deep “v” formation horizontal recessed bands (rigidity)
- d) Panel shall have 2 x 70° flanges along sides (internal) fixtures – all fixtures shall be on the inside of fence line)
- e) Panel shall have 2 x 30° flanges along top and toe (integrated rigid angle).
- f) Panel post shall have a flush panel post finish with no climbing aid.
- g) Panel shall be affixed to post cover 48 line wires using 8 x Double bolt comb clamps and 8 x single bolt comb clamps using 24 x Anti vandal bolts.
- h) Panel and fixtures shall be Galvanised.

PSMM 3.4.1.4 Topping

- a) A 100mm high toughened steel Shark Tooth spike shall be affixed to top panel edge, internally at 150mm intervals using Anti-vandal bolts. Spike finish shall be Hot Dipped Galvanised.
- b) A 100mm high toughened steel Castle spike shall be affixed to panel edge, internally at 150mm intervals using Anti-vandal bolts. Spike finish shall be Hot Dipped Galvanised.
- c) A 100mm high toughened steel Spear spike shall be affixed to panel edge, internally at 150mm intervals using Anti-vandal bolts. Spike finish shall be Hot Dipped Galvanised.
- d) A 730mm high Ripper Blade Smart Concertina Coil shall be fixed to post as anti –scale topping. NATO 5660-99-458-7414 or similar approved.

PSMM 3.4.1.5 Anti-Burrow

- a) A 600mm Clear View or similar approved mesh extension shall be secured to the panel’s lower edge integrated angle.
- b) A 500mm Ripper Flat Wrap shall be secured to the panels lower edge integrated angle
- c) A 200mm Concrete Still shall be secured to the panel’s lower edge integrated angle.

PSMM 8 MEASUREMENT AND PAYMENT

Add the following:

PSMM 8.6 SCHEDULED ITEMS

PSMM 8.6.1 Clear View fence panels on posts..... Unit : m

The rate shall cover the cost of supplying and erecting the fence panels, completely galvanized, as applicable, with posts (spaced to suit the standard length of panels (see PSMM 3.4.1.3), bolts, nuts, washers, and reinforcing plates, and of excavating, backfilling post holes and disposing of surplus excavated material.

Employer		Contractor	
Witness:		Witness:	

PORTION B2: VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS

INTRODUCTION

Detailed under this section of the Document are the variations to the standardised specifications (COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998)).

In certain clauses the Standard Specifications allow a choice to be specified in the scope of works between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternatives or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains some additional specifications required for this particular contract.

The number of each clause and each payment item in this part of the project specifications consists of the prefix B followed by a number corresponding to the number of the relevant clause or payment item in the standard specifications. The number of a new clause or a new payment item which does not form part of a clause or a payment item in the standard specifications and which is included here, is also prefixed by B followed by a new number. The new numbers follow on the last clause or item number used in the relevant section of the standard specifications.

SECTION 6100: FOUNDATIONS FOR STRUCTURES

B6106 Founding

Add the following clause at the end of the last paragraph :

“Where foundation slabs or pile caps are cast directly against the face of the excavations, the volume of concrete measured for payment shall be the total volume of concrete placed or the volume based on the plan dimensions detailed on the drawings plus a 100mm allowance for overbreak on either side (i.e. 200mm more than the plan dimension allowing for 2 sides), whichever is the lesser. No formwork to the footing shall be measured when the concrete is cast against the face of the excavations”.

B6109 Foundation Fill

In the 5th paragraph, 7th line delete “60” substitute “45”.

Add the following after the 6th paragraph:

“Concrete blinding shall extend 100mm all-round beyond the horizontal dimensions of all formed footings to facilitate placing of the formwork, unless otherwise directed by the Engineer.

In the case of structures where excessive ground water is encountered, the blinding layer shall extend over the full plan area of the base of the excavation. Payment shall be made for the quantity of concrete calculated as the product of the specified thickness of blinding layer and the actual area of blinding placed.”

SECTION 6200 : FALSEWORK, FORMWORK AND CONCRETE FINISH

B6202 : Materials

(b) Formwork

Formwork to exposed surfaces

Add the following:

Employer		Contractor	
Witness:		Witness:	

"The formwork at construction joints shall have moulding strips 25mm x 25mm neatly butted and set at the height of the construction joint".

(vi) Permanent Formwork

Add the following paragraph:

"Anchor ties may not be less than 6mm in diameter. Void formers shall be held in position in order that no movement exceeding 1% of the deck thickness takes place during concreting. The spacing of anchor ties shall not exceed 2m."

B6207 : Formed Surfaces – Classes of Finish

(d) Class F3 surface finish

Add the following :

"The use of steel forms shall be permitted to form surfaces for which Class F3 surface finish has been specified, provided that only undamaged forms shall be used for such work and that the forms shall be subject to the approval of the engineer."

SECTION 7500: GROUND ANCHORS

B75.08 (b) Testing

Delete paragraph and insert:

"Proving tests shall be carried out in line with the SAICE CoP Lateral support in deep excavations (1993). A minimum of 2 tests should be conducted within each ground condition at each bridge site. A detailed method statement should be submitted by the contractor and approved by the engineer prior to testing. The tests may be conducted on working anchors, allowing jacking to be done against a hard surface.

The test shall also be used to calibrate the torque required on the lock nut to achieve 5-10 % of the working load on the anchor"

Item	Unit

B75.07 Proof testing of selected anchors	Number (No)

The unit of measurement shall be the number of anchors tested as instructed.

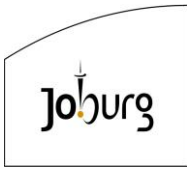
The tendered rate shall include full compensation for all labour, material and equipment required to execute the work including reporting.

Item	Unit

B75.08 Completing existing anchor lock-in, thrust plate installation and recess grouting	Number (No)

The tendered rate shall include full compensation for all labour, material and equipment required to torque the lock-in nut, over a thrust plate to 5-10 % of the working load on the anchor and permanent grouting of the thrust pocket to protect the installation.

Employer		Contractor	
Witness:		Witness:	



PORTION C: PARTICULAR SPECIFICATIONS

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Employer		Contractor	
Witness:		Witness:	

PORTION C: PARTICULAR SPECIFICATIONS

PD EMPLOYMENT AND TRAINING OF LABOUR

PD1 SCOPE

This specification covers the requirements for the employment and training of workers on the Contract.

PD2 COMMUNITY LIAISON OFFICER

An interview process involving the City of Johannesburg regional office, Johannesburg Water and the contractor will identify a Community Liaison Officer (CLO) to facilitate liaison between the Contractor and the community and amongst other things to ensure that the employment of local labour proceeds smoothly.

All decisions regarding identification and hiring of labour, relieving labour of their duties, local problems and any other matter of local importance related to the Contract, will be made in consultation with the CLO.

PD2.1 APPOINTMENT, OFFICE AND REPLACEMENT OF CLO

- The CLO will be appointed for the duration of the construction phase of this Contract.
- The CLO will occupy his own office in the Contractor's camp from where he will fulfil his duties to identify, screen and nominate labour from the community in accordance with the Contractor's requirements.
- The CLO will communicate with the Contractor daily regarding labour requirements.
- Should it become apparent that the appointed CLO fails to meet his duties, he may be relieved from his duties and replaced by a new CLO in consultation and approval with the Project Steering Committee.
- One CLO will be appointed per ward from the time that work starts in that ward until all work in that ward has been completed.

PD2.2 DUTIES OF THE CLO

- He will attend all meetings of the committee pertaining to this Contract.
- He will be available on site daily between the hours of 07:30 and 18:30, and at other times as the need arises.
- He will consult with the Contractor and the Employers' Agent daily to determine the labour requirements regarding amount and skills, to identify possible labour disputes, and to inform local labourers timeously when they will be relieved.
- He is responsible to screen candidates, to inform them of their conditions of temporary employment and to ensure their timeously availability.
- He will ensure that all workers who are involved in activities where productivity rates have been agreed, are fully informed regarding the expected level of productivity for the given tasks to be assigned as part of this Contract.
- He will attend disciplinary proceedings to ascertain that hearings are fair and reasonable.
- In consultation with the Contractor, he will determine the needs of the local labour for relevant technical training. Again he will be responsible for the identification of suitable trainees. He will also be required to attend some of the training sessions.
- He will keep a daily written record of his interviews and community liaison.
- He will attend the first part of the monthly Contractual site meetings to report about the local community labour involvement as well as any other relevant problem that needs attention.
- He will liaise regularly with the Project Steering Committee to ensure that their co-operation is obtained and their decisions accommodated. He will thus act as a liaison officer between the Contractors on site and the local community through the project committee.
- He will be involved in all SMME related matters (Contracts, terminations etc)

Employer		Contractor	
Witness:		Witness:	

PD2.3 SCHEDULED ITEM

- PD2.3.1a *Community Liaison Officers - Salaries* **Unit: Provisional Sum**
The tendered sum shall include full compensation for the provisions of the CLO including salary, provision of an office, transport costs, the cost of typing, printing and distributing notices, and for all other obligations described in Clause PD2.2.
- PD2.3.2b *Community Liaison Officers – Cellular phone* **Unit: Provisional Sum**
The Contractor must supply the CLO with a cellular phone for the duration of the CLO employment Contract and this rate must cover the cost of procuring and commissioning that phone.
- PD2.3.2c *Community Liaison Officers – Communication* **Unit: Provisional Sum**
The Contractor must allow R 500, 00/ month per CLO for work related calls and data. Calls and data above this amount will be for the CLO account.
- PD2.3.2.d *Overheads, Charges and Profit* **Unit: % = R.....**
The overheads, charge and profit on PD2.3. above.

PD3 TRAINING OF LABOUR

The training requirements of the project shall be identified by the CLO as described in Clause PD2.2. in consultation with the contractor and to be approved by the employer and the Employers' Agent . This will be applicable for both formal and/or on-site training. At the end formal training, the trainees should acquire the certification which is in accordance with Construction Education and Training Authority (CETA) accreditation. The CLO should keep records of those certifications.

The labourers will still be paid their wages in full when attending training whether it is done on or off-site. All the training needs and expenses will be incurred by the contractor.

PD3.3 SCHEDULED ITEM

- PD3.3.1 *Training of Targeted Labour* **Unit: Provisional Sum**
The tendered sum shall include full compensation for the provisions of training for the labourers and for all other obligations described in Section PD3.
- PD3.3.2 *Overheads, Charges and Profit* **Unit: % = R.....**
The overheads, charge and profit on PD3.3.1 above.

Employer		Contractor	
Witness:		Witness:	

PP GLASS REINFORCED PLASTICS (GRP) PIPES, FITTINGS AND JOINTS

CONTENTS

PP 01	GENERAL
PP 02	MATERIALS
PP 03	DESIGN
PP 04	CONSTRUCTION
PP 05	MEASUREMENT AND PAYMENT

PP 01 GENERAL

PP 01.1 SCOPE

This Particular Specification covers the design, manufacture, testing and construction of underground pressure pipes, fittings and joints machine made of thermosetting polyester resin reinforced with filament-wound glass fibre rovings and sand for the conveyance of potable and aggressive raw water at ambient temperatures. It is applicable to pipes and associated fittings having nominal diameters from DW 200 to DW 2 000 for use at pressures up to WP 2,5 MPa.

NOTE:

- All manufacturers of GRP pipes fittings and joints must be quality listed by the South African Bureau of Standards to comply with SABS ISO 9002.
- The GRP pressure pipelines should not be constructed above the ground due to their uncertain resistance to ultra-violet degradation, unless they are suitably protected against exposure to direct sunlight.
- Proper bedding and backfill procedures are essential to the performance of the pipe and must be thoroughly understood and carefully observed during installation.

PP 01.2 REFERENCES

The following documents form a part of this Specification to the extent specified herein. In any case of conflict, the requirements of this Specification shall prevail. The latest issues shall apply.

SABS 974	Rubber joint rings (non-cellular) Part I
SABS 1200	Standardised Specification for Civil Engineering Construction Section DB : Pipe trenches Section L : Medium-pressure pipelines Section LB : Bedding
SABS 0102	The selection of pipes for buried pipelines Part I : General Part IV : Flexible pipes (refer to Engineer if not published yet)
BS 2782	(ISO 75) Methods of testing plastics; Part I : Method 121A
BS 2815	Compressed asbestos fibre jointing
BS 3532	Unsaturated polyester resin systems

Employer		Contractor	
Witness:		Witness:	

BS 4504	Circular flanges for pipes, valves and fittings Section 3.1 Specification for steel flanges
BS 5480	Glass reinforced plastics (GRP) pipes joints and fittings for use for water supply or sewerage
BS 6920	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water Part I : Specification
BS 8010	Pipelines Part 1 : Pipelines on land : General Part 2 : Section 2.5 : Glass reinforced thermosetting plastics
ANSI/AWWA	C950 Fibreglass pressure pipe
SABS ISO 9002	Quality systems : Model for quality assurance in production and installation
ASTM D2996	Filament-wound reinforced thermosetting resin pipe.

PP 01.3 COMPONENTS

The following materials are used for the manufacture of GRP pipes:

- (a) Polyester thermosetting resin, isophthalic type. Orthophthalic resins shall not be used for Works with a technical life exceeding 10 years.
- (b) Continuous glass fibre roving reinforcement.
- (c) Silica sand (aggregate) or other similar inert fillers.
- (d) Resin additives, such as pigments, dyes or other colouring agents if used, shall in no way be detrimental to the performance of the product.

PP 01.4 WALL COMPOSITION

The wall of the GRP pipe is made of a monolithic structure produced with 3 different layers.

- (a) Liner, a inner layer in contact with water which provides maximum resistance to chemicals and corrosion and ensures impermeability of the pipe wall.
- (b) Intermediate (structural) layer which determines the strength and stiffness/rigidity of the pipes.
- (c) Outer protective layer (gel-coat) of pure resin without glass reinforcement which protects glass fibres from environments and handling and it contains ultra-violet ray absorber.

PP 01.5 SAFETY

Safety precautions to avoid risk to health and safety of the public, and to prevent damages to the Works (pipework) and private property, must be observed at all times. All personnel shall be informed of the nature of the product being handled. The manufacturer shall provide the Engineer a list of all important points needing attention during all stages of handling, installation, Defect Liability Period and operation.

Eg: Dust created by grinding and polishing of pipes and fittings may present a health hazard, therefore, operators should wear suitable eye protection, mask and gloves.

Employer		Contractor	
Witness:		Witness:	

PP 01.6 INSPECTION

The integrity of a properly designed pipeline depends mainly on the standards and quality of inspection applied at all stages.

Particular emphasis is laid on the inspection for possible damage to pipes, fittings and joints before installation and for the correct bedding of the pipeline, jointing, anchoring, and testing. Any sub-standard materials or workmanship should be rejected.

Factory inspection of the Plant, manufacturing processes, supervision and adjudication of test records, shall be carried out by an independent Inspectorate appointed by the Employer to act on behalf of the Engineer. The manufacturer shall make available for the inspector's use, without additional charge, all necessary facilities required for inspection.

PP 01.7 WORKMANSHIP

The pipe shall be free from all defects including indentations, delaminations, bubbles, pinholes, foreign inclusions, and resin-starved areas which, due to their nature, extent, detrimentally affect the strength and serviceability of the pipe. The pipe shall be as uniform as practicable in colour, opacity, density and other physical properties. The pipe shall be round and straight, and the bore of the pipe shall be smooth and uniform. All pipe ends shall be cut at right angles to the axis of the pipe, and any sharp edges removed.

PP 02 MATERIALS

PP 02.1 GENERAL

The materials used to make pipe products shall contain no ingredient in an amount that can migrate into water in quantities that are considered to be toxic. The materials shall comply with the requirements of BS 6920: Part 1.

PP 02.2 RESINS

The resin shall be a thermosetting polyester resin and shall comply with the requirements of BS 3532. The resin shall be such that when used according to a schedule representative of that to be used for the finished pipework and then tested in accordance with BS 2782: Method 121A, the temperature of deflection of the resin shall be not less than 20 °C higher than the maximum service temperature at which the pipework component is to be used, if known, and otherwise not less than 50 °C.

PP 02.3 FIBROUS REINFORCEMENT

In a continuous fibre reinforced composite, the fibres (also referred to as filaments) provide virtually all of the load - carrying characteristics of the composite, the most important of which are strength and stiffness.

The fibrous reinforcement shall be manufactured from the glass compatible with polyester resin of the following commercial grade:

C-glass. A soda-lime borosilicate glass, chemical resistant, used for the inner layer of the pipes and fittings in direct contact with the water.

Employer		Contractor	
Witness:		Witness:	

E-glass. A calcium aluminoborosilicate glass containing other oxides, incorporated for enhanced corrosion resistance, and having a useful balance of structural, chemical and electrical properties. It is used for the intermediate (structural layer).

PP 02.4 AGGREGATE

Inert granular material, size 0,05 - 4,75 mm, such as graded and washed silica sands, may be incorporated where they are a designed part of the composite structure to increase the stiffness of the pipe and thus its resistance to external loads and negative pressure, if it exists.

PP 02.5 GASKETS

PP 02.5.1 Joint-ring gaskets

Joint-ring gaskets shall be made from non-cellular synthetic rubber material and shall comply with the requirements of SABS 974: Part 1, class 70. The finished rings shall not contain any reclaimed rubber, vulcanized waste or any substance which will cause the rubber to impart a taste or smell to the water.

PP 02.5.2 Flange gaskets

Gaskets for flanged joints shall be full-faced, in one piece with inner gasket's diameter 6 mm larger than the inner diameter of the flange and outer diameter not to exceed outer diameter of the flange. The gasket shall be of compressed asbestos fibre to BS 2815: Grade A. For pressures up to and including 1,6 MPa cloth - inserted rubber may be used.

Note: Gaskets should be protected from unnecessary exposure to the effects of ultra-violet radiation, light and ozone.

PP 03 DESIGN

PP 03.1 PIPE DESIGN

PP 03.1.1 General

The design and testing of the pipes and fittings shall be in accordance with BS 5480 and BS 8010: Part 2, Section 2.5.

PP 03.1.2 Design pressure

The design pressure in the system due to working pressure plus surge pressure shall not exceed 1,5 times the pressure class of the pipe. Excessive surge pressure should be anticipated in the design phase and the causative condition should be eliminated or automatic surge pressure relief provided.

PP 03.1.3 Dimensions

Employer		Contractor	
Witness:		Witness:	

PP 03.1.3.1 Diameter of pipes

- (a) Nominal size (DN) pipes shall be designated by a nominal size.
- (b) Work size (DW). The work size shall be declared by the manufacturer and shall not differ from the value of the nominal size of the pipe by more than + 3,5 % or -3,5%.

The manufacturing tolerance on the work size shall comply with the permissible deviations as follows:

- (i) for pipes of nominal size up to and including 600: ∇ 3,0 mm
- (ii) for pipes over 600 nominal size: ∇ 0,5%

PP 03.1.3.2 Lengths

The pipe effective length shall be preferred 6 m with a tolerance of ∇ 25 mm. Other effective lengths are permissible and may be supplied by agreement between the manufacturer and the Engineer. A maximum of 5% of the total length supplied in any one nominal size and class may be supplied in random lengths where the random length shall not be less than 1,5 m, except for special orders.

PP 03.1.3.3 Wall thickness

When measured to an accuracy of 0,1 mm the wall thickness shall not be less than the figure declared and used by the manufacturer in the calculations for the design of the pipe.

PP 03.1.4 End squareness

All pipe ends shall be square to the axis. The tolerances on out-of-squareness shall be (2 mm + 0,005 DW) with a maximum of 10 mm, where DW is the work size of the pipe.

PP 03.1.5 Straightness

The deviation from straightness of the bore of the pipe shall not exceed 0,3% of the effective length of the pipe or 15 mm, whichever is the smaller.

PP 03.1.6 Head losses

The hydraulic head loss due to pipe friction is lower for GRP pipe than for other types of pipe due to smoother inner surface and freedom from tuberculation and erosion. Taking into account the losses at the joints, the Colebrook - White roughness co-efficient $k = 0,05 - 0,10$ mm.

PP 03.1.7 Classification

PP 03.1.7.1 General

The following classification relate to sustained service temperature up to 30 °C.

Employer		Contractor	
Witness:		Witness:	

PP 03.1.7.2 Pressure

The pressure rating of the pipes shall be equal to or less than the maximum internal hydrostatic pressure, in bar, which the pipe is capable of withstanding for a design life of 50 years.

PP 03.1.7.3 Stiffness

The stiffness class range for enhanced resistance to distortion shall be:

1 250; 2 500; 5 000; 10 000; 15 000 and 20 000 Nm⁻²

PP 03.1.8 Fittings

PP 03.1.8.1 Fittings made from GRP

GRP fittings are not subject to tests for strength and it is essential that external restraint shall be provided on installation. GRP fittings shall be equal or superior in performance to pipe of the same classification and shall be smoothly finished internally.

Fittings shall be one piece contact moulded or fabricated from the straight pipe suitably mitred.

PP 03.1.8.2 Steel fittings

In selecting the most economic fittings, steel fittings should be considered as an alternative to GRP.

Steel fittings shall meet the requirements of BS 534, be adequately protected against internal and external corrosion and shall comply with BS 5480.

PP 03.1.9 Joints

The following types of joint are acceptable to the Employer. Other types may receive consideration.

PP 03.1.9.1 Flanged joints (rigid)

Flanges shall be of steel, welding type plate and shall have flat joint faces, with dimensions in accordance with BS 4504: Section 3.1

PP 03.1.9.2 Flexible joints

The angular deflection limits relative to nominal size of the pipework shall be as follows:

DN 500- 3°
500 - 900- 2°
900 - 1 800- 1°
over 1 800- 0,5°

The flexible joints are:

Employer		Contractor	
Witness:		Witness:	

- (a) Spigot and socket joints with double rubber sealing O-rings, installed in the circumferential grooves, machined on the spigot end and with the nipple hole on the socket end between the O-rings for testing the seals by applying air pressure.
- (b) Slip-on bolted pipe coupling without centre register with rubber sealing rings, bolts and nuts. The pipe ends shall be machined to receive coupling.
- (c) Flange adaptors with flat joint face of flange, rubber sealing rings, bolts and nuts. The required thickness of the adaptor's flange shall be less than the thickness of the standard mating flange due to the reduction of end and side thrust which is absorbed by the flexibility of the rubber sealing rings. The flange adaptors do not provide the rigidity or anchorage of standard flange joints and should be anchored accordingly.

PP 03.1.10 Marking

Each pipe and fitting shall be marked with the following information in such a manner that it remains legible under normal handling and installation practices:

- (a) The manufacturer's name (or identity code)
- (b) The nominal size
- (c) The pressure rating
- (d) The stiffness rating in Nm^{-2}
- (e) The date of manufacture
- (f) The angle of bend (in degrees) of fittings

PP 03.2 PIPELINE DESIGN

PP 03.2.1 General

The necessary hydraulic economic and structural assessments shall be made in accordance with recognised practice. The factors taken into account should include service, environmental considerations, pipeline protective devices to control the pressure and the flow, joints and external and internal corrosion resistance.

PP 03.2.2 Access to pipeline

Internal access shall be provided at intervals for inspection, maintenance and the removal of obstructions, giving consideration to the need to provide a safe working environment at all times.

PP 03.2.3 Anchors and thrust blocks

Anchors and thrust blocks are required at changes of pipe sizes, direction of the pipeline and isolating and scour valves, to withstand the forces developed by the internal pressure.

The safe bearing pressure of the surrounding soil should be determined from field tests and taken into account in the design of the structure.

Employer		Contractor	
Witness:		Witness:	

Where fittings are fabricated in GRP, they should be completely encased in reinforced concrete.

Where GRP pipes enter manholes or pass through solid structures, anchor blocks or valve chambers, it is essential to provide flexibility to the pipeline at either side of the structure. This shall be effected by introducing two flexible joints to the pipeline on each side of the structure such, that the first joint is no more than one pipe diameter or 600 mm, whichever is the greater, from the structure and the second is approximately 1,5 diameter from the first.

At the point of pipe entry into the structure the circumference of the pipe shall be wrapped with a 10 to 20 mm thick (depending on the pipe diameter) and 200 mm wide band of a non-degradable compressible material (rubber) to help the pipe to absorb the stresses resulting from pipe deflection outside the structure. In addition, at this point it is necessary to increase the bed depth not less than 1 pipe diameter for a length not less than 2 pipe diameters and trench width to a minimum of 3 pipe diameters for a length of 3 to 5 pipe diameters.

Where water tightness between pipe and structure is required, pipes should be supplied with puddle flanges laminated into the pipe. Puddle flanges should not be used to anchor the pipe against thrust unless specifically designed so to do. The external surface of the pipe shall be treated to improve its bond with the concrete by painting with a suitable resin and blending with sand to give a roughened surface prior to placing the concrete. The pipe manufacturer's advice should be sought when determining suitable resins.

PP 04 CONSTRUCTION

PP 04.1 TRANSPORT, HANDLING AND STORAGE

Transport, handling and storage shall be as specified, where applicable, in SABS 1200 L : Medium-pressure pipelines.

Care must be exercised at all stages during the transportation, handling and laying of GRP pipe to minimise the possibility of overstraining, point loading or otherwise damaging the pipe wall, since this can have a deleterious effect on its long-term performance. GRP pipes shall always be lifted with fabric straps or hemp rope and not cables or chains. They should not be subjected to impact loads or rolled over rough or hard ground.

If straw is used for protecting pipes and fittings in transit, it should be collected and burnt in a safe area immediately after use to avoid any possible agricultural contamination.

Pipes shall be stored on cradles and away from the inflammable liquids or other aggressive materials. Pipes can be stored in the open for a period of 6 months without any detrimental effects being caused by ultra-violet exposure. However, the manufacturer shall be consulted regarding longer periods of storage in the open.

PP 04.2 TRENCHING, BEDDING AND BACKFILL

The GRP pipes fall into the category of flexible pipes. As such, in the buried condition they rely on the pipe-soil structure interaction for their load bearing capacity. Therefore, it is important that the pipes are bedded and surrounded in a material which is capable of transmitting lateral thrust from the pipe to the soil forming the trench wall and that this soil does not become over-stressed.

The minimum thickness of the bedding shall not be less than 150 mm, and the selected backfill material shall be to a height of 300 mm over the crown of the pipe. The minimum depth of cover to natural ground level over the crown of the pipe shall be 1 m. Where high water tables are encountered, precautions should be taken to prevent floatation when the pipeline is empty. Such precautions should not induce localised stress in the pipes. No concrete slabs shall be placed directly onto the pipe.

Employer		Contractor	
Witness:		Witness:	

Where ground water conditions are such that there is a risk of the trench backfill being washed away, suitable impermeable stops (e.g. clay dams) shall be provided at appropriate intervals to prevent longitudinal drainage.

Where ground water is present, the geotextile fabric shall be laid in the excavated trench such that it fully encases the pipe bedding and pipe zone of granular material preferred of single size compacted 20 mm aggregate. This is to prevent the fines to migrate from the adjacent soil of the trench bottom and walls.

For guidance on design and construction, reference is made to the following Specifications as applicable:

SABS 1200 : Section DB (Pipe trenches), L (Medium-pressure pipelines) and LB (Bedding).

BS 8010 : Part 2 Section 2.5: Pipelines; Glass reinforced thermosetting plastics.

PP 04.3 PIPE INSPECTION, REPAIR AND CUTTING

PP 04.3.1 Inspection

Prior to installation, each pipe, fitting and joint shall be visually inspected both externally and, where practicable, internally for all defects, including indentations, delaminations, bubbles, pinholes, blisters, foreign inclusions and resin starved areas.

Damage showing the star cracking on the inner surface or any external damage which can not be inspected (on assumption that the damage extends through the pipe wall), the pipe shall be rejected and replaced as directed by the Engineer. Areas of tackiness and imperfection to the pipe inner surface shall not be accepted.

PP 04.3.2 Repairs

Owing to the difficulties of controlling the quality, any repair under Site conditions shall not be carried out without the Engineer's prior approval.

PP 04.3.3 Cutting

GRP pipes can be cut with a power-driven, abrasive-wheel cutting machine. Burrs and sharp edges shall be removed by filing or grinding and, where required, a chamfer shall be provided. The cut ends shall be resealed to prevent moisture absorption, using a repair resin recommended by the pipe manufacturer and approved by the Engineer. The repair resin must be suitable for contact with potable water (see Clause 2.1).

PP 04.4 CLEANING, TESTING AND STERILIZATION

PP 04.4.1 Cleaning

Before a pipeline can be considered ready for service it shall be cleaned internally as thoroughly as possible to ensure that no foreign matter remains inside the pipe.

Employer		Contractor	
Witness:		Witness:	

PP 04.4.2 Hydrostatic testing

The complete pipeline shall be tested in accordance with SABS 1200L: Clause 7.3, where applicable. A test duration shall be 24 hours.

The GRP pressure pipeline shall be hydrostatically tested in lengths about 1,0 to 1,5 km, as approved by the Engineer. Sections of pipeline to be tested shall be carefully filled with water so, as to ensure that all air is eliminated from the test length prior to the application of Site test pressure. The Site hydrostatic test pressure at any point along the test section shall not be less than 1,1 times, nor greater than 1,4 times the design (working plus surge) pressure.

The leakage of the pipeline under test, taken as the total quantity of water added over a 24 hours period to reinstate required test pressure shall not exceed 20 litres per metre nominal diameter per kilometre length per 24 hours per bar (10,2 m) of pressure head applied.

Where joints are left uncovered until after testing, each pipe shall be backfilled and compacted to prevent movement.

PP 04.4.3 Sterilisation

Pipelines intended to convey potable water shall be sterilised.

The chlorinated water shall received treatment to dilute the chlorine to an acceptable level before discharging to a waste.

The pipeline should not be brought into service until the water at each sampling point, having stood in the pipeline for 24h, has maintained a satisfactory potable standard.

PP 05 MEASUREMENT AND PAYMENT

The measurement and payment shall be in accordance with SABS 1200L where applicable.

Employer		Contractor	
Witness:		Witness:	

PERFORMANCE SPECIFICATION

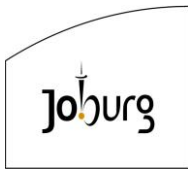
ELECTRONIC SECURITY SURVEILLANCES INSTALLATION

I N D E X

PART A

GENERAL SPECIFICATION

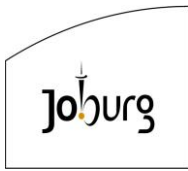
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PART B

GENERAL TECHNICAL SPECIFICATION

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PART C

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**PERFORMANCE SPECIFICATION
FOR THE ELECTRONIC SERVICES SYSTEMS**

PART A

GENERAL SPECIFICATION

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ELE PTA 1.1: STANDARDS AND REGULATIONS

ELE PTA 1.1.1: The completed system and its components shall be in accordance with the following regulations:

- a) SANS 0142 - Code of Practice for the Wiring of Premises.
- b) Occupational Health & Safety Act.
- c) The Municipal or Local Authorities' By-Laws and Supply Authorities' Regulations.
- e) SANS 2220 - Intruder Alarm Detector Systems.
- f) Postmaster General Regulations.
 - a) National Building Regulations. Act No. 103 of 1977 (SANS 0400).
 - b) Regulations of Telkom.

ELE PTA 1.1.2: The design of the systems, the equipment supplied for the systems, and the installation of such equipment shall be in accordance with the approved safety Standards. The equipment and components shall be deemed to have been tested and approved by a reputable and recognised international test laboratory to prove compliance with at least one or more of these Standards.

ELE PTA 1.1.3: All equipment used shall originate from suppliers which have been certified in accordance with SANS and copies of certificates of approval shall be provided by the tenderers with their tenders.

ELE PTA 1.2: SCHEDULE OF FITTINGS

In all instances where schedules of outlet points are attached or included on the drawings, these schedules are to be regarded as forming part of the specification.

ELE PTA 1.3: QUALITY OF MATERIALS

Only materials of first class quality shall be used and all materials shall be subject to the approval of the Engineer.

Wherever applicable the material is to comply with the relevant South African National Safety Standard Specifications.

Materials wherever possible, must be of South African manufacture.

ELE PTA 1.4: CONDUIT, SLEEVES AND ACCESSORIES

All conduit, wiring channel and accessories will be installed to outlet points as indicated on the drawings, as part of the Electrical Installation. All conduits will be fitted with stout non-corrodible draw-wires.

The conduit and conduit accessories will comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African National Safety Standards.

- (a) Screwed metallic conduit and accessories : SANS 162.
- (b) Plain-end metallic conduit and accessories : SANS 1007.
- (c) PVC conduit and accessories : SANS 950.

All conduit fittings except couplings, will be of the inspection type. Where cast metal conduit accessories are used, these will be of malleable iron. Zinc base fittings will not be allowed.

Bushes used for metallic conduit will be brass and will be provided in addition to locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

Drawboxes will be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

For electronic systems circuits, the conduit used will have an external diameter of 25 mm or 32 mm as indicated on the drawings.

The use of plain-end steel conduit in reinforced concrete slabs will be limited to conduit having a wall thickness of not less than 1,2 mm.

ELE PTA 1.5: WIRING

Except where specified above or where otherwise specified in Part B of the specification, wiring shall be carried out in conduit and wiring channel throughout.

Where cabling is not done in conduit, the cables in the ceiling space will be installed parallel or at right angles to the beams and walls, etc., and will be suspended/ secured at intervals not exceeding 1,5 m by means of saddles or purpose-made staples fixed to the slab/beam soffits or to ceiling / roof members.

No wiring shall be drawn into conduit or installed in wiring channel until the conduit/channel installation has been completed and all conduit ends provided with bushes. All conduit and wiring channel to be clear of moisture and debris before wiring is commenced.

The loop-in system shall be followed throughout, and no joints of any description will be permitted.

The type of wiring shall be as specified in Part B of this specification.

Where cable ends connect onto equipment, the end strands must be neatly and tightly twisted together and firmly secured. Cutting away of wire strands of any cables will not

be allowed.

Each wire shall be identified at both ends with the wire designation corresponding to the wire numbers as shown on wiring diagrams.

All exposed wiring within cabinets, consoles, and terminals shall be formed neatly with wires grouped in bundles using non-metallic, flame-resistant wire ties.

ELE PTA 1.6: WORKMANSHIP AND STAFF

All work on the service shall be carried out by, or under the strict supervision of, registered artisans.

The workmanship shall be of the highest grade and to the satisfaction of the Representative/Agent.

All inferior work shall, on indication by the Engineer, immediately be removed and rectified by and at the expense of the contractor.

ELE PTA 1.7: SPARE CAPACITY

20% spare capacity shall be allowed in the design of all equipment eg. control panels, loops, zones, etc.

ELE PTA 1.8: INFORMATION ON TENDER PROPOSALS

Tenderers shall submit with their tender full information regarding the equipment and designs proposed, including pamphlets, descriptive literature and drawings of the equipment and layout which are offered.

WARNING

Tenderers are reminded that failure to comply with this essential clause of the specification in regard to drawings, may invalidate their tender. The drawings need not be detailed in every respect, but they must be sufficiently clear to convey the general layout, the type of plant offered and the method of operation.

Tenderers shall inform the Engineer at this stage whether they are proposing to use the Engineer's drawings as working drawings, or whether they propose to produce their own working drawings. If the Engineer's drawings are to be used, any amendments thereto, however minor, shall be mentioned. Should such amendments require sketches for their clear interpretation, the successful tenderer will be required to submit these in due course as overlays to the Engineer's drawings and to the same scale, so that they can be super-imposed over the originals for clarification and approval.

ELE PTA 1.9: SCHEDULES

All schedules in this tender document shall be completed and failure to do so may render the tender liable to disqualification.

ELE PTA 1.10: APPROVAL OF WORKING DRAWINGS

Not later than two weeks after signing the contract or receiving verbal instructions, the successful tenderer shall submit to the Engineer, either four (4) copies of his detailed working drawings or written advice that the Engineer's tender drawings will be used, for approval in writing.

In the event of any changes having been made to the Engineer's tender drawings, as mentioned in Clause 1.9, these are to be submitted simultaneously for the necessary written approval.

ELE PTA 1.11: SETTING OUT OF WORK

The contractor shall be responsible for the setting out of the whole of the Works under this Contract and during the progress of same shall at his own cost amend, at the request of the Engineer, any errors that may have arisen therein.

Base lines and datum levels from where the setting out of the work is to be done will be given to the contractor by the building contractor, if applicable, or the Engineer.

The contractor shall be held solely responsible for the taking of any site sizes and measurements as may be necessary and for the correctness of all dimensions as "set out". He shall provide without extra charge, all assistance and everything necessary for testing the strength of the materials, checking the accuracy of setting out, quantity of work done, as may be directed from time to time by the Engineer.

The tender drawings are to be considered to be diagrammatic and the contractor shall verify all dimensions. The contractor shall on commencing his shop drawings, which he is required to do in accordance with Clause 1.11 of this Specification, advise the Engineer of any major changes to the general lay-out or the proposed positions of the various elements and equipment that may be necessary so as to comply with the design requirements, before submitting his drawings for approval. Due allowance shall be made for conditions on the site whether shown on the tender drawings or not.

ELE PTA 1.12: CONFIRMATION OF POSITIONS

The contractor shall obtain confirmation that the positions where he proposed installing apparatus are correct before final securing of same.

The contractor shall confirm positions of light fittings, sprinklers and air-conditioning equipment with the Engineer, prior to installing detectors.

ELE PTA 1.13: "AS-BUILT" DRAWINGS

The contractor shall furnish the Engineer with a complete set of "As-Built" drawings, consisting of both a signed transparent, and an electronic copy, as a prerequisite to the completion. The transparencies are to be of 0,05 mm thickness plastic. The "As-Built" set shall include all mechanical, electrical or other work where applicable.

"As-Built" drawings shall be up-dated as work progresses and all deviations in work as actually installed, shall be recorded on these drawings.

ELE PTA 1.14: CONTRACTOR'S LIABILITY IN RESPECT OF DEFECTS

ELE PTA 1.14.1: PERIOD OF LIABILITY

- (a) Any defects or faults which may appear within twelve months from the completion of the Works or part thereof due to materials or workmanship not being in accordance with the Contract shall be made good by the Contractor within such period as may be determined by the Engineer or the Employer in written instructions to do so.
- b) Should the Contractor fail to rectify the defects or faults referred to above, the Employer shall, without prejudice to any other rights that he may have, be entitled himself to rectify such defects or faults or to arrange for the rectification thereof and to recover from the Contractor any damages that the Employer may have suffered as a result of the Contractor's failure to carry out the terms of the Contract.
- c) The above provisions shall not deprive the Employer of any rights that he may have in regard to defects and faults that may appear after the aforesaid period of twelve months.

ELE PTA 1.14.2: MAINTENANCE OF INSTALLATIONS

With effect from the date of the First Delivery Certificate the Contractor shall at his own expense undertake the regular servicing of the installation during the period stated in 1.15.1 hereof, and shall make all adjustments necessary for the correct operation thereof.

If during the said period the installation is not in working order for any reason for which the Contractor can be held responsible, or if the installation develops defects, he shall immediately upon being notified thereof take steps to remedy the defects or faults or to make any necessary adjustments.

Should such stoppages however be so frequent as to become troublesome, or should the installation otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Engineer or the Employer, at his own expense replace the whole installation or such parts thereof as the Engineer or the Employer may deem necessary with apparatus specified by the Engineer or the Employer.

ELE PTA 1.14.3: MAINTENANCE PERIOD

During the 12 months free maintenance period, the contractor will be required to carry out free of charge, a normal service of monthly inspections, and at the end of each 6-monthly period one full maintenance service and to submit the usual reports thereon in duplicate within 7 days of the carrying out of the services, one copy being submitted to the Employer, and the other copy to the Engineer.

ELE PTA 1.15: INSTALLATION OPERATING AND MAINTENANCE INSTRUCTIONS

Four sets of installation, operating and maintenance instructions shall be supplied with each system and shall include schematics and detailed wiring drawings with a full component list indicating not only component values but sources of supply. Equipment will not be accepted until this information has been handed to the Engineer.

The contractor shall instruct the appointed representative of the Employer in the

operation of the installation. A list of these operating instructions, as well as all necessary maintenance work shall be included, together with full details of period of inspections and types of tests to be carried out.

ELE PTA 1.16: SITE MEETINGS

Site meetings will be held at set intervals or by arrangement.

The contractor shall arrange for a representative at these meetings, who will have the necessary authority and ability to take decisions on behalf of the contractor.

ELE PTA 1.17: CONTRACT WORK

The installation shall be carried out entirely by the Contractor's own staff and shall not in any way be sub-let.

ELE PTA 1.18: INFORMATION

The tenderer's attention is drawn to the fact that if the information schedules in this specification are not completed, his tender may be disqualified.

ELE PTA 1.19: NOTICES

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General, S.A. Transport Services, Provincial or National Road Authorities, Telkom S.A., the Local Fire Department and other Authorities as may be required with respect to the installation.

ELE PTA 1.20: EQUIPMENT & FITTINGS

All equipment and fittings supplied must be in accordance with the Specification, and must be approved by the Engineer.

All equipment, material or apparatus, described in this specification, shall, wherever possible, be of South African manufacture and shall be constructed and tested in accordance with either the relevant S.A. National Safety Standards Specification or the British Standard Specification or the Underwriters Laboratories (with the latest amendments to these specifications) where applicable, and as referred to in the appropriate section of this specification.

ELE PTA 1.21: DRAWINGS

The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed.

Drawings issued with this tender are preliminary only.

ELE PTA 1.22: WORK SEQUENCE

The sequence in which the work must be carried out, must be established in consultation with the Principal Contractor and the Electrical Contractor.

ELE PTA 1.23: SUPERVISION

The work shall at all times, for the duration of the contract be carried out under the supervision of a skilled and competent representative of the contractor, who will be able and authorized to receive and carry out instructions on behalf of the contractor. A sufficient number of workmen shall be employed at all times to ensure satisfactory progress of the work.

ELE PTA 1.24: SERVICE CONDITIONS

All plant shall be designed for the climatic conditions appertaining to the service.

ELE PTA 1.25: SPECIFICATION AND DRAWINGS

ELE PTA 1.25.1: PRECEDENCE AND DISCREPANCIES

Where any clauses in Part B of this specification are at variance with clauses in any other part of the specification, the clauses in Part B shall take precedence.

Should any difference or discrepancy exist between the drawings and the specifications, it is in each case the specification which has preference and supersedes the drawings. No claim whatsoever will be entertained in this respect after the Tenderer has been notified of the acceptance of the Tender.

The above applies to equipment which is shown on the drawings and specified differently in the specification.

Equipment shown on the drawings, which is not specified at all in the specification, must be provided and installed by the contractor.

ELE PTA 1.25.2: INTERPRETATION

Incorrect interpretation of the drawings and/or specification which necessitates or carries any expenses whatsoever is the sole responsibility of the contractor.

ELE PTA 1.25.3: COMPLETENESS OF TENDER DOCUMENT

It is the responsibility of the Tenderer to ascertain that he received a complete tender document. A tender based on an incomplete tender document and/or claims which may arise as a result of the Tenderer's negligence to comply with the above, will not be considered.

ELE PTA 1.26: THE SITE

The site is located at Dainfern Valley, Riverside & Diepsloot between Fourways and Diepsloot areas.

ELE PTA 1.27: QUALITY ASSURANCE

Tenderers shall indicate in the schedules whether a quality assurance management system exists, within the organization of the various equipment manufacturers, for the design, manufacture and installation (where applicable) of equipment. They shall state to which standard (B.S. 5750 or SANS 0157, or equivalent), and to what degree the quality management systems comply. Descriptive details of systems in operation shall be provided, preferably in the form of a quality assurance manual.

ELE PTA 1.28: OUTLETS

Outlets have generally been provided as follows:

- a) CCTV Outlets -:
- | | |
|------------------|--|
| Power | - 150mm x 150mm fibre glass weatherproof box, flush mounted in pillar at 0,3 m above ground level. |
| Fibre Splice box | - 300mm x 300mm fibre glass weatherbox, flush mounted in pillar at 0,55 m above ground level. |
| Camera | - 50mm dia. round box, flush mounted in pillar at 1,8 m above ground level |

ELE PTA 1.29: SPARES

The tenderer shall indicate the amount of spares for all systems held in the country and shall provide a list of agents or distributors where such spares may be obtained.

The following shall be provided and must be handed over during the official handover of the installation.

- One log-book for maintenance inspection records.
- (b) 5% spare power supplies (all types & systems used).
- (c) 10% spare lightning protection devices used.

ELE PTA 1.30: TESTING OF SYSTEM PRIOR TO HANDING OVER

In outlining the requirements, small items which may be of a proprietary nature will, for obvious reasons, have been omitted but, notwithstanding this, it is the full responsibility of tenderers to include all equipment necessary to present, on completion, an installation conforming to the latest techniques of highly sophisticated engineering practice.

The testing of the system after completion shall be carried out in the presence of, and to the satisfaction of the Engineer and client representative.

ELE PTA 1.31: MAINTENANCE

ELE PTA 1.31.1: Maintenance and Guarantee

- (a) The tenderer for this contract shall allow in his tender price for the maintenance of the

complete installation for a period of twelve (12) months, starting from the date of the first take-over of the contract by the Engineer.

(b) It is a specific requirement of this contract that the Contractor shall allow for monthly inspection visits during the 12 month maintenance period, and that he shall submit full reports for each monthly visit. The reports shall contain the status of the system as well as the faults which occurred on the system during the previous month.

(c) A log book shall be supplied by the Contractor. The log book shall be kept on site in charge of the responsible person appointed by the facility for this purpose. The Contractor shall complete the log book, showing all maintenance done by him, as well as repairs of faults which may have occurred.

(d) The log book shall also contain the following information:

- Date
- Type of fault reported and by whom
- Date of fault report
- Work done
- Name and signature of person carrying out the work
- Name and signature of the person in charge of the site

(e) The log book shall be filled in TRIPLICATE. One copy shall accompany the monthly report to the Engineer, one copy shall be for the Contractor's own use, whilst the third copy shall remain in the log book as a record.

(f) The Contractor shall also allow for a complete maintenance service of the system after every six (6) months, i.e. two such services in the twelve (12) month guarantee period. The log book shall also be filled in and reports submitted for these services to the Engineer.

(g) The reports shall be submitted to the Engineer within seven (7) days of the service. Serious faults shall immediately be reported to the Employer and the Engineer by telephone.

(h) No maintenance or repair work shall be done on site without the knowledge, and approval, of the responsible person in charge on the site.

ELE PTA 1.31.2: Maintenance Programme

(a) The Contractor shall draw up a complete maintenance programme document for the system, which shall enable the facility to maintain the system on a daily basis. This programme must be inserted into both the Operating Manuals and Maintenance Manuals.

(b) This document shall be in English and at least one other official language, to be decided in conjunction with the school, and shall indicate clearly the steps to be taken to prevent failure of the system.

(c) The normal maintenance which is, for example, necessary for the maintenance of batteries in the system, shall be clearly indicated in the documentation in a separate section.

ELE PTA 32: SERVICE CONTRACT PROPOSAL

On completion of his maintenance period, the contractor may be requested by the employer to enter into a contract of continuance of the testing and maintenance services. Tenderers shall, therefore, advise the engineer at the time of tendering, what permanent maintenance and inspection staff they maintain for the purposes of performing such duties.

The tenderer shall include an optional service contract proposal at the time of tender. The proposal shall include:

- a) Response to emergency service requests on-site, if required.
- b) Replace or repair defective components, as required.
- c) Manufacturer's recommended preventive maintenance.
- d) Two-year and five-year maintenance contract, with price, terms, and conditions shown for each year.
- e) The service contract shall be optional and the Client shall have the right to accept or reject the contract, and accept only the warranty service as described above, at no additional cost.

ELE PTA 33: ADDITIONAL CLAUSES AND ANNEXURES

All special preliminary and general clauses, applicable to the Principal Contract, shall apply to the Sub-Contract and shall be priced accordingly on the bill of quantities. A copy of the preliminary and general conditions appertaining to the Principal Contract, and including special clauses are attached to this specification.

All annexures attached to this specification will be applicable to this contract.

ELE PTA 34: FIRM PRICE

An additional amount will be called for in the Bill of Quantities for holding the price firm (i.e. no escalation of price for labour or materials will be applicable).

Firm prices shall remain firm, for the purpose of this tender, up to and including the completion date for the Contract. Should the Contract proceed beyond this date, through no fault of the Contractor, contract price adjustment will be made, in accordance with approved industry formulas, with the Contract commencement date for purposes of calculation, being taken as this completion date.

ELE PTA 35: LIGHTNING PROTECTION

All power supplies and electronic equipment shall be suitably protected against lightning and power surges, by means of branded name surge arrestors.

ELE PTA 36: DRAWINGS & FINAL INSTALLATION

The bill of quantities forming part of this specification is based on the complete installation. The final cost of the installation will be based on final quantities using the rates as quoted in the bill of quantities.

The drawings included herewith are indicative only and are intended to give the

tenderer an indication of the nature and extent of the works.

ELE PTA 37: COMPULSORY SITE INSPECTION

Tenderers must visit the site before tendering, to satisfy themselves as to the local conditions and the extent and nature of the work to be undertaken. Subsequent claims, on the grounds of want of knowledge in this regard, will not be entertained.

ELE PTA 38: SYSTEM DEMONSTRATION

The Contractor shall, as part of the tender submission, provide a comprehensive demonstration of all of the systems forming part of this specification. This demonstration shall be arranged at a time and date to suit the engineer and the client representative. The demonstration shall be set up to suitably show the operation of each of the individual systems and the inter-operability of the combination of systems as described in this specification and as required to be operating on completion of this contract. Tenderers shall note that inability to comply with this clause may render the tender invalid.

ELE PTA 39: DESIGN, FUNCTIONALITY AND OPERATION

While this specification describes and details the workings of full CCTV installation, the contractor shall bear full responsibility for the detail design of the system and for its correct and efficient operation and functionality.

**PERFORMANCE SPECIFICATION
FOR THE ELECTRONIC SERVICES SYSTEMS**

PART B

GENERAL TECHNICAL SPECIFICATION

1.0 CCTV SYSTEM

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ELE PTB 1.0: CCTV

ELE PTB 1.1: General System

The CCTV system shall consist of all of the cameras and mounting accessories, signal distribution equipment, DATA, power and Fibre optic cabling for video, control and power supplies as well as associated equipment, display and alarm processing equipment, software configuration and implementation, detailed documentation and training required to make up a complete CCTV system which can be easily operated by Security Control Room operators.

Video switching shall be achieved by use of the video matrix in the control room. All monitors shall be installed in the control room. All camera images shall be relayed to the central control room. Monitoring equipment shall consist of video monitors installed in a control room console, to be supplied and installed by the contractor. Shop drawings of the console shall be submitted prior to manufacture for approval of the client and engineer. Real and time lapse recording equipment and software driven video switchers shall be required to route selected camera signals to various destination displays shall be installed in 19" rack cabinets.

All control of the CCTV system, including DVR control shall be by means of a Graphic User Interface (GUI) on a computer screen, with input control via keyboards, a joy stick and computer mouse units. Controls for the cameras shall be installed in the control desks in the central control room. Touch screen options may be offered.

The memory capacity of the system shall have at least 40% additional reserve capacity. A real time clock shall control all timed operations and shall continue to operate should any processor fail. The system shall be easy to operate as well as easy to integrate with other database software packages which are Windows compatible.

The control equipment shall have the capability to carry out the recording of information, database management etc. at the central processor equipment/GUI. The facility for remote access software configuration and maintenance shall be installed.

All material shall be the best quality available and bear the SANS mark, where possible, or if not shall be manufactured to BS or DIN standards.

Camera power supplies shall be fed from normal power supply installed at such locations as required by the Electrical Contractor. All cameras and associated equipment positions are preliminary, and final positions must be agreed on site and confirmed by the Engineer.

Suitability for the equipment to the particular site position requirements shall be decided on site and agreed with the Engineer. If more suitable equipment can be made available for the particular site requirement, the Engineer will decide whether or not the equipment specified will be replaced or not (if necessary covered by a site instruction).

All equipment shall be suitably protected against lightning and power supply surges. In particular vulnerable areas such as outdoors, fibre optic cables shall be used.

Power supply points will be provided by others in locations required for the equipment by the Electrical Contractor.

Allowance shall be made for the separation of video signal earth from the housing and safety earth.

Where video or transmission equipment is housed in boxes, these boxes shall be fitted with monitored anti tamper devices which shall be wired back to the access control and monitoring equipment.

ELE PTB 1.2: Static Camera Enclosures

The static camera enclosures shall be of die-cast aluminium construction suitable for outdoor use and shall have a grey powder coat paint finish. The enclosure shall have a hinged, lockable, lid for camera access, shall have suitably sized glands for power and signal cable entry, and shall incorporate a sun shroud for glare reduction. The enclosure shall have a built in heater and defroster to eliminate enclosure frosting in winter and the viewing window shall be made from clear, impact resistant, UV stabilized material.

Suitable brackets and mounting struts shall be supplied for the mounting of cameras, in their various housings and configurations. Wherever brackets are affixed ensure that the fixing is suitable for the strains and stresses caused by the rotation of the camera, or the stresses caused by high velocity winds blowing against the housings. Brackets shall be designed to allow cameras to freely move in the horizontal and vertical planes. Allowance for at least 90 degrees in the vertical plane, above and below the horizontal, and 360 degrees in the horizontal plane shall be allowed for. Where brackets are specifically designed for installation on motorised cameras the camera movement limits shall be suitably controlled with site adjustable limit switches to allow for final adjustments.

Poles shall be supplied and installed by the contractor, to camera suppliers specification, especially rigidity.

ELE PTB 1.3: Static Cameras

The static cameras shall be high performance, high definition, digital, monochrome, surveillance cameras with horizontal resolution of 720p, low light operation (0.05 lux), the camera shall draw a maximum of 4 watts at 24V AC $\pm 15\%$ or 24V DC $\pm 15\%$, shall have a 75 Ohm BNC video output connector, shall be capable of operating during temperatures of -5° to $+45^{\circ}\text{C}$ and shall carry SANS standards body approval.

ELE PTB 1.4: PTZ Cameras (Hi Definition Dome cameras)

The PTZ HD camera enclosures shall be of the 'pendant' pole-mount type, shall be of die-cast aluminium construction suitable for outdoor use, shall be rated IP66, shall have a grey powder coat paint finish. The enclosure shall have a built in heater and defroster to eliminate enclosure frosting in winter, shall incorporate a sun shroud for glare reduction, and the viewing bubble shall be made from clear, impact resistant, acrylic of minimum 140mm diameter.

The dome drive shall have password protection, shall allow a minimum of 50 preset positions with $\pm 0.5^{\circ}$ accuracy, shall have the pan, tilt, and zoom speeds programmeable up to a maximum pan of $360^{\circ}/\text{s}$ or tilt of $200^{\circ}/\text{s}$. The drive shall allow for 8 programmeable zones with on screen labels and for window blanking of at least 8 shapes. The dome shall allow for 4 programmeable camera patterns. Six alarm inputs shall be handled with the facility to go to a preset position or a pre-programmed pattern on receipt of alarm, and to resume the pre-alarm programme thereafter.

The cameras shall be high performance, high definition, digital, monochrome,

surveillance cameras with minimum horizontal resolution with 1080 effective pixel sensor resolution. The camera shall have a 75 Ohm BNC video output connector and shall carry SANS standards body approval. The dome camera features shall be accessible using the video control matrix.

Camera lenses shall be varifocal, and shall be operate suitably in low light conditions. Lenses shall be auto-iris operation with direct drive and auto zoom 30X pend CL out and auto focus with manual override Camera Power Supply Units

Power supplies shall accept 230V AC input at 50 Hz and shall provide the necessary output voltage, frequency, and power required for the specific equipment being powered. Power supply units shall be suitable for outdoor mounting, and shall be suitable for terminating and glanding 2 cables (in and back out to next supply) up to 6mm² x 4-core PVC wire armoured cable. Power supply units shall incorporate surge protection (in fuse or other form) for protection of equipment against lightning and other voltage fluctuations. Units shall carry SANS, UL or CE standards body approval.

ELE PTB 1.5: Video Monitors

Video monitors shall be 24 inch class full HD LED type, with a metal cabinet type casing, and shall maintain a 4:3 aspect ratio. Monitors shall be high definition type and shall be suitable for CCTV application. All monitors shall have automatic degaussing, and shall have a maximum pixel pitch of 0.80mm.

ELE PTB 1.6: Matrix Switchers

The matrix switcher shall be standard 19" rack mounting, and shall switch and control a minimum of 64 video inputs (static or PTZ or dome) and 4 monitor outputs from a combination of digital controllers and PC's locally or remotely connected. The matrix switcher shall have password protection and menu driven programming, shall be extendable to accommodate up to 50 video inputs, shall be capable of generating text to indicate at minimum a 20 character title, camera number, and date, and shall have motion detection. The unit shall also allow for windows based management software (to be supplied with unit) to enable PC-based programming and storage of all settings, and shall be able to be partitioned to prevent unauthorized control and viewing. Internal batteries shall provide backup data protection for at least 1 week. The unit shall be capable of controlling PTZ cameras and shall be able to be controlled and programmed from both digital controllers and a linked PC . The unit itself shall be capable of accepting and processing 4 external alarm inputs (either normally open or normally closed) with provision for an additional 128 external alarm inputs, and of generating 2 control outputs with provision for an additional 128 external relay controlled outputs.

The video inputs and outputs shall have 75 Ohm BNC connections and the unit shall incorporate video loss detection for automatic fault finding on all video inputs.

The unit shall employ cross-point video matrix switching on vertical intervals in under 20 ms, shall have a bandwidth of 15MHz with a frequency response of below ± 1 dB up to 13 Mhz, a signal to noise ratio of 50dB, and unity gain. The matrix switchers shall carry SANS, UL or CE standards body approval.

ELE PTB 1.7: Keyboard Controllers

Keyboard controllers shall be desktop type of robust manufacture, shall be digital, shall be able to fully switch, control, and programme matrix switchers, shall have joystick

control for variable speed PTZ and dome camera functions. The joystick shall have pan, tilt, and zoom control, and selector keys shall be capable of selecting cameras, selecting monitors, operating preset patterns and sequences, opening and closing irises, zooming and focusing the lenses, and controlling scanning functions. The keyboard controllers shall carry SANS, UL or CE standards body approval.

ELE PTB 1.8: Digital Video Recorders (DVR)

DVR's shall be standard 19" rack mounting, shall have 64 video inputs (16 channel), HD video outputs, shall have at least 8 alarm inputs and 8 output controls, and shall have built in internal hard disk drive space of at least 550Mb and internal CD-RW drive for backup recording. The units shall offer continuous recording of 640 images per second, motion detection & motion detection recording, alarm recording, and scheduled recording modes (to be programmeable), shall allow playback by date, time, or camera, shall feature multiple camera displays (in 1, 4, 9, or 16 simultaneously) for live or recorded playback, and shall be able to control pan, tilt, and zoom functions on PTZ or dome cameras. DVR's shall have management software which is configurable, shall maintain log files of all events, shall recognize changed images, and shall have controlled remote viewing capability over TCP/IP. All information shall be stored on a 1 month basis recording on motion detection, whereafter it shall be stored on CD/DVD indefinitely. The recording shall not be affected by security on site action such as zooming/still/pause on the screen.

ELE PTB 1.9: Cabling

All cabling shall be screened to minimise cross-talk and interference, whether or not it is installed in conduit. At distances greater than 250m, or outside, fibre optic cable shall be utilised.

Transmission of video signal shall be via RG 59-coax cable, where cable length is less than 250 meters. Where this distance is exceeded, or where cameras are mounted outdoors, transmission medium shall be that of Fibre optic cable. Provision shall be made to house Fibre optic transmission equipment in IP55/56 housings. Transmission of data signal shall be via 4 pair screen cable, where cable length is less than 250 meters. Where this distance is exceeded, or where cameras are mounted outdoors, transmission medium shall be that of Fibre optic cable.

ELE PTB 1.10: Alarm Inputs

Various alarm points shall be monitored by means of the other electronic systems. Such alarm points shall be monitored by standard input/ output modules, which shall communicate with the CCTV head, end via hard-wired links from the access control system.

Alarm inputs shall be managed via an alarm input panel.

All sensing devices shall be in the "fail safe" mode, providing a closed contact in the secure position.

ELE PTB 1.11: Testing

The Contractor shall undertake exhaustive tests and shall submit on completion and prior to hand-over acceptance tests full testing and commissioning reports of the entire CCTV system.

All required adjustments to optimize the system operation shall be carried out during this testing procedure.

All "AS BUILT" documentation shall be available at this stage of the contract for proof testing against the system.

The Contractor shall provide a full set of test equipment.

All test equipment shall be housed on a fully wired test bench, which shall become the property of the Client. All test equipment shall remain the property of the Contractor.

ELE PTB 1.11.1: Test Schedules

- a) The Contractor shall draw up detailed and comprehensive test schedules for each section of the installation, and shall submit such proposed schedules to the Engineer for comment.
- b) All schedules shall be in editable format.
- c) These schedules shall be submitted in report form at the completion of the contract.

ELE PTB 1.12: Training

- a) The Contractor shall provide a comprehensive training scheme for system operators.
- b) All candidates submitted by the client shall be tested for suitability prior to acceptance on the course.
- c) The Contractor shall, in collaboration with the Engineer and the Client, determine a "Person Specification" for the type of persons required to operate the system.
- d) The client shall be responsible for the recruitment of the proposed operators.
- e) A facility shall be incorporated in the system, which shall allow the simulation of a variety of emergency conditions for training exercise.

**PERFORMANCE SPECIFICATION
FOR THE ELECTRONIC SERVICES SYSTEMS**

PART C

DETAILED TECHNICAL SPECIFICATION

1.01 Index

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ELE PTC 2.01: Introduction

This document provides a description of the performance and operation required of the security system to be implemented at the Diepsloot Bridges.

ELE PTC 2.01.1: CCTV

The External PTZ cameras shall also be housed in weatherproof enclosures and shall all be installed on 5m high poles. These poles shall have enclosures incorporating a circuit breaker for the power supply and for the splice and termination of the cables feeding each of the cameras.

Feed cables to the cameras around the campus are to be multi-core, fibre optic, PVC enclosed, wire armoured cables and shall be laid directly in the ground (600mm below ground level) to be trenched along the inside of the perimeter fence. The data cabling contractor shall supply and install all necessary splice kits, fly leads, power supply extensions, housings, poles, and cameras necessary for the full and intended operation of the CCTV system required.

A CCTV management system shall be supplied, installed, configured, and fully programmed to ensure full coordination and integration with all of the other systems installed on site to the full requirements of the engineer and facility manager. Among the other required functionality priority levels and modes of operation shall be easily selectable to enable: 1) automatic movement and recording of cameras for all event triggers (door access, burglar alarm activation) after hours; 2) no automatic movement eg. during school operating hours; selectable triggers for cameras eg. burglary. These options shall be able to be programmed into a scheduler for automatic operating mode changes at certain times and dates, and shall also be able to be manually changed or overridden if required. While the CCTV systems shall be housed in the gate house, remote viewing capability shall be securely available and monitored elsewhere on campus via the LAN.

ELE PTC 2.01.2: Uninterruptible Power Supplies (UPS)

Although the power supplies for the computers required for the systems to be supplied as part of this contract will generally be fed from the emergency standby generator, the tenderer shall supply and install a dedicated online UPS for each of the servers and workstations forming part of the electronic systems. These UPS's shall be sized by the tenderer, and shall, as a minimum, be capable of running the systems for 60 minutes in event of a power failure and shall protect the equipment from power surges, dips, and spikes, and shall protect the equipment during periods of irregular power supply.

ELE PTC 2.01.3: Enclosures

The contractor shall supply all enclosures required for the systems, their controllers, power supplies, and other components. No equipment shall be exposed, and where required these shall offer the necessary protection from weather and other elements.

ELE PTC 2.01.4: Cabling

Cabling to the bridges shall be done through fibre optic cables that will be installed from the existing gate house to the location of the camera points. The cables shall be installed in 110 diameter sleeves that will have 800x800x600mm manholes.

ELE PTC 2.01.5: Cabling Sleeves

Where cables cross under roadways or paved areas or other services, the cables shall be installed in pvc sleeves.

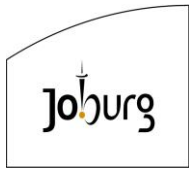
All cable sleeves shall be uPVC class 6, to SANS 791, installed by the contractor, and shall, unless otherwise specified, be 110 mm nominal diameter, installed at 1,0 m below ground level, in accordance with detail drawing. Sleeves shall be installed complete with draw-wire, plugs and marker blocks, as indicated on the drawing. Sleeve shall be cleaned out prior to the installation of cables and/or plugging of ends.

Pipe joints shall be profiled rubber sealing type.

Trenching and backfilling for sleeves shall be as specified for cables.

Where multiple cable sleeves are installed at road or paving crossings, at least one of these sleeves shall, wherever possible, be kept free of any cables, such that it will be readily available for later use.

The ends of all sleeves shall be sealed with a non-hardening watertight resin compound after the installation of cables (3-M Re-enterable Resin Cat. 48 FR, or equal approved). All sleeves intended for future use shall likewise be sealed.



VOLUME 1
ELECTRICAL INSTALLATION
JOHANNESBURG WATER
DIEPSLOOT SEWAGE AQUEDUCT

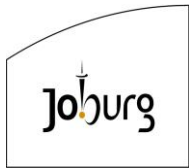
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ELECTRICAL INSTALLATION
JOHANNESBURG WATER
DIEPSLOOT SEWAGE AQUEDUCT
PART A
INSTALLATION
AND
MATERIAL SPECIFICATIONS

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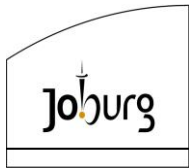


PART 1A

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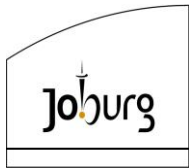


**SPECIFICATION FOR THE SECONDARY POWER DISTRIBUTION SYSTEM FOR EXCAVATIONS,
INSTALLATION OF SLEEVES, LAYING OF CABLES AND BACK FILLING OF CABLE TRENCHES**

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1. PURPOSE
2. SCOPE
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ELEC PT1A 1: PURPOSE

The purpose of this specification is to specify the minimum requirements for excavations, installation of sleeves, laying of cables, and backfilling of cable trenches for all cables.

ELEC PT1A 2: SCOPE

This specification is applicable to all secondary power distribution systems.

ELEC PT1A 3: GENERAL

ELEC PT1A 3.1: The term “excavation” shall mean all excavations required for the execution of the contract and includes the digging of cable trenches, pole holes, manholes, cable jointing pits and any other excavations for the purpose of the contract.

ELEC PT1A 3.2: All the regulations included in the Occupational Health and Safety Act (Act No 85 of 1993) must be adhered to. It is necessary to take cognisance of the requirements in respect of struts for the walls of cable trenches deeper than 1,5m.

ELEC PT1A 3.3: Where a cable trench has to be excavated in front of or through private is non-municipal property, all the concerned owners must be informed at an early stage.

ELEC PT1A 3.4: Written approval for the use of a mechanical trench digger must be obtained from the Engineer.

ELEC PT1A 3.5: All possible steps must be taken for the protection of trees, plants, flowers and shrubs during the execution of the contract.

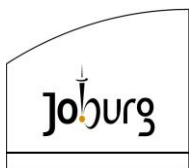
ELEC PT1A 3.6: Where the cable trench passes through chemically active soil, the Engineer must be informed accordingly.

ELEC PT1A 3.7: If the Engineer is not notified of chemically active soil, the organisation erecting the installation will be held responsible for any damage that may be done to the installation.

ELEC PT1A 3.8: Where any obstacle or obstruction is encountered during the erection of the installation which necessitates alterations to the cable trench or cable route or method of construction, such alterations must first be approved by the Engineer in writing. The alterations must be indicated on the “as-built” drawings.

ELEC PT1A 3.9: Where excavations pass within one meter of strut-, telephone-, electrical-, or traffic light poles it is necessary to carry out tunnel excavations for a distance of 500mm on each side of the relevant service. The tunnel excavation must be executed as a safety measure for overhead services. The number of cables that have to be laid will determine the width of the tunnel. The height must be such that the maximum quantity of support soil is retained.

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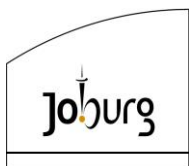
ELEC PT1A 4: SAFETY MEASURES AT EXCAVATIONS

- ELEC PT1A 4.1: All excavations must be made safe unless otherwise stated.
- ELEC PT1A 4.2: All the vehicle-or road crossings over a cable trench, whether it is a private entrance or a public road, must be secured on either side by means of solid efficient railings to the satisfaction of the Engineer.
- ELEC PT1A 4.3: Where planks are used for bridges the planks must be bolted together by means of cross planks on the underside so that the planks do not move or twist. Such a crossing must be capable of carrying a load of 6 metric tons without collapsing or what ever may be necessary for the specific application.
- ELEC PT1A 4.4: For the use a bridge 1m wide and 1m high with firm hand railings must be provided over open cable trenches in front of buildings or by means of another approved method. The planks for the bridge must be at least 38mm thick and the hand railings must be firmly bolted to the bridge planks so that the hand railing will not collapse if a person leans or falls against it. The hand railings must be built in such a way that a person (child) cannot fall or crawl through it.
- ELEC PT1A 4.5: Alternative structures of steel or other material can be used if they comply with the requirements detailed in par. 4.4 above and are approved by the Engineer.
- ELEC PT1A 4.6: Both ends of all open excavations must be barricaded at a distance of 3m by means of white 200 liter steel drums (example oil drums), or a method approved by the Engineer.
- ELEC PT1A 4.6: Where roads, footpaths or pavements, vehicle entrances or road crossings cross a cable trench, effective warning lights must be installed. All barricades must be effectively illuminated as follows:
- ELEC PT1A 4.7.1: Across the ends of the cable trench two flashing, red/amber warning lights must be installed 1m apart 1200mm above the natural ground level.
- ELEC PT1A 4.7.2: Next to open cable trenches flashing red/amber, warning lights must be installed 15m apart 1200mm above the natural ground level together with a rope or pole barricade.
- ELEC PT1A 4.7.3: At least two (2) red and white PVC warning tapes must be provided at 600mm and 1200mm above the natural ground level at each foot and vehicle bridge.

ELEC PT1A 5: CABLE TRENCHES

- ELEC PT1A 5.1: Cross-section cuttings must be made through cable trenches at the places indicated by the Engineer.
- ELEC PT1A 5.2: The cable trench must be excavated in the position indicated on the drawings in accordance with the standard methods prescribed in the drawings or as

Employer		Contractor	
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determined by the Engineer

- ELEC PT1A 5.3: The cable trench must be straight and excavated in accordance with the required dimensions. The length of cable trench that may be excavated at a time must not exceed 400m, following which a length of cable must be laid, inspected and the cable trench backfilled before further excavations are carried out. Cables, which have been laid, must be energised as soon as possible to limit the possibility of theft of cable.
- ELEC PT1A 5.4: The cable trench must be wide enough to accommodate the cables in accordance with the schedule of technical details.
- ELEC PT1A 5.5: The cable trench must be excavated to a depth of 700mm (with a 50mm tolerance) below the final level of the pavement or 500mm below the final tarred level of the street. If the cable trench, due to circumstances is excavated on the lower side of the road, the bottom of the cable trench must be at least 500mm below the ground level of the boundary of the stand. Any additional excavations due to the abovementioned condition shall be deemed to be included in the unit tariff.
- ELEC PT1A 5.6: Where roads and streets have not been built and the road surface has to be crossed, cables must be laid in sleeves 1,5m below street level to prevent damage of the cables at a later stage.
- ELEC PT1A 5.7: The bottom of the cable trench must be level with and must follow the contour of the final tarred surface. Excessive depths must be filled with soft soil compacted to the required depths.
- ELEC PT1A 5.8: Where the cable trench passes through rocky soil, sharp points and edges that could damage the cables during installation and thereafter, must be removed. All loose rocks and fragments must be removed from the cable trench.
- ELEC PT1A 5.9: Natural obstructions must either be removed or tunneled but when other services are encountered, the shortest route must be taken in accordance with the prescribed specified clearance.
- ELEC PT1A 5.10: Where a cable trench is excavated adjacent to an existing cable route:
- ELEC PT1A 5.10.1: Cross sections through the trench must be made and the Engineer must decide on the position and route of the new cable trench.
- ELEC PT1A 5.10.2: Cables and cable joints may only be moved under the supervision of the Engineer.
- ELEC PT1A 5.10.3: The necessary precautions must be taken to prevent damage to the existing cables. The repair of the damaged cables will be carried out by the Electricity Department and the contract will be debited with the cost thereof.

ELEC PT1A 6: **EXCAVATIONS OF CABLE JOINTING PITS**

- ELEC PT1A 6.1: Excavations for cable jointing pits must be at least 1,2m deep, rectangular and large enough for two cable jointers to comfortable and effectively execute the

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work. If more than one cable joint has to be made in the same position, the jointing pit must be large and long enough so that the cable joints can be staggered. The minimum size of the jointing pits for cable joints are as follows:

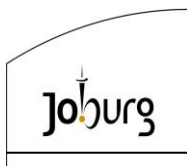
ELEC PT1A 6.1.1:	Single cable joint	2,5m long x 1,25m wide
ELEC PT1A 6.1.2:	Two staggered cable joints	3m long x 1,5m wide
ELEC PT1A 6.1.3:	Three staggered cable joints (triangular pattern)	3m long x 1,6m wide
ELEC PT1A 6.1.4:	Four staggered cable joints	3,5m long x 2m wide
ELEC PT1A 6.1.5:	Five staggered cable joints	4m long x 2m wide
- ELEC PT1A 6.2: The exact position of all cable jointing pits must at all times be approved by the Engineer.
- ELEC PT1A 6.3: Flashing red/amber warning lights must be installed around the cable jointing pits at a height of 1200mm above the natural ground level. A rope and pole barricade must be erected in addition to the warning lights.
- ELEC PT1A 7: **INSPECTION AND MEASUREMENT OF EXCAVATIONS**
- When the excavations for the cable trenches and cable jointing pits have been completed, the Engineer must be notified twenty four (24) hours beforehand so that he can execute inspections and be present when the excavations are measured. Inspections are not executed on Saturdays, Sundays and Public Holidays.
- ELEC PT1A 8: **MAINTENANCE OF EXCAVATIONS**
- ELEC PT1A 8.1: The excavations must be maintained in a good condition, free of storm-, rain- and seepage water, mud, loose ground, rocks, gravel or any other foreign material that may be found in the cable trench until the cables have been laid, are covered and the backfilling compacted.
- ELEC PT1A 8.2: The necessary steps must be taken to prevent loose rocks and ground falling from the pavement onto the tarred surface or landing in other services during torrential rain. If the above-mentioned does happen, it must be rectified immediately.
- ELEC PT1A 9: **STORAGE OF EXCAVATED MATERIAL**
- ELEC PT1A 9.1: No excavated soil material may be dumped on stand beacons or nearer than 300mm from the edge of the excavations. Soil, which the Engineer considers suitable for use as a ground layer, may be heaped next to the excavations. The excavated material must be heaped in as small a heap as possible, taking the safety of the workers into consideration, so that the excavated soil will not take up unnecessary space and also does not obstruct the drawing in of cables.
- ELEC PT1A 9.2: All excavated material must be heaped in such a way that pedestrians or traffic will not be inconvenienced unduly. If the Engineer considers it necessary for the flow of traffic or any other reason, the excavated material must be removed to a pre-

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Witness:		Witness:	

arranged site immediately after the ground has been excavated. The cost connected with the handling of the excavated material shall be deemed to be included in the unit price for excavations.

- ELEC PT1A 9.3: No excavated material may be heaped on the tarred surface. If the road reserve and stand boundary is a narrow pavement, the Engineer must issue instructions regarding the heaping of excavated material.
- ELEC PT1A 10: **INSTALLATION OF SLEEVES**
- ELEC PT1A 10.1: In the event of cables which cross roads and streets, where the road or the street has not been built, sleeves must be installed at a depth of 1,5m below the ground level in the positions indicated on the drawing.
- ELEC PT1A 10.2: Where roads and streets have been built or are in the process of being built with the kerbing in position, the top of the upper layer of sleeves must be installed at a minimum depth of 800mm below the surface of the kerbing. When other services cross the ends of cable sleeves within 1m, and the cables cannot be laid above the service with the minimum clearance, the sleeves must be installed deeper to the extent that the cables cross the other services with the minimum clearance.
- ELEC PT1A 10.3: Unless otherwise specified, two additional sleeves must be installed at all crossings for future purposes.
- ELEC PT1A 10.4: If more than five sleeves are to be provided, sleeves may be installed in two layers in a staggered formation. When sleeves are installed in layers, they must be so indicated on the “as-built” drawing.
- ELEC PT1A 10.5: The bottom layer of sleeves must be used first and the top layer must be left for future installations.
- ELEC PT1A 10.6: Sleeves used in crossings must be straight and without any physical damage. Turns or bends are not allowed in crossings.
- ELEC PT1A 10.7: Sleeves below pavements, road surfaces and tarred streets must be carefully enclosed with ground so that air pockets are not formed between the sleeves. The cable trench must be backfilled in layers of 300mm and compacted with mechanical stumpers as specified in par. 14.7.6. It is preferable to drill cavities for sleeves below vehicle- and pedestrian crossings.
- ELEC PT1A 10.8: Sleeves must be laid, joined and compacted to the satisfaction of the Engineer. After the sleeves have been installed and cleaned, a plug, which neatly fits into the sleeve, must be drawn through the sleeve. A galvanized wire must be provided in each sleeve. The ends of the sleeves must be sealed by means of polythene caps until the cables have been drawn into the sleeves where after the ends of the sleeves must be sealed by means of an approved method.
- ELEC PT1A 10.9: If necessary, road- and street crossings must be executed in two phases so that

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Witness:		Witness:	



the traffic is not affected detrimentally.

ELEC PT1A 11: INSTALLATION OF CONCRETE PLANKS AND CABLE MARKERS

ELEC PT1A 11.1: Where electrical cables cross over other services, for example water pipes, sewage pipes, other electrical cables, pilot cables or telephone cables, or if there is a possibility that the cables can be damaged as a result of excavations by a third party, the cables must be protected by means of reinforced concrete planks. The concrete planks must protect the cable over a distance of approximately 500mm on either side of a crossing.

ELEC PT1A 11.2: Where electrical cables cross below other services, for example water pipes, sewage pipes, other electrical cables, pilot cables and telephone cables, the concrete planks must be placed below and axially with the service. If the clearance between the electrical cables and the other services is less than 300mm (oil pipe line and Rand Water Board excluded) an additional concrete plank must be placed axially on top of the electrical cable. The concrete plank must protect the other services and the electrical cables over a distance of approximately 500mm on either side of the crossing.

ELEC PT1A 11.3: Where electrical cables cross an oil pipeline or a water pipe of the Jo'burg Water Board a cable marker must be installed on either side of the servitude.

ELEC PT1A 11.4: A cable marker must be installed at each turn in the cable route.

ELEC PT1A 12: CROSSINGS WITH OTHER SERVICES

ELEC PT1A 12.1: General

ELEC PT1A 12.1.1: Where an electrical cable is installed over another service, the cable must be installed at a minimum level of 800mm below the final ground level, if the 800mm cannot be achieved the cable must be installed below the relevant service. The electrical cable must be protected by means of concrete planks as specified in par. 11. The deeper installation level of the electrical cable is applicable over a distance of 1m on either side of the crossing.

ELEC PT1A 12.1.2: If due to circumstances, it is not possible to cross below another service the situation must be discussed with the Engineer for his decision.

ELEC PT1A 12.1.2: Where holes are drilled for the installation of sleeves below roads and streets at least 4 sleeves with an internal diameter of 100mm must be installed unless otherwise specified. The Council does not accept the responsibility for the risks attached to drilling.

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ELEC PT1A 12.2: Clearances

The following minimum clearances must be maintained between electrical cables and other services:

	<u>Vertical (mm)</u>	<u>Horizontal (mm)</u>
Telkom cables	300	300
Oil pipeline and Rand Water Board	1000	1000
Other water pipes	300	300
Sewage pipes	300	800
All types of manholes and catch pits.	—	100
Pilot cables	50	—

ELEC PT1A 12.3: Telkom cables

The special conditions of Telkom must be adhered to in respect of crossing of telephone cables.

ELEC PT1A 12.4: Jo'burg Water Board- and oil pipe line crossings

ELEC PT1A 12.4.1: Where the cable route cross any of the above-mentioned services a letter of consent must be obtained from the Engineer of the relevant authority.

ELEC PT1A 12.4.2: Since the above-mentioned pipelines function at a high pressure all excavations must be executed under the supervision of the Engineer of the relevant authority in accordance with the letter of consent. The necessary inspections must be arranged with the relevant authority.

ELEC PT1A 12.4.3: Sleeves for the above-mentioned services must be installed so that the sleeves protrude over a distance of 1,5m on either side of the respective pipe. Concrete planks must be placed axially on top of the sleeves over the entire length of the sleeves.

ELEC PT1A 12.4.4: Where horizontal drilling is executed for the installation of sleeves below a pipeline, it must be approved by the relevant authority, and one additional sleeve must be installed. The Council does not accept responsibility for the risk attached to drilling. Concrete planks must be laid on top of the cable for over a distance of 1,5m from the sleeves below the pipeline.

ELEC PT1A 12.4.5: Cable markers must be installed at the ends of the sleeves.

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ELEC PT1A 12.5: National and Provincial Road crossings

- ELEC PT1A 12.5.1: Crossing of the abovementioned roads is subject to the written approval of the relevant authority.
- ELEC PT1A 12.5.2: A road crossing must be executed under the supervision of the Engineer of the relevant authority. The work must be executed in accordance with the instructions in the letter of consent.
- ELEC PT1A 12.5.3: The crossing must be executed in such a way that the traffic is disrupted to a minimum.

ELEC PT1A 13: Installation of cable racks and cable clamps

Where it is necessary to provide cable racks and/or cable clamps, the proposals and plans of such cable racks and/or cable clamps must be provided to the Engineer for his approval prior to the providing and installation thereof. The cables must be supported at a minimum distance of 600mm.

ELEC PT1A 14: INSTALLATION OF CABLES

ELEC PT1A 14.1: Bottom layer for cables

- ELEC PT1A 14.1.1: The bottom of the cable trench must be leveled with a layer of soft soil to a minimum thickness of 100mm before a cable trench inspection is requested.
- ELEC PT1A 14.1.2: If the soil which has been excavated is not suitable for the bottom layer in the cable trench, suitable soil must be brought to the site. The cost of the soil and the transport thereof is deemed to be included in the unit price of normal excavations. (Under no circumstances may topsoil from the immediate surrounding or any other unapproved site be used for this purpose).
- ELEC PT1A 14.1.3: A sufficient quantity of soft soil similar to that of the bottom layer must be made available alongside the cable trench which will cover the cables for a minimum depth of 300mm when an inspection of the cable trench has been requested. The cables must be covered immediately after they have been inspected.
- ELEC PT1A 14.1.4: If the soil for the bottom or top layer has to be sifted, a sieve with 6mm diameter holes, maximum, must be used for this purpose.

ELEC PT1A 14.2: Planning

- ELEC PT1A 14.2.1: The laying of cables must be planned in such a way that the off-cuts can be used elsewhere in the installation to minimize the quantity of a cable wasted. The cost

Employer		Contractor	
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of unnecessary cable waisted will not be for the account of the Council.

ELEC PT1A 14.2.2: The cables must be laid in such a way that the start of one drum will link up with the end of the previous cable drum so that the phase rotation of the 11kV cables are kept the same. In the case where a new 11kV cable must be joined to an existing 11kV cable the phase rotation of the existing 11kV cable must be determined so that the new 11kV cable can be laid to suit the phase rotation of the existing cable.

ELEC PT1A 14.2.3: The length of cable at the beginning and end of a cable route must be sufficient for the connection of the cable to the switchgear and other equipment. Where necessary the lengths to be allowed will be determined by the Engineer. The necessary steps must be taken to fix the termination lengths and seal the cable ends watertight by means of a heat shrink cap. Each cable end must be clearly marked in the substation.

ELEC PT1A 14.3: **Method**

ELEC PT1A 14.3.1: The methods intended to be used for the installation of cables must be approved by the Engineer.

ELEC PT1A 14.3.2: All cables must be laid with a minimum delay so that the cable trench can be backfilled as soon as possible. Before the cable trench can be backfilled the cable must be tested, inspected and approved by the Engineer. Only one cable must be laid at a time and this process must not damage cables, which have been installed.

ELEC PT1A 14.3.3: Where the cables are drawn into the cable trench cable rollers must be supplied and positioned in such a way that the cable does not touch the bottom or side of the cable trench. Rollers must be of an approved construction without sharp edges, which can damage the cable. After the rollers have been removed the cables must be straightened immediately.

ELEC PT1A 14.3.4: If a winch is used to draw the cables into the cable trench tension clamps must be provided and soldered to the cable so that tension is applied simultaneously to all the cores, the lead sheath and the steel armoring of the cable.

ELEC PT1A 14.4: **Other requirements**

ELEC PT1A 14.4.1: Where cables are drawn into sleeves they must not be bent excessively to prevent damage of cables.

ELEC PT1A 14.4.2: Sharp objects for example picks, spades etc. must not be used to move cables and must not be left close to cable trenches where they can cause damage to cables.

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ELEC PT1A 14.4.3: Accurate records must be kept of each cable drum used. The following information is required:

Manufacturer
Cable drum number
Size of cable
Installed from to
Length of slack
Date installed

Note: If the abovementioned information is not noted immediately after the cable has been laid, the Council will not be responsible for the repair cost of any factory faults that may be present in the cables.

ELEC PT1A 14.5: **Inspection and measurements of cables**

ELEC PT1A 14.5.1: When the Engineer is notified that a length of cable has been laid and is ready for inspection; the information requested in par. 14.4.3 above must be indicated on the drawing. The drawing must be filed on site so that the Engineer can check the information and measurements and certify the relevant portion during inspection.

ELEC PT1A 14.5.1: All cables must be measured and certified by a representative of the Council before backfilling of the cable trench is executed. (The measurements of the cables must be used as far as possible.)

ELEC PT1A 14.6: **Backfilling of the cable trench**

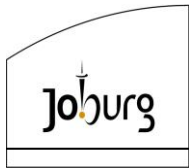
ELEC PT1A 14.6.1: After the cable has been laid, straightened, inspected, measured, approved and covered with a layer of soil as described in par. 14.1.3 above, the cable trench must be backfilled over its entire width. The soil used for backfilling must not contain more than 40% rock or shale and must pass through sieve with 100mm openings. The Engineer must approve soil used for backfilling.

ELEC PT1A 14.6.2: If the soil contains more than 40% but less than 70% rock the percentage of rock will be determined by the Engineer. This percentage shall determine the quantity of suitable soil for backfilling which replaces the rocks. Additional payments will be made to replace the percentage rock with suitable soil. If the soil contains more than 70% rock, all the soil for backfilling must be made available at extra cost.

ELEC PT1A 14.6.3: If suitable soil without any rock is brought to the site instead of sifting the soil, additional payment will be made in respect of the actual percentage of rock as determined by the Engineer. The quantity of suitable soil will be calculated according to the nominal width and depth of the cable trench.

ELEC PT1A 14.6.4: The cable trench must be backfilled with 300mm layers of soil, rammed and consolidated in accordance with AASHTO as specified in par. 14.7.6. Soil for

Employer		Contractor	
Witness:		Witness:	

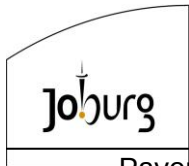


backfilling must not contain more than 10% moisture. The Engineer may, if he considers it necessary, request that a mechanical compactor be used.

- ELEC PT1A 14.6.5: The portions of the cable trench that have been completely backfilled must be maintained in a safe condition for the entire duration of the contract. If the soil subsides in the cable trench it must be refilled with soil and rammed
- ELEC PT1A 14.6.6: The pavements adjacent to the cable route must be cleaned and finished off over their entire width. All rocks larger than 25mm, loose organic material and building rubble must be removed from the site.
- ELEC PT1A 14.7: **Repair of road- and other surface covering**
- ELEC PT1A 14.7.1: Where excavations are executed in streets and roads, all road material must be carefully heaped on one side so that it is readily available for re-use if necessary. If the above-mentioned material cannot be re-used it must be removed and dumped at the appropriate dumping site.
- ELEC PT1A 14.7.2: Where a cable trench is excavated over an existing road, the cable trench must be repaired temporarily so that the road can be opened for the traffic until permanent repair work has been carried out by the Council. The cable trench must be refilled in 300mm layers and compacted with a mechanical compactor to 95% AASHTO. The temporary refilling must be kept in a good piled condition so that it does not disrupt the traffic.
- ELEC PT1A 14.7.3: Where excavations necessitate the lifting of tiles, bricks or other similar material, they must be loosened carefully without causing damage and carefully packed on one side for re-use. No extra payment will be made for the damage of such tiles, bricks, etc. except for those, which were broken before commencement of the installation and indicated to the Engineer and noted in the site book.
- ELEC PT1A 14.7.4: Where excavations pass through lawns, grass sods must be cut, removed and carefully placed on one side before the excavations are commenced. After the cables have been laid, the cable trench must be backfilled and rammed. The grass sods, which were removed, must be replaced carefully.
- ELEC PT1A 14.7.5: Concrete surfaces must not be broken but cut in a pattern which can be readily repaired.
- ELEC PT1A 14.7.6: Where a cable trench is excavated in a pavement, a driveway or tarred road, the cable trench must be backfilled with soil in layers of 300mm and compacted as follows:

Revised AASHTO

Employer		Contractor	
Witness:		Witness:	



Pavements : 87%

Driveways : 90%

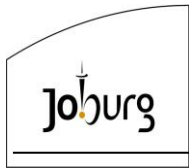
Tarred roads : 95%

ELEC PT1A 15: INSPECTIONS

ELEC PT1A 15.1: Each phase of the installation or portion thereof must be inspected by Engineer according to the progress made.

ELEC PT1A 15.2: The inspections must be carried out in accordance with Form ESS F0089-“Inspection of the Installation of cables, excavating and backfilling of cable trenches”. The inspection form must be completed and signed during every inspection.

Employer		Contractor	
Witness:		Witness:	



SPECIFICATION OF THE SECONDARY POWER DISTRIBUTION SYSTEM FOR THE INSTALLATION
OF LOW TENSION METER AND DISTRIBUTION BOXES

PART 1B

CONTENTS

1. PURPOSE
2. SCOPE
3. INSTALLATION
4. CONNECTION OF CIRCUIT BREAKERS, ENERGY METERS AND LOW TENSION CABLES
5. MARKING AND NAMING OF LOW TENSION METERS AND DISTRIBUTION BOXES
6. INSTALLATION OF LOW TENSION CABLES
7. TOLERANCES IN RESPECT OF THE INSTALLATION OF LOW TENSION METER AND DISTRIBUTION BOXES
8. EARTHING
9. INSPECTION

Employer		Contractor	
Witness:		Witness:	

ELEC PT1B 1: PURPOSE

The purpose of this specification is to specify the minimum requirements for the installation and connection of low-tension meter and distribution boxes.

ELEC PT1B 2: SCOPE

This specification is applicable to installation and connections of meter and distribution boxes.

ELEC PT1B 3: INSTALLATION

ELEC PT1B 3.1: The meter and distribution boxes must be installed in the relevant positions as indicated on the drawings.

ELEC PT1B 3.2: The meter and distribution boxes must be planted vertical with the short side of the box parallel to and 400mm away from the guard house.

ELEC PT1B 3.3: In cases where the slope of the surrounding ground is such that it is not practical to install the meter box in the normal position, the meter box may be installed 2m away from the curbing with the approval of the Engineer. If the slope of the surrounding ground requires special support, the Engineer must approve the proposed method.

ELEC PT1B 3.4: Distribution boxes must be accessible free of vegetation or inflammable material until the maintenance period has expired.

ELEC PT1B 4: CONNECTION OF CIRCUIT BREAKERS, ENERGY METERS AND LOW TENSION CABLES

ELEC PT1B 4.6: The low-tension cables, which are terminated distribution box, must be clearly marked where they are fed from or where they are feeding to.

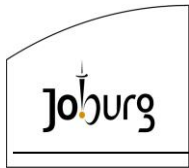
ELEC PT1B 4.2: The cable conductors must be connected to the front side of the busbars by means of crimping cable lugs.

ELEC PT1B 4.3: The color of the PVC insulation of the low-tension cable conductors must correspond to the phase colors (RED, WHITE and BLUE) of the busbars.

ELEC PT1B 4.4: Each circuit breaker in a meter box must be connected to the busbars by means of 16mm² copper conductor and crimping cable lugs. The color of the PVC insulation of the conductors must correspond to the phase colors of the busbars.

ELEC PT1B 4.5: 16mm² copper conductors must be provided and installed from the circuit breakers to the meters (which will be provided, installed and connected by the Council). The color of the PVC insulation of the conductors must correspond to phase colors of the busbars. All the bolts used for electrical connections must be equipped with washers and spring-washers or locknuts. All bolts, nuts, washers and spring

Employer		Contractor	
Witness:		Witness:	



washers must be manufactured of a non-magnetic material.

ELEC PT1B 4.6: All the low-tension cables must be fixed in meter boxes by means of clamps.

ELEC PT1B 4.7: 40% of the armoring wires of the main LT cables and the supply cables to the stands must be separately twisted and connected to the earth busbar by means of a crimping cable lug. The twisted armouring wires must not be thinner than 50% of a conductor of the cable.

ELEC PT1B 5: **MARKING AND NAMING OF DISTRIBUTION BOARDS**

ELEC PT1B 5.1: The numbers of the stands adjacent to the meter box must be engraved on the nameplate.

ELEC PT1B 5.2: In the case of a panhandle stand the meter box must be placed next to the stand beacon, if the meter box feeds both stands both stand numbers must be engraved on the nameplate.

ELEC PT1B 5.3: The above-mentioned nameplate must be manufactured from aluminum

ELEC PT1B 5.4: In a low tension distribution box a lead- ; aluminum strip must be secured above the cable gland for the identification of the cable.

ELEC PT1B 5.5: The following abbreviations must be used for marking equipment and cables, example:

DB - Low-tension distribution box

ELEC PT1B 6: **INSTALLATION OF LOW TENSION CABLES**

The 400/230V-cables must be installed in accordance with specification.

ELEC PT1B 7: **TOLERANCES IN RESPECT OF THE INSTALLATION OF LOW TENSION METER AND DISTRIBUTION BOXES**

The meter and distribution boxes must be planted with the bottom of the front and rear removable panels at least a 150mm above the final ground level.

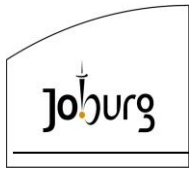
ELEC PT1B 8: **EARTHING**

The meter and distribution boxes must be earthed in accordance with SANS Specifications.

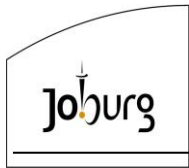
ELEC PT1B 9: **INSPECTION**

ELEC PT1B 9.1 After the meter and distribution boxes have been installed, the installation must be inspected by the Engineer.

Employer		Contractor	
Witness:		Witness:	

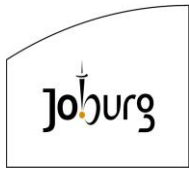


Employer		Contractor	
Witness:		Witness:	



ELECTRICAL INSTALLATION
JOHANNESBURG WATER
DIEPSLOOT SEWAGE AQUEDUCT
PART 2
DETAIL SPECIFICATION

Employer		Contractor	
Witness:		Witness:	



PART 2

DETAIL SPECIFICATION

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25. DIGGING HOLES	
26. PLANT HOLES	
27. ASSEMBLE MV STRUCTURE	
28. EQUIPMENT TESTING	

Employer		Contractor	
Witness:		Witness:	



DETAIL SPECIFICATION

ELEC PT2 1: GENERAL

ELEC PT2 1.1: This part of the specification should be read in conjunction with the Bills of Quantities and drawings as listed in this specification.

ELEC PT2 2: SCOPE OF CONTRACT

ELEC PT2 2.1: This contract covers the supply delivery, installation, testing, handing over in working order and 12 month's maintenance after first hand over of the complete electrical reticulation as described and as detailed on the drawings.

ELEC PT2 2.2: Tenderers are advised to allow in the respective rates for all equipment, materials, labour and other cost related to the particular item and to complete the installation as specified in this document and as detailed on the drawings.

ELEC PT2 3: VISIT TO SITE

ELEC PT2 3.1: The site is situated along Pretoria street and School road, Diepsloot, Johannesburg.

ELEC PT2 3.2: There will be no compulsory site inspection. Tenderers are advised to visit the site to acquaint themselves with the local conditions, access to site for personnel, etc. Any claims that may arise later due to a lack of knowledge in this regard will not be considered.

ELEC PT2 4: SCOPE OF WORKS

ELEC PT2 4.1: General

ELEC PT2 4.1.1: The works consist of removing of existing street lighting and cables.

ELEC PT2 4.1.2: The works also include the provision of new lighting for the sections for street lighting.

ELEC PT2 4.1.3: Installation of new lighting in bridge 1 and 2.

ELEC PT2 4.1.4: Installation of lighting and power to new guard house.

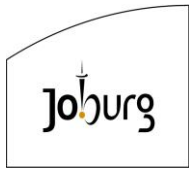
ELEC PT2 4.1.5: Installation of power to security system.

ELEC PT2 4.1.6: Trenching and cabling power for guard house 1 and 2

ELEC PT2 5.0: SUB-CONTRACT WORK

ELEC PT2 5.1: All work specified shall only be performed by the tenderer's own personnel and shall under no circumstances be sub-contracted unless of a specialised nature i.e. 11 kV cable ends and joints.

Employer		Contractor	
Witness:		Witness:	



ELEC PT2 6: SITE CO-ORDINATION

ELEC PT2 6.1: The electrical contractor will be a sub-contractor to the civil contractor and shall co-ordinate his work with the civil construction to avoid any clashes between the relevant parties.

ELEC PT2 7.0: CABLE RETICULATION

ELEC PT2 7.1: MEDIUM VOLTAGE CABLES

ELEC PT2 7.1.1: General

The existing medium voltage cables will be exposed and re-located where required. Where new cables are required these shall conform to the specifications of the Eskom.

ELEC PT2 7.1.1.1: Special care shall be taken not to bend the cables less than twice the normal bending radius of the cables during the re-location.

ELEC PT2 7.2: LOW VOLTAGE CABLES

ELEC PT2 7.2.1: General

ELEC PT2 7.2.1.1: Low voltage cables shall be of the 600/1000V PVC insulated, armoured, copper conductor type (PVC/PVC/SWA/PVC) suitable for general use and manufactured according to SABS 1507 as amended and shall conform to the Eskom specifications.

ELEC PT2 7.2.2: **Cable Terminations**

ELEC PT2 7.2.2.1: Low voltage cables shall be terminated with approved cable glands, with PVC shrouds of the correct size.

ELEC PT2 7.2.2.2: The armoring shall be earthed by means of the cable glands to the cable mounting plate.

ELEC PT2 7.2.2.3: The individual cable cores shall be connected to the busbars or the connecting terminals by means of sweated or crimped cable lugs of the correct size. The right size of crimping die shall be used in the crimping apparatus for the connection of the copper wires to the cable lugs.

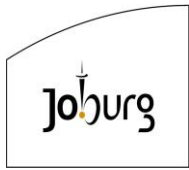
ELEC PT2 7.2.3: **JOINTS**

ELEC PT2 7.2.3.1: Joints will only be permitted if approved by the Engineer prior to installation.

ELEC PT2 7.2.3.2: Joints shall be strictly in accordance with the instructions of the manufacturers.

ELEC PT2 7.3 : LIGHTING

Employer		Contractor	
Witness:		Witness:	



The lighting at the bridge 1 shall consist of 70 watts High Pressure Sodium post top light fitting mounted on a 3meter steel pole including concrete base and miniature circuit breaker.

The lighting at the bridge2 shall consist of 48 watts LED post top light fitting mounted on a 5meter steel pole including concrete base

ELEC PT2 7.4 Lighting inside the guardhouse shall consist of bulkhead light with 11watt compact fluorescent fitting, with a white trim.

ELEC PT2 7.5 Lighting inside the guardhouse shall consist of bulkhead light with 11watt compact fluorescent fitting, with a black trim.

ELEC PT2 7.5 Masts shall be equipped with 2m double cross arms.

ELEC PT2 8: **TRENCHES**

ELEC PT2 8.1: **Excavations**

Excavation for trenches shall be either by mechanical or manual means. Various trench widths and depths will be required.

Trenches for cables will be 500mm deep and 500mm wide.

The electrical contractor shall mark out all cable trenches prior to excavations to ensure the correctness of the cable trench positions.

Cable trench widths depends on the number of cables in the trenches. Cables shall be installed 150mm apart except for service connections which are to be grouped on either side of the trench for the "on" side and "off" side stands. The contractor will not be compensated for excavations wider than a 100mm from the outside cables.

If required, the necessary pumps and other equipment for the removal of water from cable trenches shall be provided by the contractor, the cost of which shall be included in the unit rates for excavation.

Tenderers shall base the cost for trenches in ground and hard rock on the quantities in the Bills of Quantities. Final quantities will be re-measured and the cost adjusted based on the rates in the Bills of Quantities. Payment will be made on the volumetric tariff, based on the given maximum or actual dimensions whichever will be the lesser.

Employer		Contractor	
Witness:		Witness:	

Ground

Ground means ground that can be excavated by hand pick and shovel or machine and includes gravel, clay, compacted ground, scale loose oukclip and rocks of less than .03 cub metre volume.

Hard rock

Hard rock means granite, quartzitic sandstone, slate and rocks of similar hardness, solid scale and rocks larger than 0,03 cub metre volume.

The contractor shall call upon the Engineer to inspect cable trenches prior to installation of cables and also prior to backfilling after installation of all cables for a section of trench. No backfilling may start before inspection of the cables by the Engineer.

Backfilling of trenches shall be done in layers of 200mm, each layer dampened and compacted mechanically to achieve a 90% MOD AASHO density with the initial layer consisting of selected backfill covering the cables to a depth of 100mm with and with 100mm below the cables. All excess large stones and rocks are to be removed and transported of the site and shall not be used for backfilling.

ELEC PT2 10.2: **CABLE SLEEVES**

All cable sleeves for road crossings will be provided by the electrical contractor but installed by the civil contractor.

ELEC PT2 11: **ISOLATORS**

Unless otherwise specified isolators shall be of the flush and surface mounting type rating as shown on the relevant drawings.

External isolators shall be enclosed in a weatherproof yolk box.

ELEC PT2 12: **GEYSERS**

The electrical sub-contractor shall Install isolators for geysers, final connection and commissioning of the geysers will be done by others.

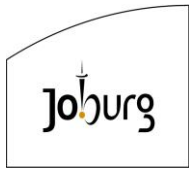
ELEC PT2 13: **16 AMP, 3-PIN, 250 VOLT SWITCH-SOCKET CIRCUITS**

Wiring shall consist of 2 x 4,0mm² PVC conductors and 1 x 2,5mm² earth wire in 20mm diameter conduit.

Outlet boxes for switch-socket outlets shall be installed at the following height above finished floor level, measured to underside, unless otherwise specified:

a) Generally otherwise: 300mm

Employer		Contractor	
Witness:		Witness:	



ELEC PT2 14: CONDUITS

Unless otherwise specified all conduiting shall be PVC.

ELEC PT2 15: LIGHTING CIRCUITS

Lighting circuits shall be wired using 2.5mm² insulated wires. Cabling shall be installed neatly in the ceiling void and installed in 20mm diameter PVC conduit where light fitting. All light fittings shall be hardwired.

ELEC PT2 16: POWERSKIRTING

Power skirting shall be 2-compartment sheet-steel and installed in the positions indicated on the layout drawings. The standard colour will be chosen by the Architect. Power skirting shall be complete with separate covers, end caps, corner pieces and all other accessories. The power skirting shall be installed at floor level.

ELEC PT2 17: OUTLETS FOR ELECTRONIC SERVICES INSTALLATIONS

The Electrical contractor is required to install wireways (trunking and/or conduit as specified on layout drawings) to facilitate the installation of these services. The Electrical Sub-contractor is required to provide conduit boxes with blank cover plates where outlets for these services are indicated on the electrical layout drawings. Where outlets are in powerskirting, the electrical sub-contractor shall provide blank cover plates in the powerskirting. The electrical contractor will also supply the necessary power outlets for electronic services.

ELEC PT2 18: CONDUITS FOR ELECTRONIC SERVICES

Supply and install 25mm diameter conduits complete with galvanised draw-wire positions as shown on the relevant layout drawings. Assist and point out where necessary the various conduits and draw boxes when wiring is taking place by others.

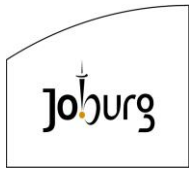
ELEC PT2 19: MEDIUM VOLTAGE OVERLOAD LINE DESIGN

ELEC PT2 19.1: System Configuration

The system configuration for this project is based upon the actual load requirements. The conductor that is used in this project is Hare. The rating for Hare line is templated at a temperature of 50 degrees. The normal MVA rating at 50 degrees is 6MVA and Emergency MVA rating at 50 degrees is 7MVA, Normal rated Amps is 292A and Emergency rated Amps is 380A.

ELEC PT2 20: Basic Insulation Level and Bonding

Employer		Contractor	
Witness:		Witness:	



For the purpose of our design, the BIL was assumed to be 75kV for the 11kV bare conductors which will be utilised.

ELEC PT2 21: Material Selections

Key materials that has been utilised for this design are:

ELEC PT2 21.1: 50kVA transformers, due to ease of operation and load calculations for this project.

ELEC PT2 21.2: Wooden poles ranging from 9m (160dia) to 11m (200dia), depending on where they will be used, for example, an 11m 180dia pole for MV installations with medium to heavy conductor and a 11m, 160dia for an MV installations, light to medium conductor. In this project, both 11m 160dia and 180dia poles were selected for use.

ELEC PT2 21.3: Hare overhead conductor for medium voltage reticulation link lines,

ELEC PT2 21.4: Section cut-out (fuse links), at Take-Off structures

ELEC PT2 21.5: Surge Arresters (3-phase) in transformers

ELEC PT2 22: MV OVERHEAD LINE ACCESSORIES

The main accessories for the overhead lines include:

1. Fuses
2. MV stays
3. LV struts

ELEC PT2 23: EARTHING DESIGN

ELEC PT2 23.1: Earth Resistivity Test Measurements

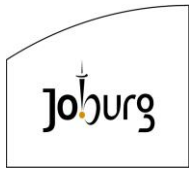
ELEC PT2 23.1.1: A major aim of grounding system is to set up a shared reference potential for the building structure, power supply system, electrical conduits, plant steelwork, and the instrumentation system. To achieve this objective, a suitable low resistance connection to earth is desirable.

ELEC PT2 23.1.2: Earth resistivity tests are done using the earth ground tester.

ELEC PT2 23.1.3: For the electrification design, earthing designs was done using a 3-point star formation of 1.5m earth spikes driven into the ground. Both the MV and the LV earthing are done at the transformer pole, with a 16mm base of green and yellow coloured conductors connecting the earth terminals to the spikes which are installed 5m away from the pole with the earth spikes separated from each other by at least 5m.

The acceptable earth resistivity for the 11kV installation should not exceed 30 ohm.

Employer		Contractor	
Witness:		Witness:	



ELEC PT2 24: MARKING AND LABELLING

MV and LV pole numbering will need to be done as required on the design. MV pole numbering is based on the number format as provided by City of Tshwane on the first pole of the MV installations. LV numbering will be updated on the design, based on transformer number format provided by Eskom so that the pole numbers matches the transformer numbers.

Labels will also be updated on the design.

ELEC PT2 25: DIGGING HOLES

The holes shall be dug by hand or back actor in accordance with stays and poles. The diameters of the hole shall vary according to the pole top structure configuration. The following are the diameters of the hole:

- i) 1.5 m for 9m 160Dia poles
- ii) 1.3 m for 5m 140Dia poles
- iii) 1.5 m for MV stays
- iv) 1.2 m for LV stays

ELEC PT2 26: PLANT POLES

The following poles are used in this design:

ELEC PT2 26.1: 10m 200Dia poles for transformer structures, planted alongside the 11m 200Dia pole in an H-pole formation. The poles will be planted at a dept of 1800mm.

ELEC PT2 26.2: 9m 160Dia poles for MV reticulation, and used mostly at road crossings. The poles will be planted at a dept of 1500mm.

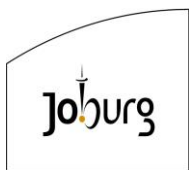
ELEC PT2 26.3: 7m 140Dia poles for LV reticulation, both inline structures and strain structures. The poles will be planted at a dept of 1300mm.

ELEC PT2 27: ASSEMBLE MV STRUCTURES

The materials for this shall be supplied by contractor. The following materials shall be used:

- i) Construction for inline strain structures shall be done utilising 22 kV Long Rod Insulators rated for 10 kN.
- ii) Construction for 1-60 deg strain structures shall be done utilising 1744 structures, D-DT 1744 which will utilise 22 kV Long Rod Insulators rated for 10 kN. The structure utilizes 1 x 2.5m wooden cross arm, D-DT 0320
- iii) Terminal structures will be constructed using which utilizes Long Rods insulators and 1x2.5m wooden cross arms.

Employer		Contractor	
Witness:		Witness:	



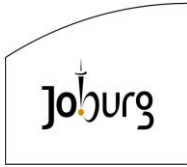
- iv) MV take-off structures will be constructed using. The structures are constructed utilizing 2x2.5m cross arms, and Long Rods insulators.

ELEC PT2 28: **EQUIPMENT TESTING**

The following test shall be performed:

- ELEC PT2 28.1: Phasing test.
ELEC PT2 28.2: Continuity test.

Employer		Contractor	
Witness:		Witness:	



**PROJECT SPECIFICATION FOR THE REPAIR
OF BRIDGE STRUCTURES TO COLTO
1200**

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SECTION 12 100: ACCESS FOR BRIDGE REHABILITATION

PS 12 101 Scope

This specification covers the requirements for the provision of suitable and safe access to all areas requiring concrete demolition, repair work or rehabilitation of bridges in accordance with the contract, and for inspections by the engineer.

This specification shall be read with the COLTO Standard Specifications for Road and Bridge Works (1998), in particular Section 1200: General Requirements and Provisions, and Section 1300: Contractor's Establishment on Site and General Obligations of the Standard Specification.

PS 12 102 Interpretation

a) Supporting Specifications

The following specifications shall be read with, and shall form part of the contract:

Project Specification

COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 Edition).

SABS and BS standards referred to in this specification

b) Definitions

(i) Temporary works

The temporary works necessary for access to the work area includes all foundations, scaffolding and support structures, working platforms, cradles, fixtures to existing structural members, etc required for the safe access to and execution of the work, and for the protection of passing persons, animals and vehicles against injury or damage and prevention of damage and littering to the environment.

(ii) Mobile access unit

A mobile access unit consists of a vehicle-mounted access gantry and work platform, including mobile crane type units.

(iii) Location

Location means a specific bridge as a whole where rehabilitation work has to be done.

(iv) Structural Element

Setting up at each structural element as measured in the schedule of quantities shall include all movement from point to point on a particular element. Structural elements are abutments, piers, decks and parapets/balustrades/edges of deck only. Other parts of a bridge shall be deemed to be included in the structural element to which they are most closely associated. A pier, abutment, deck or balustrade/parapet/ edge of deck may comprise single or multiple elements.

PS 12 103 General requirements

The contractor shall provide and will be responsible for safe access structures and work platforms to all areas requiring remedial work. The access and temporary works shall be designed, constructed and maintained in accordance with the current relevant safety regulations, all in compliance with the Occupational Health and Safety Act (Act 85 of 1993) and its applicable Regulations, and shall remain in place until removal is authorised by the engineer. Appropriate allowances shall be made for screening of the work and other protective measures required by the various work activities.

Access and work platforms may be provided from overhead mobile access gantries or vehicles, or from temporary works supported from the ground or fixed to structural members. The design and erection/construction of such temporary works shall be certified by a professional engineer on behalf of the contractor to comply with the relevant safety regulations regarding strength and stability for all imposed loads that can be anticipated to arise from the specified work activities.

Notwithstanding approval given by the engineer for the design and drawings prepared by the contractor and the acceptance of temporary works including the working platform(s) and access structure(s) as constructed, the contractor shall be solely responsible for the safety and adequacy of the temporary works and shall indemnify and keep indemnified the employer and engineer against any losses, damage to persons or property, all claims, demands, proceedings, damages, costs, charges and expenses whatsoever, which may arise out of or in consequence of the design, construction, use and maintenance of the temporary works.

For works on, over, under or adjacent to any railway line which is controlled by Transnet, the contractor shall comply, inter alia, with the requirements for the preparation and submission of drawings for falsework and formwork, and the submission of certificates for the proper construction thereof, all in accordance with the latest Transnet Specification, E7 (2). The contractor shall submit to the engineer the relevant design details and drawings of the working platform(s) and access structures for comment and/or record purposes.

Abseiling techniques shall not be allowed.

The contractor shall comply with any additional imposed or physical restraints upon the means of access to and from the structure as stated in the project specification and/or the drawings.

The contractor shall provide access facilities for inspection and testing by the engineer, including the inspection at the end of the maintenance period. Any specific access facility required for the inspection at the end of the maintenance period shall be as specified in the schedule of quantities.

PS 12 104 Material

All timber, structural steel and scaffolding used shall be free from defects that may prejudice the stability of the working platform(s) and access structures. The jacks, devices, clamps and fittings shall all be in good working order and of adequate design and strength.

The type, grade and condition of the material shall be subject to the engineers inspection.

PS 12 105 Plant and Equipment

a) Mobile Access Units

Access structures and work platforms mounted and operated from a mobile vehicular support base shall be of an approved type and capacity for the intended use. The unit shall at all times be operated within the recommended limits in terms of reach and capacity as stated by the manufacturer or the authority responsible for the operation and maintenance of the access unit.

The contractor shall, prior to dispatching the mobile access unit to the site, provide certification from the manufacturer or the operating authority that the unit has been thoroughly inspected and serviced, that the unit is functioning properly and that it complies with the relevant safety regulations.

b) Scaffolds, Platforms and Cradles

Temporary works entailing scaffolds, platforms and cradles providing access to the work area shall be assembled and constructed from materials and structural sections complying with the relevant specifications. The temporary works shall be designed, erected, operated, maintained and dismantled so as to ensure safe working conditions for all site personnel, and where necessary the safety of the general public having access to the site.

PS 12 106 Construction

All temporary access structures and work platforms and associated works shall be erected, modified, maintained and dismantled under the direction of an experienced and competent supervisor or safety officer.

Prior to using any temporary access structure or facility, and at regular intervals thereafter, or following unforeseen circumstances, the temporary works shall be inspected and certified by a suitably experienced and qualified person on behalf of the contractor.

To ensure the safety of, and to prevent injury or damage to passing persons, vehicles, animals, etc the temporary works shall be enclosed with a suitable screening membrane or boarding where necessary to contain material or work equipment within the limits of the restricted work area.

Suitable debris containers and chutes shall be provided to assist in the removal of debris and unusable or rejected materials.

Where temporary works are to be fixed to, or supported from an existing permanent structure, the location shall be subject to the approval by the engineer. Such temporary works shall be removed when the work is completed and any holes, surface damage or blemishes arising from the fixture shall be repaired to the surface finish of the adjacent surface to the satisfaction of the engineer.

PS 12 107 Measurement and payment

The payment items in this clause shall include full compensation for all works items associated with the provision of suitable and safe access to all areas on site which are not already covered by the measurement and payment items of the Standard Specifications, i.e. all temporary works related to access structures and work platforms, or mobile access units including associated plant, equipment and labour.

Item

Unit

121.01 Temporary access structures and work platforms

Access and Platform to (height range indicated)

i)	Design, supply and erect at the following structural elements and height ranges inclusive of dismantling and moving to the next structural element	lump sum/ meter/No
ii)	Dismantle and remove from location or structure	lump sum

The unit of measurement for each sub-item shall be either, lump sum, meter or the number as scheduled.

The height range shall be measured from the average ground surface to the agreed height limit accessed from the work platform.

The height range shall be measured in the following height bands:

- 0 m up to 5,0 m
- Exceeding 5,0 m up to 10,0 m
- Exceeding 10,0 m up to 20,0 m
- Etc. in increments of 10 m height

The tendered amount shall include full compensation for design, supply, fabrication, erection, dismantling, movement and for all labour, materials, and equipment required for the above works including the inspections, supervision by the safety officer and maintenance of the temporary access structure and work platform.

The amount shall also include for all temporary traffic accommodation required during the deployment of the access equipment.

Payment shall be made on completion of each sub-item.

Item	Unit
121.02 Mobile access units	
a) Establishment of mobile access unit on site (description of unit)	lump sum
b) Setting up of mobile access unit at each location (bridge location) and removal after completion	number (No)
c) Operation of mobile access unit during repair work at each location (bridge structure)	days
d) Operation of mobile access unit during inspections by the engineer	hours (h)
e) Standing time authorised by the engineer	hours (h)

f) De-establishing and removal of mobile access unit from site after completion of work	lump sum

The unit of measurement for each sub-item shall be the lump sum, number or hours as indicated.

The tendered amounts and rates shall include full compensation for all labour, plant and equipment required to procure, transport to site and to establish the mobile access unit including all costs related to inspection, operation and maintenance of the unit on site. The amount shall also include all temporary traffic accommodation required during the deployment of the access unit.

The tendered rate for sub-items (a) and (f) shall cover all costs necessary for establishing and de-establishing of the mobile access unit on site.

The tendered rate for sub-item (b) shall cover the cost for setting up of the mobile unit at each of the number of locations scheduled, and removal after completion of the work at the location.

The tendered sum for sub-item (c) shall cover all costs for operating the mobile access unit on location for the full time required to complete the repairs, depending on the critical path of the construction programme. Idle time and standing time shall not be measured separately and shall be deemed to be included in the tendered sum for operation of the mobile unit.

The tendered rate for sub-item (d) shall cover the cost of operation of the mobile access unit as required by the engineer. No payment shall be considered for this item if the engineer requires the use of the mobile access unit while it is on location for the normal work to be done under the contract and not specially re-established on the location for the purpose of inspection only.

The tendered rate for sub-item (e) shall cover the cost for standing time ordered or authorised by the engineer on occasions where the mobile access unit is specifically required for the use of the engineer.

Item	Unit
121.03 Access at end of maintenance period (Description of location)	lump sum

The unit of measurement shall be the lump sum for access to each site at the end of the maintenance period as ordered by the engineer

The tendered amount shall include full compensation for all labour, material, plant or equipment including plant operators required to provide suitable and safe access for the engineer to carry out the necessary inspections as measured in the schedule of quantities.

SECTION 12 200: DEMOLITION AND REMOVAL OF STRUCTURAL CONCRETE

PS 12 201 Scope

This specification covers the work in connection with the demolition of entire members of a concrete structure as well as cutting back concrete to expose reinforcement and the initial preparation of the exposed surface. Surface and structural repair of concrete members is covered in Section 10 300.

PS 12 202 Interpretation

a) Supporting Specification

The following specifications shall be read with, and form part of the contract:

- i) Project Specification
- ii) COLTO Standard Specification for Road and Bridge Works for State Road Authorities (1998)
- iii) SABS and BS standards referred to in this specification

b) Definitions

i) Concrete members

All references to concrete members shall include mass concrete, un-reinforced, reinforced and pre-stressed concrete members.

ii) Demolition of concrete members

Demolition means the breaking up and removal of an entire concrete member.

iii) Removal of concrete

Removal of concrete means cutting back into the surface or end of a concrete member and the removal of unsound, damaged or contaminated concrete, or the partial removal of concrete sections, to expose a sound surface for bonding new material for the repair or extension of the concrete member.

PS 12 203 Materials

All devices used to remove concrete or to demolish concrete members, shall be handled, stored and used strictly in accordance with the manufacturer's instructions and current safety regulations.

PS 12 204 Plant and Equipment

a) General

All plant, equipment, tools and devices used for the demolition of concrete members or the removal of portions of existing concrete shall be based on proven and accepted technology within the industry. The plant, equipment, tools and accessories shall be inspected and maintained on a regular basis to ensure that they remain in good working order, function efficiently, and that safety is not compromised. All cutting and breaking tools shall be kept sharp to reduce the force required to break out concrete to a minimum.

The plant, equipment, tools and devices used for the demolition or removal process shall be of the accepted type and capacity for the relevant application. The suitability of the chosen method shall be demonstrated on a representative test section identified by the engineer prior to the execution of any programmed work.

b) Access structures and working platforms

Where necessary, the contractor shall provide suitable and safe temporary access structures, working platforms, debris collection and removal chutes and bins, including protection screens where required, at each location where concrete has to be demolished or removed.

The temporary structures, platforms, chutes, etc must be stable and of sufficient strength and rigidity to safely carry the imposed temporary loads arising from the work activity, all as described in Section 12 100.

PS 12 205 Construction

a) Sequence of execution

The method and sequence of demolition or removal of concrete shall be in accordance with the drawings or as directed by the engineer and the approved method statement submitted by the contractor following pre-construction testing if necessary.

Any temporary propping specified in the approved method statement and the drawings shall be securely positioned in accordance with each stage of the demolition or removal sequence prior to commencement of the following stage.

b) Site preparation and access

The necessary access and temporary support structures shall be in place prior to the commencement of demolition or removal of concrete. Screening and protective measures shall be established around the work area as necessary to ensure acceptable environmental, health and safety conditions.

c) Demolition of concrete members

The demolition of entire concrete structures or major elements of a structure shall employ techniques that do not damage adjacent structures or structural elements, nor contaminate the surrounding environment except during special periods as may be approved by the engineer. The contractor shall ensure that any nuisance associated with his work activity is minimised by implementing appropriate precautions and measures to the approval of the engineer. Common nuisances associated with demolition and concrete removal include fumes, noise, dust, flying fragments, heat and vibration.

Concrete members which are to be demolished completely shall be broken into suitably sized fragments to allow easy removal from site to an approved dump area.

Recommended demolition techniques include the use of percussion breakers, chisels or other approved mechanical equipment, the use of thermal or hydraulic cutting techniques or by non-explosive chemical means, to ensure minimal damage (e.g. micro-cracking) to the existing concrete. Demolition by explosive means will normally not be acceptable and will be subject to the engineer's written approval. Water jet removal of concrete is preferred wherever feasible.

d) Removal of concrete from structural elements

i) Cutting back concrete to a new finished surface

The concrete and reinforcement shall be cut back adequately to provide the prescribed concrete cover to the new finished surface as indicated on the drawings or as directed by the engineer. The technique used shall be suited to its intended purpose and shall not cause damage to the remaining concrete member.

Only techniques that do not damage the inherent structure, bond or strength of the remaining sound concrete shall be used. The thermal cutting technique shall not be used closer than 100 mm from the final surface as indicated on the drawings. The remaining concrete shall be removed using approved mechanical equipment or hydraulic techniques.

The fixed exposed contact surface shall be bounded by straight line edges cut at least 10 mm deep by a diamond cutting saw, angle grinder or other approved equipment.

ii) Cutting back concrete to expose reinforcement

Where a concrete member has to be joined or extended or replaced by new concrete, the concrete shall be carefully cut or broken from the reinforcement bars to expose the bars to the dimensions and outline as shown on the drawings or as directed by the engineer. Care shall be taken not to damage or reduce the strength of the exposed bars or concrete member thereby making them unfit for use. The remaining concrete contact surface shall be cut to a plane and even surface with exposed faces perpendicular to the horizontal face or side faces as applicable.

The bounding lines of the cut concrete shall be straight and neat cut to at least 10 mm depth using a diamond cutting saw, angle grinder or other approved concrete cutting equipment.

e) Removal of metal sections embedded in concrete

Metal sections that are embedded in concrete members by means of grout pockets shall be removed by carefully chipping out the embedment grout filling the pocket. Care shall be taken not to damage the structural concrete surrounding the pocket. Suitable tools such as hand-held power tools with chisel bits or hand tools shall be used.

Following the removal of the metal section, all remaining grout shall be removed and the pocket cleaned out to expose only solid concrete surfaces. The pocket shall be finally cleaned using high-pressure water jetting or oil-free compressed air to remove all loose fragments of grout, or concrete aggregate.

f) Preparation of exposed contact surfaces
(For extension of existing concrete elements or construction of new concrete members)

All loose and shattered concrete, as well as foreign material such as oil, paint, grease, etc shall be removed from the contact surface of old concrete before new concrete is placed. The aggregate must be exposed to provide a good bonding surface.

The mechanically prepared concrete surface shall be cleaned by means of oil-free compressed air or water jetting.

The breaking out and preparation of damaged, spalled and / or cracked concrete surfaces is described and measured under the Sections 12 300 and 12 400.

g) Disposal of waste material

All waste materials, rubble, scrap and rubbish arising from the contractors presence on site and / or the execution of the works shall be disposed of weekly to a disposal site identified by the contractor and approved by the engineer.

PS 12 206 Tolerances

The contractor shall remove concrete to a planar, uniform surface with 25 mm maximum deviation from the level or dimension indicated on the drawings unless otherwise approved by the engineer. The outer edge of the contact surface shall consist of straight lines with maximum deviation of 5 mm from straight, measured with a 1 m long straight edge, and shall be within 5 mm of the position indicated on the drawings, or as instructed by the Engineer.

PS 12 207 Testing

The contractor shall carry out pre-construction tests with the proposed equipment to determine the suitability of the technique for the envisaged application. The test results shall be reported to the engineer and shall be subject to the engineer's approval.

PS 12 208 Measurement and Payment

The pay items in this clause shall include full compensation for all work associated with the demolition and removal of concrete structural elements including initial preparation of concrete surfaces or portions thereof which are not already covered by the measurement and payment items of the Standard Specifications or the Project Specification, such as procurement, transport, access and temporary works, plant and equipment required to undertake the work as specified. General access, work platforms and associated temporary works are covered in Section 12 100.

The quantities indicated in the Schedule of Quantities under Section 12 200 are based on the dimensions shown on the drawings and on inspections carried out as part of the preliminary and detail design phases increased to allow for unseen work. It must, however, be accepted that the quantities of work actually done may vary significantly from the scheduled quantities, and that the contractor shall be deemed to have allowed in his tendered rates for such variations in quantities which can be reasonably expected.

Item	Unit
122.01 Demolition of concrete members (location and description)	cubic metre (m ³)

The unit of measurement is the cubic metre of concrete demolished, measured in its original position and shape based on:

- (i) Full demolition
- (ii) Partial demolition

The tendered rate shall include full compensation for all labour, material, screening of the structure for safety and environmental protective measures, equipment and plant as well as for all work and incidentals required to complete the work as specified and required to demolish the concrete member and to load, transport and dump the concrete segments and rubble at the nearest approved dumping site. See 12 205 (g)

Item	Unit

122.02 Removal of metal sections embedded in concrete
(description) number (No)

The unit of measurement shall be the number of metal sections removed.

The tendered rate shall include full compensation for all labour, materials, equipment, screening of the structure and protective measures, required for the removal of the metal sections as described in 10 205(e) and disposal of all rubble at an approved waste disposal site, and the cleaning of the pocket as specified in 12 205(e).

Item		Unit
122.03	Cutback concrete surface to specified or ordered depth (location and description)	cubic metre (m ³)

The unit of measurement is the cubic metre of concrete demolished, measured in its original position and shape based.

The tendered rate shall include full compensation for all labour, material, screening of the structure for safety and environmental protective measures, equipment and plant as well as for all work and incidentals required to complete the work as specified and required to remove the concrete from the member and to load, transport and dump the concrete rubble at the nearest approved dumping site. See 12 205 (g)

SECTION 12 300: SURFACE AND STRUCTURAL REPAIR OF CONCRETE MEMBERS

PS 12 301 Scope

This specification covers the requirements for the surface and structural repair of structural concrete members, including concrete pipelines supported by a bridge structure. It covers the requirements for the removal of defective or contaminated concrete and/or reinforcement, the preparation of the exposed concrete surface and reinforcement for the rehabilitation of the member, and the repair or replacement of concrete with cementitious mortars, epoxy systems and proprietary concrete repair compounds.

The removal of defective or contaminated concrete, partial removal of concrete sections and the initial preparation of contact surfaces are covered in Section 12 200.

PS 12 302 Interpretation

a) Supporting specifications

The following specifications shall be read with and shall form part of the contract:

- i) Project Specification
- ii) COLTO Standard Specifications for Road and Bridge Works (1998).

PS 12 303 Materials

a) General

In addition to compliance with the requirements of the COLTO Standard Specifications Series 6000, materials shall comply with the relevant requirements of Clause 12 303 (b).

b) Cementitious mortar or concrete

Materials used in the cementitious mortar or concrete shall comply with the following requirements:

i) Cement

Cement shall be ordinary CEM.1. (42.5) or CEM.1.(42.5R).

ii) Aggregates

Aggregates shall comply with the requirements of SABS 1083.

c) Admixtures

Admixtures shall comply with the requirements of ASTM C-194 or AASHTO M-154 and shall be of an approved brand and type.

d) Epoxy systems

Epoxy systems shall consist of a solvent-free, two-part adhesive consisting of a resin and hardener curing at ambient temperatures. The hardener shall be polyamide-based with a high resistance to moisture. The epoxy shall be supplied and used in accordance with the

manufacturer's instructions and recommendations regarding the intended use thereof. Aggregates for epoxy mortars shall be kiln-dry when mixed with the epoxy system.

e) Proprietary cementitious repair compounds

The materials for proprietary cementitious repair compounds shall be supplied as a factory pre-packed dry premix of cements, aggregate and other proprietary products requiring only the addition of pre-packed liquid or a prescribed volume of water of an approved quality to produce the usable repair product. The proprietary repair compound shall compensate for shrinkage in both the plastic and hardened states and shall be suitable for use in the proposed mix and placing techniques.

Proprietary concrete shall be highly workable and self-compacting without the use of vibrators. The aggregate grading shall be designed to prevent segregation during transportation and placing. The concrete system shall have a low alkali content to ensure minimal risk of alkali-silica reaction and shall contain no chlorides. The proprietary concrete shall comply with the material properties as indicated on the detail drawings, alternatively the following shall apply:

Table 12 303/1: Characteristic compressive strength (Minimum)

AGE (DAYS)	COMPRESSIVE STRENGTH (MPa)
3	30
7	40
28	60

Modulus of Elasticity (Static): $30 \text{ GPa} < E_c < 35 \text{ GPa}$ - BS 1881 : Part 121 : 1983

All the necessary health, safety and fire precautions stated by the manufacturer shall be complied with.

Only material of which the shelf life has not expired shall be used.

f) Bonding agents

Non-cementitious bonding agents shall be either a single-component emulsion based on modified acrylic type resins or a slow-setting, solvent-free epoxy resin supplied as a two-part material, pre-packaged and ready for on-site mixing and application, and shall be of an approved brand and type suited to the application.

g) Anti-corrosion primer for reinforcement

The anti-corrosion primer shall be a single component material based on zinc and epoxy resins, and shall be of an approved type and brand suited to required application.

The primer shall be supplied and used in accordance with the manufacturer's instructions and recommendations regarding the intended application. All necessary health, safety and fire precautions stated by the manufacturer shall be complied with.

PS 12 304 Plant and Equipment

All plant and equipment used for the preparation of concrete surfaces, batching of material and mixing operations shall be in good working order and suited for the intended use. The plant shall be inspected, serviced and calibrated at regular intervals and tested to ensure proper functioning, all to the satisfaction of the engineer.

PS 12 305 Construction

- a) Preparation of repair surfaces
- i) Preparation of concrete contact surface

All surface laitance and damaged, loose and soft concrete, concrete containing aggressive ions e.g. chloride, as well as all foreign materials such as oil, paint, grease, etc shall be removed from the contact surface using pneumatic chisels or other approved mechanical equipment or thermal/hydraulic techniques. The contact surface shall be treated to expose the aggregate by means of chiselling, sand blasting or high-pressure water-jetting or where it can be shown to produce the required aggregate exposure, a hard brush may be used subject to the engineer's approval.

The mechanically prepared concrete surface shall be cleaned of dust by means of oil-free compressed air or water-jetting.

The area to be repaired shall be bounded by straight line edges cut to the required depth using a diamond cutting saw, angle grinder or other approved equipment. The edges shall be recessed such that the patch has a thickness at the edge of at least twice the maximum aggregate size of the patching material, but in any case not less than 10 mm.

- ii) Preparation and protection of embedded reinforcement

All visible or embedded reinforcement bars showing signs of corrosion shall be exposed by cutting back the concrete around the bar with pneumatic chisels or other approved method. The corrosion shall be removed by sand blasting, or where this is not warranted, by wire-brushing with power tools to an acceptable surface. The treated steel surface shall be clean of all corrosion and foreign material likely to impair the bond of the anti-corrosion primer to the reinforcement. No chemical solvents shall be used without the approval of the engineer.

Reinforcement that has experienced significant pitting or reduction in diameter shall be referred to the engineer for acceptance. All rejected reinforcement shall be cut out and replaced with new bars of the same type and size, allowing for a minimum overlap of 45 diameter with the in situ bars.

All exposed and cleaned reinforcement shall receive one coat of a single-component anti-corrosion primer based on zinc and epoxy resins, which shall be evenly applied to achieve a minimum 40 µm dry film thickness. The primer shall contain at least 30 % zinc solids by volume. The primed surface shall not be exposed to the atmosphere longer than necessary before the application of the repair mortar, but at least until the coating is fully dry.

Alternative proprietary anti-corrosion coatings shall be subject to the approval of the engineer, based on submitted test documentation and proven performance within the industry.

In cases where the final concrete cover is deemed by the engineer to be inadequate the following protection shall be applied at the engineer's instruction:

- Cover 0 - 5 mm

The reinforcement shall receive two coats of anti-corrosion zinc-based epoxy primer as described previously. In order to improve the bond to the covering epoxy mortar, kiln-dry quartzitic sand shall be applied onto the final wet coat.

- Cover >5 mm

The outer surface mortar patch shall receive a surface coating based on an approved low viscosity cementitious or polymer-based barrier liquid as described in Section 12 600. Where an epoxy mortar is used as repair material, the reinforcement shall be coated as for the 0-5 mm case.

b) Bonding layer

i) Cementitious mortar or concrete repair

Concrete surfaces that exhibit a high moisture absorption shall be wetted prior to patching, the mortar being applied only when the surface has dried sufficiently to have a matt moist appearance, preferably on the dryish side.

The bond of the patching mortar to old concrete may be enhanced by brushing a thick cement paste into the prepared concrete surface before applying the mortar to the fresh paste.

Generally, the cement paste shall consist of one part cement (same type as for patching mortar) and one part sand (< 2 mm) mixed with water to a thick, but fluid consistency.

The use of polymer dispersive additives to improve workability and bond characteristics shall be subject to the approval of the engineer.

Alternatively, an approved adhesive or bonding agent may be applied to the prepared surface so as to enhance the bond of the fresh mortar to the dry concrete in accordance with the manufacturer's instructions. Only compatible materials shall be used.

ii) Epoxy mortar repair

The repair surfaces shall be covered with a thin compatible bonding layer of epoxy resin. Should the time interval between resin and mortar application exceed 24 hours, the wet bonding layer shall be sprayed with a kiln-dry quartzitic sand to achieve a sandpaper-like covering. All loose sand shall be brushed off before applying the epoxy mortar to the bonding layer.

iii) Proprietary cementitious repair compounds

The contact surfaces shall be prepared and treated with a compatible bonding layer in accordance with the manufacturer's specification.

c) Repair material

i) Cementitious mortar or concrete

The cementitious repair mortar shall comply with the strength requirements of the concrete in the structural member to be repaired. The water/cement (w/c) ratio shall not exceed 0,5 and

guidelines for the composition of mortars and concretes consisting of different aggregate sizes are given in Table 12 305/1.

The contractor shall, however, be responsible for the final design of the repair mix and shall submit a test report by an approved testing laboratory to the engineer for approval prior to its use in the permanent works. All the test results shall be incorporated in the standard concrete mix design approval form (D2).

Table 12 305/1: Cementitious mortar/concrete composition: guidelines

	Layer thickness (mm)	Materials proportions cement: Aggregate (by mass)	Max aggregate size (mm)	Grading limits for aggregate % passing by mass								
				mm 0,15	mm 0,30	mm 0,60	mm 1,18	mm 2,36	mm 4,75	mm 10,0	mm 12,0	mm 19,0
Mortar	0-10	1:2,0 to 1:2,5	2	2 to 10	10 to 60	50 to 75	100					
	10-20	1:2,5 to 1:3,0	5	2 to 10	10 to 30	25 to 60	50 to 80	80 to 100	100			
Concrete	20-40	1:3,0 to 1:3,5	10	2 to 10	8 to 20	20 to 35	35 to 55	50 to 70	70 to 85	100		
	40-80	1:3,5 to 1:4,0	16	2 to 10	5 to 17	10 to 30	20 to 40	35 to 55	50 to 70	70 to 90	80 to 95	100

ii) Epoxy mortar

The suitability of the epoxy mortar for a particular application shall be proved by testing or submission of an approved industry track record of usage under similar circumstances.

The epoxy mortar shall consist of a waterproofing membrane with a compressive strength equal to or greater than the adjacent concrete and it shall exhibit similar temperature expansion characteristics. The elastic modulus, E_e , shall not exceed that of the parent concrete. Aggregate (fine and coarse) shall be clean and dry and the size shall not exceed one third of the minimum patch thickness.

Guidelines for the composition of suitable epoxy mortars are shown in Table 12 305/2. However, the contractor shall be responsible for the final mix design and shall submit details to the engineer for approval prior to its use in the permanent works.

Table 12 305/2: Epoxy mortar composition: guidelines

	Layer thickness (mm)	Material proportions cement: aggregate (by mass)	Maximum aggregate size (mm)	Temperature Coefficient of Expansion $10^{-6}/^{\circ}\text{C}$
Paste	0 – 5	1:2 - 1:5	0,5	< 30

Mortar	0 – 20	1:8 - 1:10	2	< 20
	>20	1:14 - 1:16	8	< 15

iii) Proprietary repair compounds

The suitability of the repair compound for a particular application shall be proved by testing or submission of an approved industry track record of usage under similar circumstances.

The contractor shall submit details of the proprietary compounds to the engineer for approval prior to its use in the permanent works.

The repair systems shall have the following properties:

- High bond strength to existing concrete
- Rebar corrosion inhibition
- Low chloride ion permeability
- Good workability
- Freeze/thaw resistant
- Sulphate attack resistant
- Durable

The contractor shall submit details of Repair System to the engineer for approval during the tender period

d) Batching and mixing

i) Cementitious mortar or concrete

The constituent parts of the mortar or concrete, i.e. the cement, aggregate and water, shall be weigh-batched.

Mixing of mortar shall be done with plant or equipment suited to the amount of mortar to be mixed.

The batched materials shall be mixed continuously for at least five minutes in a mechanical drum or table type mixer, or, for small amounts, with an electric drill with mixing ladle.

ii) Epoxy mortar

The epoxy base and activator shall be mixed strictly in accordance with the manufacturer's instructions.

The epoxy and aggregate shall be weigh-batched. The base and activator shall first be mixed thoroughly for at least 180 seconds and until a consistent uniform colour is maintained, whereafter the aggregate shall be added and mixed to a uniform consistency. The manufacturer's instructions shall be strictly adhered to.

iii) Proprietary cementitious repair compounds

The repair compound shall be mixed strictly in accordance with the manufacturer's specifications. Unless otherwise specified the product shall be thoroughly mixed in a forced-action mixer of adequate capacity. Alternatively a suitably sized drum may be used with a slow

speed (400/500 rpm) high-torque rotary drill fitted with an approved mixing paddle. The contents shall be properly mixed to ensure a smooth, uniform mix.

The mixing capacity and placing capacity of equipment and labour shall be adequate and matched to enable placing operations to be carried out continuously within the recommended placement time of the product, generally within 20 minutes of mixing ensuring a smooth, uniform mix. The mixed product shall be passed through a suitable coarse metal screen prior to placing or pumping to remove any lumps of unmixed product.

Tools and equipment shall be cleaned after each batch and all previously mixed material shall be removed from tools and equipment prior to charging and mixing a new batch of repair compound.

e) Formwork for structural concrete repair

All formwork surfaces which will be in contact with proprietary concrete repair compounds shall be treated with a suitable mould release agent. The formwork surfaces shall match the existing surface textures as closely as possible.

The formwork shall be constructed to be leakproof with suitable provision for the drainage of pre-soaking water or access for the application of a surface bonding layer immediately prior to placing the repair concrete.

f) Application of the repair material

i) Cementitious mortar

After the defective concrete surface and the embedded reinforcement have been prepared, the bonding layer shall be worked onto the concrete contact surface followed directly by the freshly mixed repair mortar. The mortar application shall follow the technique of plastering.

The mortar surface shall be trowelled when the mortar exhibits initial set to obtain a uniform plain surface true to line, matching the boundaries of the repair area, and shall then be finished to match the adjacent existing surface finish.

Local areas, where deep recesses have been cut out, or where concrete has been removed around reinforcement bars, shall be built up in thin layers not exceeding 20 mm over several work sessions.

ii) Concrete

After the defective concrete surface or member has been prepared, an approved bonding layer shall be worked onto the concrete contact surface followed directly by the freshly mixed concrete. The concrete shall be properly compacted and where possible, vibrators shall be used.

iii) Epoxy mortar

The epoxy mortar shall be applied in accordance with the manufacturer's recommendation and specification.

Each layer of epoxy mortar shall be trowelled onto the prepared and primed surface in one work session. The rate at which the epoxy mortar can be applied shall determine the batch

quantity such that the pot life of the epoxy is not exceeded. Unused mortar for which the pot life has been exceeded shall be discarded.

iv) Proprietary cementitious repair compound

The proprietary compound shall be applied in accordance with the manufacturer's recommendation and specification.

The minimum layer thickness shall be 10 mm with a maximum as specified by the manufacturer, depending on the orientation of the application.

Each layer of repair compound shall be thoroughly worked and compacted into the repair zone ensuring that full contact with the primed contact surface is achieved and no air entrapment occurs. All sagging or slumping material shall be removed and the contact surface cleaned prior to re-application using a reduced layer thickness.

g) Protection and curing

i) Cementitious mortar or concrete

The finished mortar surface shall be protected from drying out due to wind, direct sunlight or frost. The contractor shall arrange such protection to the engineer's approval who will assess each case on its merits.

The surfaces shall be cured over a period of at least 7 days by spraying a uniform, full coat of an approved resin-based curing membrane not later than 8 hours after placement of the mortar, but within 20 minutes after stripping the formwork, or by any other approved procedure.

ii) Epoxy mortar

The mortar shall be protected from rain and frost for at least 24 hours and shall be cured in accordance with the epoxy supplier's recommendations, or as directed by the engineer.

iii) Proprietary cementitious repair compounds

Immediately after the proprietary compound has been applied or after formwork has been removed, the repaired surfaces shall be thoroughly cured by means of an approved curing compound and procedure suitable to, and compatible with the repair compound.

h) Reinstatement of concrete cover

i) Cementitious mortar

The mortar shall consist of one part cement and two parts sand (0-2 mm) by mass with a water/cement ratio not exceeding 0,42. Additives approved by the engineer may be used to improve workability.

The mortar shall be applied to minimum thickness of 10 mm and the finished surface shall be treated with an approved diffusion resistant coating. Such coating shall be applied in at least two coats of 150 to 250 g/m².

ii) Epoxy Mortar

Epoxy mortars shall not be applied to structural concrete surfaces with temperatures below +8 °C.

The concrete and reinforcement shall be prepared as described in Clause 12 305(g) and primed with the bonding layer before applying the approved epoxy mortar based on the size and depth of repair.

i) Partial removal of concrete to expose reinforcement

Where a structural element contains embedded reinforcement which will be re-used in the rehabilitation process, the concrete shall be carefully chipped away without damaging the reinforcing bars. Damaged bars shall be replaced with new reinforcement of similar type and size, subject to the engineer's approval.

j) Sounding survey

On instruction from the engineer a sounding survey shall be carried out by striking the concrete with a club hammer of approximately 1kg mass and recording the location of hollow sounding areas. On plane areas of concrete the surface shall be sounded at approximately 300mm centres in each direction. On columns, beams or other similar members with faces less than 300mm wide, each face shall be sounded near each edge or corner at approximately 300mm centres along the member. Where a hollow sounding area is detected its extent shall be determined by local sounding and its periphery marked on the surface of the member.

PS 12 306 Tolerances

The contractor shall apply the patching mortar or concrete and finish the surface to the line and level of the existing concrete and within the tolerances specified on the drawings, or if none is specified, to the tolerances specified in COLTO Standard Specification, Section 6800.

PS 12 307 Testing

a) Material

The contractor shall ensure that only compatible materials are used as ingredients for the repair mixes.

The contractor shall carry out pre-construction compatibility tests on the proposed repair system to ensure that the strength and serviceability requirements of the structural rehabilitation are met. The test results shall be reported to the engineer and shall be subject to the engineer's approval.

b) Acceptance testing

The engineer will assess cast repair concrete or proprietary cementitious compounds according to Section 6400, clause 6414 of the COLTO Standard Specifications and the relevant subclauses and any applicable Project Specifications.

Repair material for surface repair will be assessed for compliance based on the 28-day mean strength test result compared to the specified 28-day compressive strength for each class of repair material.

The criteria for compliance with the strength requirements shall be the mean strength result of three test cubes made from the repair material mix used, which are then prepared and tested in accordance with SABS 863 and other relevant standards, by a SANS accredited laboratory.

Test cubes shall be stored and cured in a manner appropriate to the materials to be tested in accordance with the manufacturer's instructions and shall be properly identified.

The strength results shall represent the section of work executed in the period as agreed to by the contractor and the engineer in advance of sampling.

The work at risk due to non-compliance shall be that executed during the agreed period represented by the strength results that failed to achieve the specified strength.

As a consequence of non-compliance in terms of the acceptance criteria, the contractor shall take such remedial action as the engineer may consider necessary. Such action may include removal and replacement of material in repairs at risk and/or further testing. All such costs shall be borne by the contractor.

PS 12 308 Measurement and Payment

The payment items in this clause shall include full compensation for all work associated with the repair of concrete structures which are not already covered by the measurement and payment items of the COLTO Standard Specifications or the Project Specification, such as procurement, transport, additional access and temporary works, plant and equipment required to undertake the work as specified. General access and work platforms and associated temporary works are covered in Section 12 100.

The quantities indicated in the Schedule of Quantities under Section 12 300 are based on inspections carried out as part of the preliminary and detail design phases increased to allow for defects that are not visible. The actual work done may vary significantly from the scheduled quantities and the contractor shall be deemed to have allowed in his tendered rates for such variations as can be reasonably expected.

New reinforcement will be measured separately.

Item		Unit
123.01	Cementitious mortar or concrete (Class) to (description)	litre (l)

The unit of measurement is the litre of mortar or concrete, of specified class, used for the repair of specified concrete defects.

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to break out, prepare. Prime all surfaces, repair and cure the designated areas (including for wastage) all in accordance with the project specification and the repair material manufacturer's procedures, methods and specifications.

Item		Unit
123.02	Epoxy mortar	litre (l)

The unit of measurement is the litre of epoxy mortar, of specified type used for the repair of specified concrete defects.

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to break out, prepare, prime all surfaces, repair and cure the designated areas (including wastage) all in accordance with the project specifications and the repair material manufacture's procedures, methods and specifications.

Item	Unit
123.03 Proprietary cementitious repair compound (Repair systems) to (description)	litre (l)

The unit of measurement is the litre of proprietary repair compound used for the repair of specified concrete defects.

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to break out, prepare, prime all surfaces, repair and cure the designated areas (including for wastage) all in accordance with the project specifications and the repair material manufacture's procedures, methods and specifications.

Item	Unit
123.04 Curing of repair surfaces	
a) By coating the surface with (type indicated) to (description)	square metre (m ²)
b) Curing by (method indicated) to (description)	square metre (m ²)

The unit of measurement is the square metre of concrete repair surface treated or coated by the method and curing compound indicated and accepted by the engineer.

The tendered rates shall include full compensation for all labour, materials, plant, equipment and safety measures required to cure the repair work to the satisfaction of the engineer.

Item	Unit
123.05S Sounding survey	square metre (m ²)

The unit of measurement for the sounding survey shall be the square metre of area tested.

The tendered rate shall include full compensation for everything that is necessary to carry out the survey as specified or instructed, mark out repair limits on the concrete surfaces and accompany the engineer during subsequent inspection to confirm the extent of concrete that is to be repaired on the basis of the sounding survey.

SECTION E 12 400: GROUTING AND CRACK INJECTION

PS 12 401 Scope

This specification covers the requirements for the filling of gaps, holes and pockets with fluid grout systems and the injection of cracks and cavities with low-viscosity liquid epoxy systems.

PS 12 402 Interpretation

a) Supporting Specification

The following specifications shall be read with and shall form part of the contract:

- i) Project Specification
- ii) COLTO Standard Specifications for Road and Bridge Works (1998)

b) Definitions

i) Grouting

Grouting means the filling of gaps between structural elements by using gravity techniques or to fill holes or pockets in concrete members including the embedment of dowels, anchors, steel sections, etc.

Grouting is generally done with a proprietary high-strength, non-shrink, cementitious compound or epoxy system.

ii) Crack injection

Crack injection means the filling of cracks and internal cavities in concrete members with low-viscosity liquid epoxy adhesive by a low-pressure injection procedure.

iii) Epoxy adhesive

Epoxy adhesive means the compound that serves to bond together two separate materials or contact faces resisting the interfacial stresses to ensure structural composite action of the joined materials.

PS 12 403 Materials

a) Grout

i) Cementitious grout

The materials for the grout shall be supplied as a factory pre-packed dry premix of Portland cement powder, graded fillers and other proprietary products requiring only the addition of water to produce the required consistency ranging from a plastic state to a free-flowing liquid grout. The proprietary grout shall compensate for shrinkage in both the plastic and hardened states whilst hardening free of bleeding and settlement, without gas-generating and air-releasing agents.

Free-flowing grouts shall be suitable for use by pumping and mix-and-pour placing techniques, and shall be highly workable, self-compacting and self-levelling without the use of vibrators.

The grout shall have a low alkali content to ensure minimal risk of alkali-silica reaction and shall contain no chlorides.

The proprietary grout shall comply with the material properties indicated on the detail drawings or by reference to a particular product.

Only material of which the shelf life has not expired shall be used.

All necessary health, safety and fire precautions according to the manufacturer's specifications shall be complied with.

ii) Epoxy and polyester resin grout

The materials for the grout shall consist of a factory pre-packed, solvent-free, two-part epoxy of polyester adhesive consisting of resin and hardener components and specially prepared and graded aggregate. The epoxy shall be polyamide-based with a high resistance to moisture and low creep values under sustained loads.

The mixed adhesive shall have a smooth, free-flowing liquid consistency which, when mixed with the aggregate, will not separate or settle out prior to curing.

The grout system shall be suited to the intended application and the toxicity of the chemicals in the components shall be low enough to enable safe usage in confined areas of the construction site and in a normal workshop environment.

All necessary health, safety and fire precautions according to the manufacturer's specifications shall be complied with.

iii) Working characteristics of grout

- Application

The grout system shall be suitable for application by pouring into gaps, holes or pockets depending on the particular circumstances.

- Cure time and temperature

The grout shall be capable of curing to the required strength at ambient temperatures between 10 °C and 40 °C in relative humidities up to 95 %.

The grout must cure sufficiently within 24 hours, to the compressive strength specified on the drawings, with negligible shrinkage on curing.

b) Crack injection

i) Adhesive

The adhesive used for epoxy injection into cracks in concrete shall consist of an unfilled, solvent-free, two-part epoxy consisting of resin and hardener components. The epoxy shall be polyamide-based with a high resistance to moisture and low creep values under sustained loads.

The adhesive components shall be supplied in liquid form and in separate sealed containers. Each component shall have a different identifiable colour which results in a distinctive homogeneous colour when thoroughly mixed.

The adhesive shall mix readily to a smooth liquid consistency of low to medium viscosity and shall be suitable for injection into cracks on surfaces ranging from horizontal to vertical and on inverted overhead surfaces.

The mixed adhesive shall be free of lumps and the components shall not separate or settle out during the pot life of the adhesive.

The toxicity of the chemicals in the components shall be low enough to enable safe usage in confined areas on the construction site and in a normal workshop environment. If special ventilation is necessary such requirement shall be complied with.

ii) Working characteristics of adhesive

- Application

The adhesive shall be suitable for injection into cracks and voids under low pressure.

The viscosity of the epoxy shall be matched to the crack width and material macroporosity surrounding the crack, generally between 200 cP and 400 cP at 25 °C.

The adhesive shall be capable of bonding to dry and moist surfaces where the injected adhesive displaces moisture present in cracks and cavities.

- Pot life

The usable life (pot life) of the mixed adhesive shall exceed 60 minutes at 25 °C and a relatively high humidity, unless special circumstances dictate a fast-setting adhesive.

- Storage life

The storage life (shelf life) in the original sealed containers of both the resin and hardener shall not be less than 6 months stored at temperatures between 5 °C and 25 °C. Only batches of material of which the shelf life has not expired shall be used.

- Cure time and temperature

The adhesive shall be capable of curing to the required strength at temperatures between 10 °C and 40 °C in relative humidities of up to 95 %.

The adhesive must cure sufficiently to confer the specified mechanical properties within 7 days, with negligible shrinkage on curing.

iii) Mechanical properties of cured adhesive

- Moisture resistance

The adhesive shall be formulated to minimise moisture transport through the adhesive itself. Water absorption shall not exceed 2 % by mass after immersion for 24 hours in distilled water at 20 °C.

- Temperature resistance

The adhesive shall have a heat distortion temperature (HDT) of at least 50 °C.

- Flexural modulus

The instantaneous flexural modulus of the adhesive shall be between 2,0 GPa and 10,0 GPa at 20 °C. The adhesive must have a consistent static fatigue behaviour for temperatures ranging between -20 °C to 40 °C.

- Shear strength

The bulk shear strength of the adhesive shall exceed 12 MPa at 20 °C.

- Tensile strength

The tensile strength of the adhesive must exceed 12 MPa at 20 °C.

- Double lap shear strength

The average lap shear strength of a double overlap joint at failure using steel plates shall exceed 8 MPa at 20 °C.

- Epoxy resin injection

c) Quality control

The material manufacturer's quality control and conformance certificates and test results for each batch of material supplied to site shall be made available to the engineer upon request.

The average test results shall meet the specification requirements and no single result shall deviate by more than 15 % from the specified criteria.

d) Packaging, handling and storage

All adhesive components shall be supplied in separate sealed containers of suitable sizes to obtain a workable quantity within the potlife of the adhesive. The components shall be packaged in the correct portions so that the entire contents of each container mixed together shall produce a mix of the correct proportions. The adhesive properties shall not vary significantly with minor variations in the mix proportions resulting from the container emptying process.

Each container shall be durably and legibly marked and complete records of stock acquired and issued for use, shall be kept. The containers shall be clearly marked with the following information:

- (i) name of manufacturer;
- (ii) manufacturer's product identification;
- (iii) batch number and date of manufacture;
- (iv) date of expiry of shelf life;
- (v) manufacturer's instructions for mixing; and
- (vi) safety precautions, warnings for handling and toxicity.

e) Manufacturer's instructions

The manufacturer shall provide a dated, coded and titled instruction sheet with each delivery of adhesive. The following information shall be contained on the sheet in a clear and unambiguous manner:

- (i) the general chemical type of each component used in the adhesive;
- (ii) recommended storage conditions and shelf life when stored under these conditions;
- (iii) preparation instructions for steel and concrete surfaces;
- (iv) instructions for use of primers, including optimum dry film thickness and permissible ranges;
- (v) mixing instructions, including allowable variations in mix ratio and any temperature control requirements during the mixing process;
- (vi) application instructions, including limits on pressure, temperature, open time and relative humidity before injection;
- (vii) safety precautions for all components of the adhesive; and
- (viii) curing conditions and temperature-related precautions.

f) Surface sealant for cracks

The surface sealant for cracks and for the bonding of injection ports to the concrete surface shall be an approved epoxy putty.

g) Injection ports

Injection ports shall consist of short lengths (75 mm to 100 mm) of small diameter (3 mm to 5 mm ID), flexible, high-pressure plastic tubing each fitted with a locating end at the base for bonding in the crack sealant. The locating pin shall be supplied with a length of wire flattened at the end for accurate positioning of the tube over a crack.

Grease nipples or similar self-closing injection nipples shall not be used unless authorized by the engineer. Sufficient field testing to demonstrate the satisfactory operation of such injection port shall precede any approval application.

PS 12 404 Plant and Equipment

a) General

All plant and equipment used for pressure injection of epoxy resins shall be based on proven technology and practice, and shall be maintained in a clean and good working order. The equipment shall be inspected, serviced and calibrated at regular intervals and tested to ensure that the system functions efficiently and accurately, such procedures being to the satisfaction of the engineer.

b) Pressure injection equipment

The type and capacity of the pressure injection equipment, delivery hoses and nozzles shall be such as to ensure the uniform supply of separate components to the mixing nozzle, thereby obtaining the correct consistency and a uniform discharge rate from the nozzle.

The pressure injection equipment shall be capable of continuously supplying the freshly mixed epoxy resin on demand. The equipment shall be fitted with properly calibrated positive

displacement pumps and a pressure gauge capable of recording correct pressures applied up to 2,0 MPa with 0,1 MPa divisions.

The two components of the epoxy injection compound shall be fed separately to the extrusion gun and shall only be mixed together within the pressure chamber of the gun at the time of injection. On no account shall ready-mixed epoxy be fed to the extrusion gun.

c) Temporary access structures and working platforms

Where necessary the contractor shall provide specialist additional safe temporary access structures and working platforms at each location for grouting or crack preparation and injection procedures. Provision for general access and work platforms shall be in accordance with Section 12 100.

The temporary structures and platforms must be stable and of sufficient strength and rigidity to safely carry all imposed temporary loads arising from the work activity.

PS 12 405 Construction

a) Grouting

i) Preparation of contact surfaces

Concrete contact surfaces shall be prepared by removing all surface laitance and damaged, loose and soft concrete, concrete containing aggressive ions, e.g. chloride, as well as cleaning the surfaces of all foreign adherents and impregnants such as oil, paint, grease, curing compounds, dirt, etc. The contact surface shall be treated to expose the sound substrate by means of chiselling, grit blasting or high-pressure water-jetting.

The mechanically prepared surfaces shall be finally cleaned of loose dirt and dust by means of oil-free compressed air, water-jetting or vacuum cleaning, as appropriate.

ii) Holes and pockets for embedding dowels, anchorages etc.

Pockets that are formed in concrete must be cleaned of all foreign material and prepared as for the contact surfaces in clause 12 405(a)(i) above.

Holes shall be drilled using approved mechanical equipment. The size of a drilled hole is dependent on the type of grout to be used, and as a guideline the following sizes are recommended as a minimum, based on the dowel or anchor bar diameter, D.

Dimensions of drill holes

Table 1

Grout type	Diameter of hole	Minimum depth of hole	Direction and Inclination
Cementitious	1,5 to 2,0.D	15.D	As detailed on drawings
Epoxy resin	1,3 to 1,5.D	15.D	

The diameter, depth, direction and inclination of the holes required shall be as shown on the detail drawings, but shall not be less than the dimensions scheduled in Table 1. Before the

holes are grouted, the dowel bars, anchors, etc shall be cleaned, and all water, concrete and residue and other foreign material shall be blown out of the hole with compressed air.

iii) Pre-soaking

The use of a cementitious compound requires the pre-soaking of the concrete substrate with water several hours prior to grouting. All free water shall however be removed from the surface and holes or pockets immediately prior to grouting.

The use of an epoxy or polyester resin grout usually requires a clean and substantially dry contact surface. No pre-soaking is required unless specified by the grout manufacturer.

iv) Formwork

Temporary formwork to place and contain the fluid grout may be required. Reference shall be made to the manufacturer's recommendations regarding flow distance based on the gap width and the fluid head at the pouring side. The unrestrained or exposed surface area of the grout shall not extend more than 50 mm beyond the perimeter of the smaller contact surface. The formwork shall be constructed to be leakproof to prevent wastage and loss of material.

v) Batching and mixing

The proprietary grout shall be batched and mixed strictly in accordance with the manufacturer's instructions and specifications.

Unless otherwise specified, the product shall be mixed thoroughly in a forced action mixer of adequate capacity. Alternatively a suitably sized container equipped with a slow-speed (400/500 rpm), high-torque rotary drill fitted with an approved paddle may be used. The liquid components shall be properly mixed to ensure a smooth uniform mix prior to adding the aggregate.

The premixed aggregate shall be added slowly to the liquid binder and mixed until an evenly coated and wet mix is obtained.

The mixing and placing capacity of equipment and labour shall be adequate and matched to enable placing operations to be carried out continuously within the recommended pot life or placement time of the product, generally within 15 minutes of mixing for cementitious grouts. The mixed product shall be passed through a suitable coarse metal screen prior to placing or pumping to remove any lumps of unmixed product.

The mixed product shall not be used after expiry of the pot life and all material unused after the placement time limit, shall be discarded. All previously mixed material shall be removed from tools and equipment prior to charging and mixing a new batch of grout.

vi) Placement of grout for bedding or gap filling

The mixed grout shall be placed within the placement life or pot life of the material in accordance with the manufacturer's instructions regarding specific placement recommendations and procedures.

In general, continuous grout flow is essential, hence sufficient mixed grout shall be available prior to commencing placement, and the rate of placing a batch shall be matched to the time taken to batch and mix a new batch.

Placement shall take place at one end of a gap to ensure continuous flow through the gap expelling all air from the exit opening. A sufficient grout head shall be maintained at the inlet end to ensure a continuous grout front through the gap.

For an epoxy grout a single batch shall not exceed 30 ℓ of mixed material.

For large batches of cementitious grout, placing by pump may be considered.

vii) Grouting of dowel bars and anchors into holes and pockets

The grout type and consistency used shall be suited to the application and adequate measures shall be taken to prevent grout loss from the hole or pocket during the setting period. If necessary, a thixotropic grout shall be used.

The hole or pocket shall be filled with the prepared grout making allowance for the displacement of material by the item to be embedded.

Immediately after the hole has been filled with grout to the determined level, the embedment object shall be inserted slowly into the hole with a rotary motion so as to displace the grout without incurring over-displacement, which may leave the hole not full, and ensuring complete wetting of the object and the concrete faces.

Precautions shall be taken to ensure that the hole is completely filled and no air is entrapped.

The embedded object shall not be disturbed until the bond is effective, and the necessary support shall be provided to hold the object firmly in position until the grout has gained sufficient strength.

viii) Protection and curing

The exposed grout surfaces which are not cut back shall be protected from wind, rain and high temperature which can cause rapid drying out in cementitious grouts.

Cementitious grouts shall be thoroughly cured by means of an approved curing compound and procedure suitable for the product.

b) Crack Injection

All work related to the injection of cracks with epoxy shall be executed in accordance with the approved method statement as confirmed by site tests according to clause 12 406(a).

i) Extent and sequence of work

The extent of work will be indicated by the engineer and no work may commence unless instructed by the engineer. The extent of the actual work may vary very significantly from that indicated in the schedule of quantities and the contractor is advised to discuss the extent of the work with the engineer at the outset of the contract before establishing the necessary personnel, equipment or plant on site.

Following the erection of the necessary temporary access and working platforms at the work location, the engineer, assisted by the contractor, shall undertake a detailed inspection of the existing concrete surfaces to identify cracks requiring epoxy injection. The engineer shall then issue an instruction to the contractor detailing the extent and nature of the work. In general,

only cracks exhibiting a surface crack width exceeding 0,2 mm shall be injected unless instructed to the contrary.

ii) Crack Preparation

All surfaces within 50 mm of a crack line shall be thoroughly cleaned of all foreign material likely to impair the bond of the surface sealant to the concrete by high-pressure water-jetting, wet grit blasting or other approved mechanical means. All loose spalls and foreign materials within the crack shall be similarly removed followed by final cleaning with clean, oil-free compressed air. The concrete surface and crack shall be allowed to dry out completely and finally cleaned before commencing with crack sealing and injection.

iii) Surface sealing and injection port installation

The whole surface of the crack shall be temporarily sealed with an approved epoxy surface sealant. The type of temporary sealant used shall be such that it can be removed without causing damage to or defacement of the concrete surface.

Approved injection ports shall be properly spaced along cracks, but shall not be drilled and fixed directly into the crack. The injection ports shall be located over the cracks using the locating wire and the locating end shall be firmly sealed and bonded to the concrete surface with a generous amount of epoxy sealant. Thereafter the crack surface between injection ports shall be sealed with an approved epoxy surface sealant band at least 3 mm thick and 30 mm wide.

While guidelines can be given for proper spacing, good judgement must be the final criterion.

Guidelines for injection port spacing in partial depth cracks are as follows:

- Spacing between injection ports should be equal to the desired depth of penetration since the resin generally travels as far into the crack as along the face of the crack. If port-to-port travel at this spacing is not obtained, intermediate injection ports must be established.
- If the cracks are less than 0,20 mm wide, injection ports should not be spaced more than 150 mm apart.
- If the cracks are more than 0,6 mm in depth, full penetration may be difficult to achieve because of equipment limitations. Intermediate ports should be established to monitor the flow of epoxy.

Guidelines for injection port spacing in cracks extending the full depth of the member are as follows:

- Members up to 0,3 m thick

For members 0,3 m or less in thickness, injection ports should be placed in the crack on one side only and spaced at the thickness of the member.

- Members 0,3 m to 0,6 m thick

For members 0,3 m to 0,6 m in thickness, injection ports should be placed in the crack on all available sides and spaced no more than the thickness of the member.

- Members over 0,6 m thick

For members greater than 0,6 m in thickness, injection ports should be placed in the crack on all available sides and spaced according to the guidelines set forth for the partial depth cracks.

The first and last injection ports must be established at either end of a crack in a member.

iv) Epoxy resin injection

Either the pressure injection or vacuum impregnation technique of crack injection shall be used.

The epoxy surface sealant shall have cured fully before commencing with any crack injection.

All traces of cleaning solvent and air shall be expelled from the injection gun prior to commencing with crack injection.

Using an automatic epoxy mixing gun, the epoxy resin shall be injected in such a way that there is a steady displacement of air and moisture from within the crack. Starting from the lowest injection port at one end, the epoxy resin shall be injected until resin flows out of the next injection port. The upper injection port is closed and the process of injecting the epoxy resin is continued briefly. A steady injection pressure shall be maintained, however at no stage shall the pressure exceed 1,0 MPa.

The gun shall then be moved to the injection port where the resin has flowed out and the procedure is repeated for the length of the crack. After the crack is filled, and not longer than 30 minutes after the work has begun, another attempt shall be made to inject more resin, starting at the first port.

Before injection work starts, a rough calculation shall have been made as to the amount of resin required to fill the crack. If consumption exceeds the estimated quantity by more than three times, the matter shall be referred back to the engineer for investigation.

At all cracks, contact surface or repaired cavities, epoxy injection shall commence at the lowest injection point and at one end, and shall in all cases be executed such that there is a steady displacement of air, residual moisture and fine material from the void being injected.

During the entire injection operation, the sealing lines (on both sides in the case of full depth cracks) and adjacent concrete surfaces shall be inspected for any signs of leakage of epoxy and, if observed, the injection shall be stopped and the leaking region sealed or resealed.

Further injection shall recommence only once the epoxy sealant repair has cured sufficiently. Accurate and complete records shall be kept of the amount of epoxy injected into each crack, contact surface or repaired cavity together with any leakage that may have occurred during the injection operation.

After satisfactory completion of the pressure injection at any particular location and the full curing period of the epoxy injection material, the injection points and all epoxy sealant shall be removed and the concrete surfaces and crack lines, as applicable, made good, grinding down the areas as necessary and finished to a smooth and clean surface.

Where the crack is chased out, the chase should be filled with an approved repair material and finished flush with the concrete surface.

c) Crack filling

i) Extent and sequence of work

The extent of the work will be indicated by the engineer and no work may commence unless instructed by the engineer. The extent of the actual work may vary very significantly from that indicated in the schedule of quantities and the contractor is advised to discuss the extent of the work with the engineer at the outset of the contract before establishing the necessary personnel, equipment or plant on site.

Following the erection of the necessary temporary access and working platforms at the work location, the engineer, assisted by the contractor shall undertake a detailed inspection of the existing concrete surfaces to identify cracks requiring filling. The engineer shall then issue an instruction to the contractor detailing the extent and nature of the work. In general, only cracks exhibiting a surface crack width exceeding 0,2mm shall be filled unless instructed to the contrary.

ii) Surface preparation

All surfaces within 50mm of a crack line shall be thoroughly cleaned of all foreign material likely to impair the bond of the surface sealant to the concrete by high pressure water jetting, wet grit blasting or other approved mechanical means. All loose spalls and foreign materials within the crack shall be similarly removed followed by final cleaning with clean, oil free compressed air. The concrete surface and crack shall be allowed to dry out completely and finally cleaned before commencing with crack filling.

iii) Crack preparation

Create a vee notch in the concrete approximately 20mm wide over the crack using a hammer and chisel or small power tools. Clear all debris, loose concrete and dust and prime the surface with the specialised materials.

iv) Crack filling

Fill the vee notch with specified material and grind smooth with the surrounding surface when cured.

PS 12 406 Testing

a) Site tests

The contractor shall ensure that only approved materials for the proposed crack injection process are used. Preconstruction site tests to confirm proposed work procedures shall be undertaken in accordance with this specification and the approved preliminary method statement. Any variation to procedures or material usage arising from site test results shall be incorporated into the approved final method statement. Further site tests to confirm revised procedures or material use, and test coring to confirm crack penetration and sealing quality shall be at the discretion of the engineer.

b) Core tests

Test coring from the actual crack injection areas shall be done at positions and at intervals as instructed by the engineer to confirm satisfactory crack penetration and sealing quality. The core size shall be 25 mm to 50 mm nominal diameter and shall extend at least to the full depth of the crack or other dimension as instructed. Acceptance of the core results will be at the discretion of the engineer.

Site tests and core tests as required by the engineer will be reimbursed under the relevant payment items.

PS 12 407 Measurement and Payment

Payment for items in this section shall include full compensation for all work associated with grouting and crack injection of concrete structures which are not already covered by the measurement and payment items of the COLTO Standard Specification or the Project Specification such as procurement, transport, additional access and temporary works and plant and equipment required to undertake the work as specified. General access, work platforms and associated temporary works shall be measured in Section 12 100.

The quantities indicated in the Schedule of Quantities Section 12 400 are based on inspections performed as part of the preliminary and detail design phases increased to allow for defects that were not identified. The actual work done may vary significantly from the scheduled quantities and the contractor shall be deemed to have allowed in his tendered rates for such variations as can be reasonably expected.

Item	Unit
124.01 Preparation of contact surfaces for grouting (type, position and size indicated)	number (No)

The unit of measurement shall be the number of surfaces of type, position and size that have been prepared for grouting.

The tendered rate shall include full compensation for all labour, materials, plant and equipment as well as all work and incidentals required to adequately prepare the concrete surfaces, including any pre-soaking where required.

Item	Unit
124.02 Grouting for:	
a) Bedding (type, thickness and size indicated) litre (l) to (description)	
b) Gap filling (type, thickness and size indicated) to (description)	litre (l)

The unit of measurement shall be the volume of grout used measured in situ according to the sizes indicated on the drawings.

The tendered rate shall include full compensation for all labour, material, plant and equipment as well as all work and incidentals required to supply, mix, place and cure the grout in position including any temporary formwork, support and control measures as necessary to assist the placement procedure.

Item	Unit
124.03 Grouting of dowel bars and anchors into:	
a) holes (hole, diameter and depth stated) in (description of member)	number (No)
b) pockets (pocket size and depth stated) in (description of member)	number (No)

The unit of measurement shall be the number of dowel bars or anchors installed into holes or pockets as specified.

The tendered rate shall include full compensation for all labour, material, plant and equipment as well as for all work and incidentals required to install each item as detailed on the drawings including all drilling and cleaning of holes, preparation of pockets, supplying, placing and curing of grout and the installation, support and treatment of each item as indicated.

Item	Unit
124.04 Establishment on site for crack injection	lump sum

The unit of measurement shall be the lump sum.

The tendered sum shall include full compensation for the establishment on site and the subsequent removal of all special plant and equipment required for the pressure injection of epoxy resin into cracks and any additional plant, specialist access structures and work platforms required for the execution of the work.

The lump sum shall be paid as follows:

- i) 75 % when all equipment is established on site and the first crack injection work has been satisfactorily completed according to the approved method statement,
- ii) 25 % after all crack injection work has been satisfactorily completed and the equipment is removed from site.

Item	Unit
124.05 Crack injection with epoxy resin to (location)	metre (m)

The unit of measurement shall be the metre (m)

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to prepare, prime all surfaces, repair and cure the designated cracks (including for wastage) all in accordance with the project specification and the repair material manufacturer's procedures, methods and specifications.

Item	Unit
124.06 Site and core tests	

a)	Drilling of cores (specify diameter of cores)	metre (m)
b)	Site testing and testing of cores	provisional sum
c)	Percentage on provisional sum for charges and profit	percent (%)

The unit of measurement for drilling of cores shall be the metre length of cores drilled and extracted. The tendered rate shall include full compensation for all labour, plant, equipment and material as necessary to drill and extract the cores, submit the cores to the engineer and to fill and finish the drilled holes to the approval of the engineer.

The stated provisional sum for site and core testing shall be employed to cover the cost of specific tests to be carried out as ordered by the engineer.

Item		Unit
124.07	Crack filling (Repair system to location)	metre (m)

The unit of measurement shall be the metre (m).

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to, prepare, prime all surfaces, repair and cure the designated cracks (including for wastage) all in accordance with the project specification and the repair material manufacturer's procedures, methods and specifications.

SECTION E 12 500 : SPRAYED CONCRETE FOR STRUCTURES

PS 12 501 Scope

This specification covers the requirements for the use of sprayed concrete in the rehabilitation of concrete structures.

PS 12 502 Interpretation

a) Supporting Specification

The following specifications shall be read with and shall form part of the contract:

- i) Project Specification
- ii) COLTO Standard Specifications for Road and Bridge Works (1998).

b) Definitions

i) Sprayed concrete

Sprayed concrete means mortar or concrete pneumatically projected at high velocity onto a surface.

ii) Dry-mix sprayed concrete

The constituent materials of cement and sand/aggregate are mixed and delivered to the application nozzle as a dry-mix. Water and admixtures are added at the delivery nozzle under high pressure while being sprayed to the receiving surface.

iii) Wet-mix sprayed concrete

The constituent materials of cement, sand/aggregate, water and admixtures are premixed and delivered to the application nozzle as a wet-mix before being sprayed to the receiving surface.

PS 12 503 Materials

a) Cement

Cement used in sprayed concrete shall be ordinary Portland cement, rapid hardening Portland cement or sulphate resisting cement complying with the requirements of SABS ENV 197.

The partial replacement of Portland cement with silica fume shall be subject to the engineer's written approval.

b) Aggregate

All aggregates shall comply with the requirements of SABS 1083.

Fine aggregates shall contain no soft particles and shall be uniformly graded within the grading limits of Table 12 503/1.

Table 12 503/1 : Grading limits for aggregates

SIEVE SIZE (mm)	% PASSING (BY MASS)
10,00	100
5,00	95 – 100
2,36	80 - 90
1,18	50 - 85
0,60	25 - 60
0,30	10 - 30
0,15	2 - 10

The sand aggregate shall be washed, clean and sharp, with a moisture content between 4% and 6 % . The optimum moisture content shall not exceed 8%.

The fineness modulus shall be approximately 2,5 and shall not exceed 3,2.

Aggregate for premixed sprayed concrete delivered in bags or stored in silos shall be kiln-dried.

No coarse aggregate (> 5 mm) shall be used unless approved by the engineer in writing.

c) Water

Water used for mixing and curing shall conform to the requirements of COLTO Standard Specifications Section 6400 and the relevant project specification. The supply of water to the mixing nozzle shall be such that a pressure of at least 400 kPa can be maintained.

d) Admixtures

Admixtures shall not be used without the written approval of the engineer. Should the use of admixtures or air-entraining agents be considered necessary, the contractor shall submit a full report prepared by an approved laboratory, giving the results of tests on sprayed concrete using the constituent materials with and without the admixture, to indicate the influence of the admixture on the initial and final setting time and early strength development of the sprayed concrete.

e) Deteriorated Material

Materials that have been contaminated or rejected subsequent to initial approval on delivery to site shall be removed from site at the contractor's expense.

PS 12 504 Plant

a) General

All plant used for the sprayed concrete application shall be based on proven technology within the industry, and shall be in good working order. The plant shall be inspected, serviced and calibrated at regular intervals and tested to ensure that the system functions efficiently and accurately, all to the satisfaction of the engineer.

b) Mixing and delivery plant

The type and capacity of the mixing plant, delivery hoses and nozzles shall be such as to ensure a uniform mix and supply of the dry-mix ingredients to the mixing nozzle, thereby obtaining the correct consistency and a uniform discharge rate from the nozzle.

The air operating pressure supply at the gun outlet shall not be less than 240 kPa, and in any case such as to maintain a discharge nozzle velocity of between 90 to 120 m/s.

The water pressure supply at the nozzle shall be not less than 400 kPa.

PS 12 505 Construction

a) Sprayed concrete

i) Mix design

The sprayed concrete mix shall be designed and tested by the contractor and a report submitted to the engineer for approval. The mix ingredients and material source shall not be altered during the course of the construction without prior approval of the engineer. Such approval may be subject to an approved laboratory test report. The sprayed concrete mix shall be designed to yield a 28-day compressive strength as shown on the drawings for the different application areas.

No admixtures shall be used for structural repair work unless required by circumstances, in which case it shall then be subject to the approval of the engineer.

ii) Batching

All batching of materials shall be by mass rather than by volume. Generally, the sand aggregate may have a moisture content not exceeding 8 % when batching. When kiln-dry sand is used, allowance shall be made for the lack of moisture content in order to maintain the required consistency.

The batching proportions shall allow for the loss of material due to rebound.

iii) Mixing

The materials shall be mixed thoroughly for a period of at least 90 seconds, ensuring the complete coating of the sand particles with cement.

Powdered admixtures, if approved, shall be added to the mix in the gun while liquid admixtures shall be added through the nozzle.

Any batch of wet-mix sprayed concrete or any batch of dry-mix sprayed concrete using moist sand shall be used within one hour after mixing and shall be discarded after such elapsed period.

Rebound material shall not be used in sprayed concrete for structural rehabilitation work.

In temporary works or for concrete strengths less than 15 MPa rebound material may be used if approved by the engineer. Rebound material shall not be used in a batch without being subjected to an approved preparation procedure. The cleaned and accepted rebound aggregate may be mixed with the fine aggregate as partial replacement thereof. Such a mix

shall be deemed to be a new mix design and shall be tested and a report submitted to the engineer for approval.

The mix shall be screened prior to loading the gun to prevent the inclusion of stones, cement bag scraps or other foreign materials in the mix.

Sprayed concrete mixes using moist sand (< 8 % moisture) shall be mixed on site due to the time limitation on the use of the batch.

Dry mixes using kiln-dried sands may be premixed, transported and stored in an approved manner on site prior to use. Premixed mixes shall be used with plant that prevents excessive cement dust generation and aggregate separation.

iv) Placing/Shooting

The contractor shall use experienced, skilled operators. The nozzle operator shall have adequate experience of work of a similar nature to that required for the particular application and the crew shall be familiar with the plant and equipment being used. The crew shall consist of at least the nozzle operator, a blowpipe operator, a machine operator and two rebound clearing men, all of whom shall be present during the application of sprayed concrete.

The nozzle shall be held in the optimum position for placement, generally 0,6 m to 1,2 m from, and perpendicular to the receiving surface. Care shall be taken to ensure the full encasement of exposed reinforcing bars and prestressing ducts without the formation of voids or sand pockets. All voids and sand pockets formed during the application of sprayed concrete shall be cut out and made good during the course of the work while the sprayed concrete is still plastic.

All vertical surfaces shall be worked from the bottom upwards.

The contractor shall provide on-site a standby hose of capacity similar to the one in use to maintain continuity of work in case of a hose blockage. Hoses shall be blown clean before any work is stopped.

v) Test panels

The contractor shall provide test panel formers made of 20 mm nominal thickness shutterboard, size 600 mm x 900 mm skirted with a light expanded metal mesh standing at least 150 mm high around the edges of the panel.

The contractor shall produce a test panel alongside every new stage of the work, at least one per day, at the engineer's discretion. At the start of, or during the work, the nozzle operator shall produce a test panel alongside and in a similar orientation to the work. These panels shall be left to cure for seven days alongside the work.

vi) Construction joints

Once a section of work has commenced the application of the sprayed concrete shall be continuous up to the construction joints shown on the drawings or up to approved locations. All construction joints shall be in the form of the standard feathered type joint, and with the last mix of the day the sprayed concrete layer shall be tapered to a fine edge which shall be wet and cleaned with an air or water blast before joining the next day's work.

Irregular edges shall be cut back to straight lines before commencing with further work.

vii) Curing and protection

The finished surface shall be protected from drying out and direct sunlight, and from rain and frost by whatever means subject to the engineer's approval.

The exposed surfaces shall be cured over a period of at least seven days by one of the following procedures.

- Spraying the sprayed concrete with continuous uniform water spray commencing eight hours after placement.
- Applying a full coat of an approved curing membrane as soon as practicable after placement but not later than eight hours thereafter.

Rapid drying of the sprayed concrete at the end of the curing period must be prevented.

viii) Surface finish

The finished surface shall have a neat, smooth, even and uniform finish free from rebound pockets or other defects. The types of finish are designated on the drawings by the following:

(1)	GU	:	Undisturbed nozzle finish
(2)	GT	:	Trowelled finish
-	GTB	:	Trowelled and brushed
-	GTF	:	Trowelled and flash-coated
-	GTW	:	Trowelled and wood-floated.

The general procedure for achieving the required finishes shall be as follows:

(1) Undisturbed nozzle finish (GU)

The sprayed surface shall be brushed with a soft plasterer's brush approximately one hour after placement to remove adhering rebound dust and to prevent surface crazing.

(2) Trowelled finish (GT)

The surface shall be trowelled when the sprayed concrete exhibits initial set to obtain a uniform curved or plain surface true to line and shall then be finished with one of the following treatments:

- Brush-coated (GTB)

Coating of the trowelled surface with a cement mortar slurry using a soft broom or brush to give a soft "brushed effect"

- Flash-coated (GTF)

Coating the trowelled surface with a thin uniform layer approximately 3,0 mm thick of sprayed concrete at least four hours after trowelling but not later than eight hours.

- Wood-floated (GTW)

Floating the trowelled surface with a wood float to produce a smooth even surface free from trowel marks.

b) Surface preparation

i) Concrete surfaces

Concrete surfaces that are to receive a layer of sprayed concrete shall be mechanically prepared to expose the aggregate in a rough but generally uniform surface. All loose, spalling and soft concrete shall be removed to expose only sound concrete.

The treated surface shall be cleaned with a high-pressure water jet as a final preparation. The concrete substrate shall be wetted immediately prior to the application of sprayed concrete.

ii) Embedded reinforcement

Exposed reinforcement shall be cleaned of all corroded material by wire brushing using power tools or sandblasting to a clean metal finish. Concrete around corroded reinforcing bars shall be chiselled away with a minimum clearance of three times the maximum sprayed concrete aggregate size between concrete and reinforcement, such that the bars can be cleaned satisfactorily. Where specified on the drawings, the cleaned reinforcement shall be coated with an approved anti-corrosion primer consisting of a single component material based on zinc and epoxy resin.

c) Reinforcement

At the time of application of the sprayed concrete, the reinforcing steel (bars or mesh) shall be free from loose or powdery rust, mill-scale, hardened rebound or any other coating which may reduce the bond strength or have a deleterious effect on the steel or sprayed concrete.

The reinforcement shall be fixed and positioned in accordance with the requirements of the COLTO Standard Specification, Section 6300 and the detail drawings.

PS 12 506 Tolerances

The contractor shall apply the sprayed concrete and finish the surface to the tolerances specified on the drawings, or if none is specified, to the tolerances in the COLTO Standard Specification, Section 6800 except that the surface regularity tolerance shall not exceed 10 mm.

PS 12 507 Testing

a) Material

The contractor shall ensure that only compatible materials are used as ingredients for the sprayed concrete mix.

Preconstruction compatibility testing shall be performed by shooting on to test panels using the material, equipment and crew proposed for use on the contract. Acceptance of the test results shall be at the discretion of the engineer, but shall not relieve the contractor of his responsibility to produce acceptable sprayed concrete in terms of this contract.

b) Laboratory testing

The contractor shall ensure that laboratory testing is carried out by a recognised testing institution or a laboratory approved by the engineer.

c) Acceptance criteria

The criteria for compliance with the strength requirements shall be the mean strength of three cores cut from a test panel, prepared and tested in accordance with SABS SM 865.

All coring, preparation and testing shall be executed by an approved laboratory for concrete testing.

The engineer shall assess the sprayed concrete quality based on the mean strength result compared to the specified 28-day compressive strength for each class of sprayed concrete.

Each test panel shall represent the section of work executed over the period agreed to by the contractor and the engineer in advance.

PS 12 508 Measurement and Payment

Payment for items in this section shall include full compensation for all works associated with any additional temporary works, execution of the work and quality assurance procedures which are not separately covered by the measurement and payment items of the Standard Specification or the Project Specifications. All costs associated with general access, work platforms and temporary works not included under Section 12 100, shall be included in the tendered rates.

Item	Unit
125.01 Establishment on site for sprayed concrete work	lump sum

The unit of measurement shall be the lump sum for the establishment on site of equipment and personnel for sprayed concrete and ancillary work.

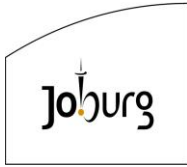
The tendered rate shall include full compensation for all labour, plant and equipment required to execute the work in terms of this section.

Item	Unit
125.02 Preparation of concrete surface	square metre (m ²)

The unit of measurement shall be the square metre surface area that is prepared for application of sprayed concrete.

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to adequately prepare the concrete surface. It shall also include the cleaning and treating of embedded and exposed reinforcement.

Item	Unit
125.03 Application of sprayed concrete (Class, thickness and finish indicated)	square metre (m ²)



The unit of measurement is the square metre of sprayed concrete, of specified class and thickness in position as indicated on the drawings.

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to supply, mix, apply, finish and cure the sprayed concrete layer in position.

Any formwork, reinforcement and prestressing work shall be measured separately according to the relevant sections of COLTO Standard Specifications.

SECTION 12 600: PROTECTIVE COATINGS AND TREATMENTS FOR CONCRETE

PS 12 601 Scope

This section covers the material, equipment and work required for applying protective coatings and treatments to concrete surfaces.

PS 12 602 Interpretation

a) Supporting Specification

The following specifications shall be read with and shall form part of the contract:

- i) Project Specification
- ii) COLTO Standard Specifications for Road and Bridge Works (1998).

PS 12 603 Materials

a) Penetrant pore liner (Water-repellant surface impregnants)

Penetrant pore liners are low viscosity fluids which penetrate the concrete surface. After the concrete has been impregnated by one of these substances, the carrier fluid evaporates, leaving behind a hydrophobic (water-repellant) layer in the pores of the concrete.

They are generally colourless and make little change to the appearance of the concrete.

Typical examples are silanes, siloxanes, silicon resins and stearates.

b) Penetrant pore blocker

Penetrant pore blockers are low viscosity solutions that can penetrate concrete surfaces and block the pores, thereby increasing the surface density of the concrete.

Some of these materials react with the concrete substrate (calcium hydroxide present in hydrated cement) to form crystals. Other fluids such as resins and drying oils, penetrate and harden by chemical reaction.

Typical examples are silicates, silicon fluorides, epoxy resins and acrylics.

c) Sealer

Sealers are more viscous fluids which both penetrate the concrete and form a thin film on its surface. They are sometimes used as sealing coats or primers to a coating. The thin film of the sealer is vulnerable to weathering.

Typical examples are epoxy resins, polyurethanes, acrylics and linseed oil.

d) Coatings

Coatings are viscous fluids that form a film on the surface of the concrete and provide protection as a result of the thickness of the film itself. They are usually pigmented to provide colour, and extended or filled to provide thickness and surface texture to the coat.

Typical examples are epoxy resins, polyurethanes, alkyds, vynils, acrylics, chlorinated rubber, styrene-butadyne, bitumens and combinations of these.

e) Renderings

Renderings are thick film coatings, generally applied by trowel rather than by brush or spray. They work in a similar way as coatings, by providing a physical barrier.

Typical examples are cement mortar with various polymer additions and crystal growth systems.

f) Carbonation inhibitor barrier coatings

An approved carbonation inhibitor barrier coating shall comply with the following criteria:

- i. Present a uniform appearance with the final colour to be decided by the engineer
- ii. Provide barrier protection against ingress of water, oxygen and carbon dioxide
- iii. Permit the passage of water vapour
- iv. Resist the deleterious effects of UV light
- v. Weather such that only minimal surface preparation is required when overcoating
- vi. Adhere strongly to concrete and repair materials
- vii. Bridge minor cracks and have flexibility to accommodate small movement
- viii. Provide a 12 year guarantee against coating failure and UV degradation
- ix. Supply a specification for surface preparation and application of overcoating after a 12 year period

The coating material will be deemed to meet the requirements of (b) and (c) with respect to water, oxygen, water vapour and carbon dioxide barrier protection if it complies with the following specification:

- The product of the minimum dry film thickness of the coating (microns) and the carbon dioxide diffusion resistance coefficient shall exceed 50m
- The cured coating shall reduce the water absorption of good quality 30MPa concrete by a factor of at least 20
- The product of the average dry film thickness of the coating (microns) and the water vapour diffusion resistance coefficient shall not exceed 4m

In the event that a multi layer and / or a multi product system is proposed criteria (i) (ii) and (iii) shall apply to the complete system acting as a combined barrier coating.

g) Corrosion Inhibitor

Corrosion inhibitors are emulsion type impregnating fluids that are applied to the outer surface of existing concrete members. Inhibitors migrate into concrete and are absorbed onto the surface of embedded reinforcing steel thus delaying the onset of corrosion and/or reducing the rate of corrosion that is in progress.

PS 12 604 Plant and Equipment

a) General

All plant and equipment used for pressure cleaning and protective treatment application shall be based on proven technology and practice, and shall be maintained in a clean and good working order. The equipment shall be inspected, serviced and calibrated at regular intervals and tested to ensure that the system functions efficiently and accurately, all to the satisfaction of the engineer.

b) High-pressure water-jetting equipment

The type and capacity of the water-jetting equipment, delivery hoses and nozzles shall be capable of delivering at least 1000 kPa water pressure through nozzles which shall at least remove curing compounds or membranes and shutter release compounds without producing an exposed aggregate finish.

c) Low-pressure airless sprayer

Low-pressure airless sprayers consist of knapsack sprayers which shall be capable of providing a uniform discharge rate and even spread over the spray area.

d) Access structures and working platforms

Where necessary the contractor shall provide suitable and safe measures at each location for pressure cleaning and surface coating. These provisions shall be deemed to form part of the access for bridge rehabilitation as specified in Section 12 100

PS 12 605 Construction

a) Storing of materials

The contractor shall provide a lock-up store for the repair materials and observe all storage requirements and safety precautions recommended by the materials manufacturers.

b) Surface preparation

i) Procedures

All concrete surfaces that are to receive protective coatings and / or treatments such as:

- Penetrant pore liners
- Penetrant pore blockers
- Sealers
- Coatings
- Renderings
- Corrosion inhibitors

shall be prepared strictly in accordance with the materials manufacturer's instructions. The preparation shall include for everything that is necessary to prepare the surface to receive the protective coatings and / or treatments.

The contractor shall ensure that technical representatives, appointed or employed by the materials suppliers, carry out regular inspections of the preparation work and provide written confirmation that the work is in accordance with the materials suppliers requirements. The reports shall be specific and definitive, generalised statements will not be acceptable.

Where surface preparation is found by the technical representatives to be inadequate the report shall contain specific advice to enable the contractor to attain a required standard.

The contractor shall provide the engineer with copies of all technical inspection reports before any surface treatment or protective coatings is applied to a bridge element.

Where the time between surface preparation and treatment exceeds two days and / or during windy and / or wet weather the prepared surfaces shall be reinspected and approved by the technical representative.

The moisture content of patch repair areas must be specifically checked by the technical representative to ensure that coatings are not applied over surfaces that contain moisture.

c) Batching and mixing

Mixing equipment, mixing times, working life and over-coating times shall conform to the manufacturer's recommendations taking into account the temperature at time of application.

Treatment materials shall be mixed (if applicable) and applied strictly in accordance with the manufacturer's specifications. Thinning or diluting shall not be permitted without the approval of the engineer.

d) Protective surface treatment

Surface treatment or coatings may consist of a system of several coats of more than one type of coating. Where such a system is applied, the various components shall be compatible and preferably from one manufacturer.

Protective treatments shall be applied to all of the exposed concrete surface as indicated. Items or areas which are not to be coated, shall be suitably protected or masked before application of the treatment.

i) Application of surface coatings

All protective coatings and treatments for concrete shall be stored, mixed and applied strictly in accordance with the product manufacture's specifications and the project specifications.

All surface coating materials shall be handled, mixed and applied strictly in accordance with the manufacture's specification..

ii) Application rate records

Records of application rates shall be submitted by the contractor to the engineer on a daily basis indicating batch numbers, the area covered by each coat and the quantity of coating

material used. Only material from the same batch shall be used for any continuous, visible, unbroken surface to attain uniformity of colour and texture on the concrete surface.

iii) Trial sample panels

Protective treatment shall not be applied until trial sample panels of the protective treatment have been prepared by the contractor and approved by the engineer and the material suppliers technical representative.

The contractor shall prepare the sample panels using the same surface preparation mixing and batching equipment, application technique, application rate and under the same climatic conditions he intends to treat the whole structure. The position of the trial sample panels are subject to the engineer's approval.

Product manufacturers of coating products are required to inspect, assist and finally approve (in writing) all aspects of surface preparation and product application employed on the trial sample panel.

The trial sample shall be used as a standard against which the rest of the work will be judged and shall be maintained intact until all other coating work is complete.

iv) Proprietary protective surface coatings

The suitability of the protective surface coating for a particular application shall be proved by testing and submission of an approved industry track record of usage under similar circumstances.

The contractor shall submit details of proprietary protective surface coating to the engineer for approval prior to its use in the permanent works.

c) Health and Safety precautions

The contractor shall observe the health and safety precautions recommended by the manufacturer regarding the handling and the disposal of unused material and containers.

The contractor shall ensure that natural water streams or rivers are not polluted by protective treatment material under any circumstances.

PS 12 606 Testing

The contractor shall ensure that only compatible materials are used for the surface treatment or protective coatings.

The test results shall be reported to the engineer and will be subject to the engineer's approval.

PS 12 607 Measurement and Payment

Payment for items in this section shall include full compensation for all works associated with the execution of the work and quality assurance procedures which are not separately covered by the measurement and payment items of the Standard Specifications or the Project Specifications. General access and work platforms and associated temporary works are covered in Section 12 100.

All work and material for which no specific pay item is defined shall be deemed to be covered by the items in this section.

Item	Unit
126.01 Cleaning and preparation of concrete surface (Method and surface finish indicated)	square metre (m ²)

This item covers concrete areas that will not be treated with protective coatings and treatments.

The unit of measurement shall be the square metre of surface area cleaned by the method indicated.

The tendered rate shall include full compensation for all material, plant and equipment, all labour and incidentals required to execute the work as specified.

Item	Unit
126.02 Application of protective treatment and treatments (Type and application rate indicated)	square metre (m ²)

The unit of measurement shall be the square metre of surface area to be protected or treated as specified. For payment purposes, the surface area shall be measured once only irrespective of the number of layers of protective coatings and / or applications of surface treatment is required to achieve the specified application rate.

The spray-on polyurethane foam insulation shall be medium density closed-cell organic product with Long Term Thermal Resistance (LTTR) R-value that ranges between 5.1 - 6 per inch.

The tendered rate shall include full compensation for all surface preparations, labour, materials, equipment, additional safety measures, storage, mixing and applications of the protective coatings and treatments, cleaning and disposal of unused or rejected material and all incidentals necessary to execute the work (including wastage) as specified, all to the satisfaction of the engineer.

Item	Unit
126.03 Trial sample panels	square metre (m ²)

The unit of measurement shall be the square metre surface area of successful and accepted trial sample panels to be treated. For payment purposes, the surface area shall be measured once only, irrespective of the number of applications of material and attempts required to achieve an acceptable sample with the specified application rate.

The tendered rate shall include full compensation for everything that is necessary to prepare an acceptable sample panel.

Item	Unit
126.04 Provide pipe cladding protection (Description)	square metre (m ²)

The unit of measurement shall be the square metre of insulated surface area to be covered with cladding cover complete to a robust fix that withstands the seasonal weather elements.

The fibre glass reinforced polyurethane coating shall be UV-stable roof type water proofing coating comprising of one-component , moisture triggered polyurethane decothane base course, fibre reinforced and sealed with 2 coats of decothane top coat.

The tendered rate shall include full compensation for all surface preparations, labour, materials, equipment, additional safety measures, storage, installation fixing and trimming of the cladding all to the satisfaction of the engineer.

SECTION 12 700: EXTERNAL BONDING OF STEEL PLATES, BARS AND SECTIONS TO CONCRETE SURFACES

PS 12 701 Scope

The specification covers the external bonding of steel plates, structural steel sections and reinforcement bars to structural concrete surfaces with adhesive.

PS 12 702 Interpretation

a) Supporting Specification

The following specifications shall be read with and form part of the contract:

- i) Project Specification
- ii) COLTO Standard Specification for Road and Bridge Works (1998)

b) Definitions

i) Adhesive

An adhesive serves to bond together two separate materials, and resists the interfacial stresses necessary to ensure structural composite action between the two materials.

ii) Cold-cure adhesive

A cold-cure adhesive is capable of curing to the required strength between the temperatures of 10° C and 30° C.

iii) Adherents

Adherents means the parts, steel and/or concrete, to be joined by the adhesive.

PS 12 703 Materials

a) Adhesive

The adhesive shall be a cured epoxy resin complying with the ASTM C-881-90, "Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete".

The adhesive used for structural bonding of steel to concrete shall be a solvent-free, two-part epoxy consisting of resin and hardener components. The epoxy shall be polyamide-based with a high resistance to moisture, and low creep values under sustained loads.

The adhesive components shall be supplied in liquid form and in separate sealed containers. Each component shall have a different identifiable colour, which results in a distinctive homogenous colour when thoroughly mixed.

The adhesive shall mix readily to a smooth paste-like (thixotropic) consistency and it shall be suitable for spreading on surfaces ranging from horizontal to vertical and on inverted overhead surfaces.

The mixed adhesive shall be free of lumps and the components shall not separate or settle out during the pot life of the adhesive.

The toxicity of the chemicals in the components must be low enough to enable safe usage on the construction site and in a normal workshop environment. If special ventilation is necessary such requirements shall be clearly stated on the containers.

b) Working characteristics of adhesive

i) Application

The adhesive shall be suitable for application to prepared steel and concrete surfaces in a layer thickness of between 1,0 mm and 10 mm.

ii) Pot life

The usable life (pot life) of the mixed adhesive before application to the substrate shall be at least 40 minutes at 20° C at a relatively high humidity.

iii) Open time

The open time represents the time available after the application of the adhesive to the substrate to place the structural components and to close the joint. The period shall not be less than 20 minutes at temperatures up to 20° C.

iv) Storage life

The storage life (shelf life) in the original sealed containers of both the resin and hardener shall not be less than 6 months at temperatures between 5° and 25°.

v) Cure time and temperature

The adhesives shall be capable of curing to the required strength at temperatures between 10° C and 30° C in relative humidities of up to 95%.

The adhesive shall cure sufficiently within three days to confer the specified mechanical properties at 20° C and shall undergo a negligible shrinkage on curing (maximum linear shrinkage of 0,5 %).

Mechanical properties of cured adhesive

i) Moisture resistance

The adhesive shall be formulated to minimize moisture transport through the adhesive itself. Water absorption shall not exceed 2% by mass after immersion for 24 hours in distilled water at 20° C.

ii) Temperature resistance

The adhesives shall have a heat distortion temperature (HDT) of at least 50° C.

iii) Flexural modulus

The instantaneous flexural modulus of the adhesive shall be between 2,0 GPa and 10,0 GPa at 20° C. The adhesive shall have a consistent static fatigue behaviour for temperatures ranging between –20 ° C to 40° C.

iv) Shear strength

The bulk shear strength of the adhesive shall exceed 12 MPa at 20° C,

v) Tensile strength

The tensile strength of the adhesive shall exceed 12 MPa at 20° C.

vi) Double lap shear strength

The average lap shear strength of a double overlap joint at failure, using plates, shall not be less than 8 MPa at 20° C.

d) Quality control

The adhesive manufacture's quality control and conformance certificates and test results for each batch of adhesive supplied on site shall be made available to the engineer upon request.

The average test results shall meet the specification requirements and no single result shall deviate by more than 15% from the specified criteria.

e) Packaging, handling and storage

All adhesive components shall be supplied in separate sealed containers of suitable sizes to obtain a workable quantity within the pot life of the adhesive. The components shall be packaged in the correct proportions so that the entire contents of each container mixed together shall produce a mix of the correct proportions. The adhesive properties shall not vary significantly with minor variations in the mix proportions resulting from the container emptying process.

Each container shall be durably and legibly marked and complete records of stock acquired and issued for use, shall be kept. The containers shall be clearly marked with the following information:

- i. name of manufacturer
- ii. manufacturer's product identification
- iii. batch number and date of manufacture
- iv. date of expiry and shelf life
- v. manufacturer's instructions for mixing
- vi. safety precautions, warnings for handling and toxicity
- vii. manufacturer's recommendations for storage

c) Manufacturer's instructions

The manufacturer shall provide a dated, coded and titled instruction sheet with each delivery of adhesive. The following information shall be contained on the sheet in a clear and unambiguous manner.

- i. the general chemical type of each component used in the adhesive;
- ii. recommended storage conditions and shelf life when stored under these conditions;

- iii. preparation instructions for steel and concrete surfaces;
- iv. Instructions for use of primers, including optimum film thickness and permissible ranges;
- v. mixing instructions, including allowable variations in mix ratio and any temperature control requirements during the mixing process;
- vi. application instructions, including limits on pressure, temperature, open time and relative humidity before mating the faying surfaces. It must also be stated whether adhesive should be applied to one or both adherents;
- vii. maximum allowable interval between application of primer to coated steel or concrete, and application of adhesive and any primer reactivation procedure if applicable;
- viii. safety precautions for all components of the adhesive and primer;
- ix. curing conditions, including the amount of pressure to be applied, the period under pressure and the temperature of the assembly when under pressure. It must be stated whether this temperature is that of the adhesive layer or of the atmosphere in which the assembly is to be maintained or both. A graph of cure time against temperature shall be supplied; and
- x. condition procedure before testing or use of the assembled product, including the time, temperature and relative humidity.

d) Structural steel

Structural steel plates and sections shall comply with the following requirements

Mild steel: grade 43C in accordance with BS4360 or,
Grade 300WC in accordance with SABS 1431

High-yield stress steel shall not be used

The dimensions and properties of the rolled steel plate and sections shall conform to the structural steel tables as issued by the SA Institute of Steel Construction, as amended.

e) Anchors, nuts and washers

Anchors shall consist of proprietary embedment type studs or bolts utilizing a chemical adhesive or mechanical expansion and locking systems to set the anchor in a concrete member. Certification and test results from a recognised approval authority or laboratory shall be made available at the request of the engineer.

PS 12 704 Construction

a) Sequence of execution

The sequence of execution for the bonding of plates or reinforcement to the concrete surface shall be in accordance with the drawings and the approved method statement submitted by the contractor.

b) Site preparation and access

The necessary access and temporary support structures shall be in place prior to the commencement of surface preparation. If deemed necessary to ensure acceptable environmental conditions and public safety, screening of the work area shall be established.

c) Preparation of Concrete Surfaces

i) Concrete surface for plate bonding

The outline positions of the plates shall be clearly marked on the receiving concrete surface. A covermeter survey shall be carried out in all regions where anchor studs are to be installed in order to accurately locate the existing reinforcement. The located bar positions must be clearly marked, and using this information, the stud positions can be determined.

The anchor stud positions shall be carefully measured up and transferred to the steel plate fabrication drawings. Particular care shall be taken with regard to the orientations and plate references during the survey and preparation of fabrication drawings. Once the survey is completed the concrete surface shall be prepared.

Any cracks wider than 0,2 mm shall be pressure injected using a low viscosity epoxy resin system in accordance with the procedures specified in Section 12 400.

Any concrete surface defects or deeper reinforcement corrosion within the plate outline and other areas considered defective shall be removed and repaired with suitable and compatible repair systems in accordance with Section 12 300 of this specification.

The marked concrete areas to be plated shall be grit-blasted to remove all concrete laitance, surface coatings and impregnants, organic growth, bituminous residues, oil, dirt and any other surface contamination. The surface must be sound and shall exhibit the coarse sand and aggregate texture to present a rough key to the adhesive.

The prepared surface profile must be checked using a 1m long profile edge and any areas deviating by more than 4 mm from the profile edge must be marked.

Any high areas shall be removed with light scabbling equipment or needle guns and low areas can be filled with the adhesive to be used for the plate bonding. Normal grit-blasting preparation shall not remove more than 1,0 mm of the concrete surface.

The engineer will inspect the prepared surface to identify areas that are defective or sub-standard which may require additional preparation and/or remedial work.

ii) Concrete surfaces for bonding reinforcement in slots

The positions of the slots for reinforcement shall be clearly marked on the receiving concrete surface. A covermeter survey shall be carried out along each slot position to determine the position of existing reinforcement bars and the concrete cover thickness. The located bar positions must be clearly marked and the depth of the slots must be adjusted if necessary to avoid cutting reinforcement transverse to the direction of the slots. Where possible the slots must be located midway between existing reinforcement bars.

A covermeter capable of measuring concrete cover to reinforcement within 3 mm accuracy shall be used.

Once the survey is completed, the slots can be cut into the concrete surface. Any cracks wider than 0,2 mm and concrete surface defects and deeper reinforcement corrosion shall be treated as required in section 12 704 (c)(i) above.

The slots for bonding the reinforcement shall be cut into the member at the positions and to the dimensions as indicated on the drawing or as directed by the engineer following the covermeter survey. The sides of the slots shall be neatly cut along the required profile using a diamond saw

or angle grinder to the required depth. Holes within a slot shall be carefully drilled using a diamond drill. Equipment that may damage the adjacent material structure, soundness or integrity shall not be used.

The surfaces of the slots shall be free of loose or unsound material, and any contaminant that may react with or impair the bond of the adhesive to the concrete surface, shall be cleaned off.

The cut surfaces shall be prepared to exhibit a coarse sandpaper-like texture by grit-blasting, water-jetting or other approved means.

The engineer will inspect the concrete surface with prepared slots to identify areas that are defective or sub-standard and which may require additional preparation or remedial work.

d) Preparation of steel plates for bonding

After the plates for bonding have been fabricated to size with all the required holes, the plate surface preparation shall be done. The plates must be handled with care to ensure that the flatness tolerances of BS 4360 are maintained in the final prepared plate.

i) Corrosion protection using paint system

All physically adhering contaminants and residues shall be removed and the bond surface shall be grit-blasted to Sa 2 ½ surface finish in accordance with Swedish Standard SIS 05 59 00 to a surface profile of between 50 to 100 µm amplitude.

The steel surfaces shall preferably be prepared under factory conditions to ensure complete removal of rust, millscale, grease, dirt, etc. using grit-blasting techniques with a clean, angular, hard metal grit free from contaminants.

Mechanical abrasion techniques such as wire brushing or emery cloth that polish rather than remove oxide layers are not acceptable.

No abrasive blasting shall be done outside factory conditions during rainy weather or where corrosive air conditions prevail.

Prepared steel surfaces must be primed within four hours of blast-cleaning to prevent re-oxidation of the steel surface. Immediately prior to the primer application the surface must be degreased and vacuum-cleaned to remove all dust and debris. The prime shall be applied to a dry film thickness (DFT) of 50 µm to 75 µm allowing for the full cure of the primer. The primer shall consist of a single-component, anti-corrosion compound based on zinc and epoxy resins compatible with the bonding adhesive.

The primed plates shall be allowed to cure for at least 24 hours before further handling or transportation is undertaken. Suitable precautions shall be taken to protect the primed plates against handling, transportation and storage damage. Plates with defective bond surfaces or out of tolerance flatness at the time of adhesive application of the adhesive will be rejected.

A suitable means of protection of plate condition is to cover the plates in a clean bubble wrap protection material with a silicon gel desiccant placed inside the wrapping to ensure that the plates are kept free from moisture.

ii) Corrosion protection using hot-dip galvanizing

The surface preparation of steel plates for hot-dip galvanizing shall entail the mechanical removal of all millscale, rust and other adhering debris to achieve a minimum grade St 3 surface finish to Swedish Standard SIS 05 58 00. All galvanizing shall be done in accordance with SABS 763, heavy-duty coating.

After the steel plates have been galvanized, the surface to be bonded shall be abrasive-blasted as in section 12 704 (d)(i) to remove the galvanizing layer and then primed and protected against damage during handling, transportation and storage.

The surrounding galvanized surface must be suitably protected against the abrasive blasting to ensure that the galvanizing is not damaged.

e) Preparation of reinforced steel bars

The steel bar surface shall preferably be cleaned and abrasive-blasted immediately before bonding into the prepared slots in the concrete surface. Alternatively, approved measures must be taken to prevent surface corrosion and maintain the clean surfaces free from dirt, oil, or any other deleterious contaminants.

The steel surface shall be prepared by removing all physically adhering contaminants and by abrasive blasting to grade Sa 2 ½ surface finish in accordance with Swedish Standard SIS 05 59 00. No abrasive-blasting shall be done during rainy weather or when corrosive environmental conditions prevail.

f) Inspection of concrete surface prior to adhesive bonding

The prepared concrete surfaces or slots shall be carefully inspected immediately prior to application of the adhesive to ensure that the requirements of clause 12 704 (c) are maintained. All bond surfaces must be dry or have a moisture content less than that recommended by the manufacturer of the selected adhesive. The surface temperature of the concrete must be between the temperature limits recommended by the adhesive manufacturer. Should the moisture content be excessive, the concrete surface must be allowed to dry sufficiently to prevent the possibility of a moisture barrier forming between the concrete substrate and the adhesive.

g) Mixing of adhesive system components

The entire contents of a multi-component adhesive system shall be mixed together as recommended by the manufacturer and shall be used within the pot life of the adhesive.

The adhesive components shall be mixed in a clean container, free of harmful residue or foreign particles. The adhesive shall be carefully and thoroughly mixed to a uniform colour and a homogenous mixture. If necessary, the adhesive components must be conditioned to a temperature of between 10 °C to 30 °C unless recommended otherwise by the manufacturer in writing.

Sufficient adhesive shall be mixed to cover the necessary bonding surfaces which can be comfortably handled within the available period to ensure the necessary quality and workmanship.

Once the adhesive has been thoroughly mixed, no re-mixing will be allowed.

In order to monitor the quality of the mixing process, flexural modulus tests on prisms made from the adhesive shall be undertaken. The results must be compared with the values specified by the manufacturer, and any discrepancies shall be listed.

h) Application of the adhesive to the bond surfaces

Immediately before the application of the adhesive to the prepared concrete surface, the receiving surface must be vacuum-cleaned to remove all dust, debris, etc.

The mixed adhesive shall be trowelled onto the receiving concrete surface using plastering techniques. The adhesive must be well worked into the grit-blasted surface to a layer thickness of approximately 2,0 mm. Skilled operators are essential due to the speed and care demanded by this phase of the work.

The adhesive shall be applied to bonding plates preferably with a specially profiled trowel to ensure a uniform thickness and profile across the plate width. The profile shall be such that when the plate is pushed into contact with the concrete surface the adhesive is squeezed out towards the free edges to reduce the risk of air entrapment. The minimum thickness of adhesive applied to the plate shall be 1,0 mm at the edges.

The actual thickness applied to the plate and concrete surface shall be carefully controlled to ensure that sufficient quantity is used to achieve the required final layer thickness with minimal wastage.

In order to ensure a uniform adhesive layer thickness, suitable inert plastic spacers may be placed along the plate at regular intervals suited to the plate stiffness.

Once the adhesive is applied to the bond surfaces, the plate must be positioned with a suitable and adjustable support system to within 5 mm of the required location. The position and alignment shall be checked against markers or guides and if correct, the plate must be pushed home against the concrete surface, pressuring the adhesive layer. Folding wedges provide a suitable means of final adjustment and locking into position of the plate for the curing phase.

The pressure applied must be sufficient to just squeeze out the adhesive along the full plate perimeter. Care must be taken to apply the pressure evenly without distortion of the plate.

Once the plate is in position, the edges must be neatly finished with a fillet of adhesive to protect the interface of the plate, adhesive layer and concrete against the ingress of moisture.

The support system shall be left undisturbed for a minimum period of 24 hours and the temperature variation shall be monitored during the initial curing period.

i) Application of adhesive and placing of reinforcement bars to be bonded

The concrete slot and reinforcing steel surfaces receiving the adhesive shall be primed with a compatible primer approved by the engineer. While the primer is still tacky the slot must be filled with adhesive to a thickness sufficient to fill, with a slight excess, the gap between the concrete substrate and the reinforcement bar.

The reinforcement bar shall be placed and fixed into position within the slot using an approved method.

The remainder of the slot depth shall then be filled with adhesive to a slightly convex surface with respect to the surrounding concrete surface.

The elements being bonded shall not be disturbed during the curing period of the adhesive.

j) Fixings and finishing

Anchor studs shall normally be installed after the plate-bonding adhesive has cured and the support system is removed.

The holes in the concrete are drilled through the holes in the steel plate using hand-held power drills with rotary hammer action.

The anchor studs shall be installed and set to the depth and detail as indicated on the drawings or the approved alternative anchor setting procedure recommended by the manufacturer.

The annular space between the stud and the plate must be filled with the same adhesive as used for the plate bonding.

Before the adhesive enters the curing phase the hole must be covered with a suitable washer and nut torqued to the specified value.

The plate fixing shall be finished off with a two-coat protective paint system applied by an airless spray extending 25 mm beyond the plate outline. The final coat shall be of a colour similar to that of the surrounding concrete.

Excess hardened adhesive shall be carefully ground away to the required surface profile. Where the adhesive colour does not match the colour of the surrounding concrete surface, a compatible finishing paint of matching colour shall be applied to the area at the instruction of the Engineer.

k) Environmental protection and cleaning-up

Care shall be taken during any work with adhesive components to avoid contamination of the subsoil and the environment. Any spillage, wastage and clean-up residues shall be collected, removed and disposed of in suitable containers at an approved waste disposal site.

The concrete surface adjacent to the prepared surfaces receiving adhesive shall be protected against spillage where necessary. Any adhesive applied or spilled on unwanted areas must be immediately removed and cleaned with an approved clean-up material and procedure recommended for the desired purpose by the manufacturer.

PS 12 705 Tolerances

The positional and level tolerances of the bonded steel elements shall comply with those specified on the detail drawings, or if none is specified, as follows:

Position & Alignment: $\pm 5,0$ mm with max 1° angular deviation
Level: $\pm 1,0$ mm
Flatness: ± 5 mm deviation over a 2,0 m long straight

PS 12 706 Quality Assurance and Testing

The contractor shall submit to the engineer for approval the following:

- a) The adhesive manufacturer's certification verifying conformance to the specification of the material in Section 12 703 for each batch of epoxy delivered on site. The certification shall include the relevant laboratory test results.
- b) A detailed method statement for the execution of the work covered in this section including details of temporary works, work procedures and equipment to be used for mixing and placement of adhesive and bonding elements, quality assurance procedures and tests that have to be followed to ensure that the correct quality of workmanship is achieved as part of his quality control testing procedure.

The engineer may instruct the on-site monitoring, sampling and testing by an independent test laboratory to ensure that the required standard of adhesive mixing, application and performance is achieved.

Detailed records of all operations and inspections carried out and materials received, issued and tested shall be kept by the contractor and submitted to the engineer for record purposes.

PS 12 707 Measurement and Payment

Payment for items in this section shall include full compensation for all works associated with additional temporary works, execution of the work and quality assurance procedures which are not separately covered by the measurement and pay items of the Standard Specification or the Project Specifications. General access and work platforms and associated temporary works are covered in Section 12 100.

All work and material for which no specific pay item is defined shall be deemed to be covered by the items in this section.

Item	Unit
127.01 Moving to and setting up the equipment at each work site. (Description of location)	number (No)

The unit of measurement shall be the number of sites where equipment had been set up for the preparation of surfaces and placement of bonded plates and bars.

The tendered rate shall include full compensation for all costs involved in moving to each location, setting up the equipment and later dismantling thereof, extra over the general access and work platform covered in Section 12 100.

Item	Unit
127.02 Preparation of concrete surfaces	
a) Concrete surfaces for plate bonding (position and size indicated)	square metre (m ²)
b) Slots in concrete for steel bonding (position and size indicated)	metre (m)

The unit of measurement shall be the square metre of concrete surface area repaired, and the metre of slots of the size specified.

The tendered rate shall include full compensation for all labour, materials, plant and equipment required for the cover and position survey of existing reinforcement, the measurement, recording and working on the concrete member, preparation of steel fabrication drawings, the surface preparation of the concrete surface and cutting of slots as required.

It shall also include the supply and application of an adhesive-compatible primer to the prepared concrete surfaced if required for the type of adhesive being used.

Item	Unit
127.03 Adhesive (Description or type) to (location)	litre (P)

The unit of measurement shall be the litre of adhesive used as approved by the engineer. The volume shall be determined from the dimensions indicated on the detail drawings or as authorized by the engineer following the detailed inspection of the prepared surfaces. Any overcut or excessive preparation resulting in additional adhesive quantities shall not be measured.

The tendered rate shall include full compensation for all labour, material, equipment, etc, required for the supply, mixing and application of the adhesive to the prepared concrete and steel surfaces, slots and holes. It shall also include the certification testing and quality assurance monitoring and testing by the contractor, as well as any wastage of mixed or spilled materials and the disposal thereof.

The rate shall also include all costs arising from any clean-up and finishing actions required due to spillage or poor workmanship.

Item	Unit
127.04 Bonded steel plates, bars or sections	
a) Steel plates (description of unit, size and mass)	number (No)
b) Steel bars (type and size indicated)	kilogram (kg)
c) Steel sections (type and size indicated)	number (No)
d) Steel elements (description)	number (No)

The unit of measurement shall be the mass of steel bars or number of identified steel plates or described items bonded to the concrete member.

The tendered rate shall include full compensation for all labour, materials, plant, equipment etc, required for the fabrication and supply of the steel items on site, the placing and fixing of the steel items into position including all ties, fasteners, waste, etc complete as per details on the drawings. Fixing studs and bolts are measured separately.

It shall also include all costs arising from the surface preparation, corrosion protection and primer application to the steel bonding surface.

Item		Unit
127.05	Fixing studs and bolts (type and size indicated)	number (No)

The unit of measurement shall be the number of units installed.

The tendered rate shall include full compensation for all labour, materials, plant and equipment required to supply and install the described fixing studs or bolts in accordance with the detail drawings, including the drilling and preparation of holes, the application of adhesive and the installation and tightening of the fixings with washers and nuts.

Item		Unit
127.06	Protective paint coatings (type and film thickness indicated)	square metre (m ²)

The unit of measurement shall be the square metre of surface area covered by the paint coating measured in place.

The tendered rate shall include full compensation for all labour, materials, plant and equipment required to prepare the surfaces and to supply and apply the protective coating and primer to the required film thickness.

SECTION 12 800: REPLACEMENT AND REPAIR OF BRIDGE ELEMENTS

PS 12 801 Scope

This section covers the requirements for the removal of debris from expansion gaps, clearing of drainage elements, repair of expansion joints, repair of handrails, removal and rebuilding of brickwork on bridges, provision of drainage to deck void formers and the refurbishment of bridge bearings.

All steelwork should be in accordance with SANS 1200 H.

PS 12 802 Accommodation of traffic

Work requiring accommodation of traffic shall be carried out in stages and widths approved by the engineer. Traffic accommodation shall be provided in accordance with Section 1500 of the COLTO Standard Specifications for Road and Bridge Works (1998).

PS 12 803 Removal of Debris from expansion Gaps

All debris in the expansion gaps and expansion joints between deck ends, walls and girder beds shall be removed and the gaps shall be cleaned out with high-pressure water or air jets or other suitable means. Solvents or fire shall not be used unless approved by the engineer.

Protective measures such as screening shall be provided to contain flying debris, dust and water spray to ensure that passing traffic is not endangered and that the environment is not contaminated.

PS 12 804 Clearing of bridge drains

All drains, in the deck and substructure, including drain inlets, outlets and channels shall be cleared of all debris and all organic material, sand etc. Where drain inlets have been covered or clogged with concrete or asphalt pavement materials, the material shall be carefully removed without damaging the inlet or the surrounding concrete.

Drain pipes shall be cleared and flushed to attain a free flowing drainage system.

Damage to inlets, outlets or pipe components shall be repaired or replaced as instructed by the engineer.

PS 12 805 Repair of expansion joints

Remedial work on bridge expansion joints shall be in accordance with the detail drawings or engineer's instructions. Refurbishment of proprietary joint systems shall entail the servicing of the joint in situ, or the removal and replacement of joint components.

Existing joint material and debris shall be stripped in accordance with E 12 803. Once cleared, new joint material shall be constructed using Sikaflex 11FC or a similarly approved product.

PS 12 806 Repair of handrails

Remedial work shall be carried out on metal handrails that have been damaged or require maintenance work.

All painting shall be in accordance with Section 8400 of the COLTO Standard Specifications with the requirement that previously painted handrails shall be cleaned and prepared for over-coating in accordance with the recommendations of the paint or protective coating manufacturer.

Damaged components of handrails shall be repaired where possible or replaced as instructed by the engineer.

The removal of sections embedded in concrete shall be done in accordance with Section 12 200.

PS 12 807 Removal and replacement of handrails

The removal of sections embedded in concrete shall be done in accordance with Section 12 200.

Installation of the new handrails should be done in accordance with manufacturer's specification.

PS 12 808 Removal and rebuilding of brickwork

Brickwork that needs to be rebuilt shall be broken down and removed as instructed by the engineer.

Care shall be taken not to damage brickwork or concrete adjacent to the section to be removed.

New brickwork shall be joined to existing brickwork using a stepped-back or keyed joint. Joints shall only be provided where shown on the detail drawings or as instructed by the engineer.

Rebuilt walls shall be plastered and the surfaces shall be treated as specified to provide a uniform texture and colour.

PS 12 809 Drainage to deck void formers

The provision of drainage to deck void formers covers the drilling of holes and installation of drainage pipes from deck soffits into void formers in the deck to facilitate drainage.

The contractor shall ensure that the equipment used is suited to the application.

The contractor shall determine the positions of void formers as accurately as possible from the detail drawings.

Prior to drilling the contractor shall use a cover meter to determine the location of reinforcement bars and to position the drainage holes between such bars maintaining at least 40 mm concrete cover to the bars.

Drainage holes of 20 mm diameter shall be drilled into the lowest end of the void former, and a PVC pipe with a 10 mm overhang free from the deck soffit, attached to the void former. The contractor shall take care not to damage the surrounding concrete during the drilling of holes. A 20 mm diameter PVC tube, 50 mm long must be inserted and epoxied 25 mm deep into each drainage hole.

PS 12 810 Replacement of bearings

The maintenance or replacement of bearings which involves jacking of the deck, shall be performed as discussed under section 12X100: Jacking of Bridge Structures.

PS 12 811 Disposal of waste material

All waste materials, rubble, scrap and rubbish arising from the contractors presence on site and / or the execution of the works shall be disposed of weekly to a disposal site identified by the contractor and approved by the engineer.

PS 12 812 Replacement of cat ladders

Cat Ladders which are no longer safe for use should be replaced as per engineer's drawings or instruction. Cat ladders shall be installed as per manufacturer's instructions and supplied with all the necessary bolts, nuts and washers for fixing.

Cat ladders are required to be maintenance free and shall be hot-dip galvanized. In addition, a protective paint coating shall be applied as per supplier specifications.

PS 12 813 Measurement and payment

Item		Unit
128.01	Removal of debris from expansion gaps (description)	metre (m)

The unit of measurement shall be the metre (m) of expansion gaps cleaned.

The tendered rate shall include full compensation for all labour, material, plant and equipment required to execute the work including any additional protective measures and disposed of debris to an approved dump site.

Item		Unit
128.02	Clear bridge drainage system (description of elements)	number (No)

The unit of measurement shall be the number of drainage elements cleaned.

The tendered rate shall allow full compensation for all labour, material, plant and equipment required to execute the work including any special protective measures.

Item		Unit
128.03	Service or replacement of existing joint system	
a)	Service and repair of bridge joints (description)	litres (l)
b)	Replace bridge joint with (description)	litres (l)
c)	Angles over joints larger than 20mm	ton

The unit of measurement shall be the metre of specified expansion joint removed or serviced, repaired and replaced as detailed.

The tendered rate shall include full compensation for all plant, equipment, labour and material required to service and replace, or to remove and dispose of the existing joint system and the preparation and installation of the new system as detailed. The rate shall also allow for the provision of special protective measures specified during each stage of the installation.

Item	Unit
128.04 Repair of handrails (description of work)	metre (m)

The unit of measurement shall be the metre of handrail repaired.

The tendered rate shall include full compensation for the fabrication, supply and installation of handrail components complete as specified.

128.05 Removal of handrails (description of work)	metre(m)

The unit of measurement shall be the metre of handrail removed.

The tendered rate shall include full compensation for all labour, material, plant and equipment required for the removal of handrails subsequent to the installation of the new handrails.

128.06 Replacement of handrails (description of work)	metre(m)

The unit of measurement shall be the metre of handrail replaced.

The tendered rate shall include full compensation for the removal of existing handrails as well as the fabrication, supply and installation of handrail components complete as specified by manufacturer.

Item	Unit
128.07 Removal and reinstatement of brickwork on bridges (description and wall thickness)	square metre (m ²)

The unit of measurement shall be the square metre of brickwork removed and disposed of, and subsequently rebuilt.

The tendered rate shall include full compensation for all labour, material, plant and equipment required for the removal of brickwork and subsequent rebuilding the brickwork complete with plaster finish.

Item	Unit
Drilling of drainage holes into void formers from deck soffit (size of hole indicated)	number (No)

The unit of measurement shall be the number of holes drilled into void formers, and the installation of PVC drainage pipes.

The tendered rate shall include full compensation for all labour, material and equipment required for the location of reinforcement bar positions and to drill holes into void formers from the soffit of the deck, and fixing of PVC drainage pipes into the concrete with a 10 mm free overhang. Access required for this operation shall be deemed to be included in the amounts tendered under Section 12 100.

Item		Unit
128.08	Refurbishment of bearings (type and size described)	number (No)

The unit of measurement shall be the number of specified bearings to be refurbished.

The tendered rate shall include full compensation for all labour, materials and equipment required for the removal, refurbishment and re-installation of bearing components.

New replacement bearings shall be provided in accordance with Section 6600 of the COLTO Standard Specifications.

Item	Unit
128.09	Replace PVC junctions in deck (type and size described)
	number (No)

The unit of measurement shall be the number of junctions replaced.

The tendered rate shall include full compensation for all labour, materials and equipment required for the removal and replacement of the junction components.

Item	Unit
128.10	Reseal PVC junctions in deck drainage network (type and size described)
	number (No)

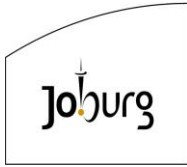
The unit of measurement shall be the number of junctions resealed.

The tendered rate shall include full compensation for all labour, materials and equipment required for the resealing of the junction components.

Item	Unit
128.11	Cast iron inlet grating in kerb (size)
	number (No)

The unit of measurement shall be the number of gratings installed.

The tendered rate shall include full compensation for the materials, fabrication, transport, handling and installation of the complete assembly, for the corrosion protection as well as for the equipment, tools, incidentals and labour required to complete the work.



Item		Unit
128.12	Seal deck drainage outlets at deck level (Size)	number (No)

The unit of measurement shall be the number of outlets sealed.

The tendered rate shall include everything that is necessary to clean out the existing outlet/deck interface and reseal with silicone sealant.

Item		Unit
128.13	New Cat Ladders (Size)	number (No)

The tendered rate shall include everything that is necessary to install and fix the cat ladders to the bridge structure.

SECTION 12 900: SURVEY AND TESTING OF SURFACE CONCRETE

PS 12 901 Scope

This section covers the requirements to determine concrete cover to reinforcement, carbonation depth and chloride content within the surface layer of a concrete member.

PS 12 902 General

The engineer will specify what provision must be made to inspect and survey exposed concrete surfaces and, if necessary, carry out appropriate in situ or laboratory tests to determine appropriate remedial work. The contractor shall make allowance in his programme for the time required to carry out surveys, tests and the reporting of results prior to commencing with repairs.

The contractor shall provide suitable and safe access to enable the engineer to carry out a close inspection of all specified concrete surfaces.

General access requirements shall be measured and paid for under Section 12 100.

PS 12 903 Concrete cover

The engineer will identify the area on the structure to be surveyed by the contractor.

The depth of concrete cover shall be determined by means of an approved electromagnetic covermeter. The covermeter shall be calibrated before being used on site. The validity of results obtained from the covermeter survey shall be checked by direct measurement to exposed reinforcing bars.

PS 12 904 Carbonation depth

The engineer will indicate where carbonation tests are to be carried out.

Samples of concrete may be removed from the structure or element by core drilling or by breaking out of a sample. Cores shall be split lengthwise and the fractured surface tested. Phenolphthalein may also be used in situ on concrete surfaces freshly exposed by fracturing or, if core drilling is not practical in dry drilled holes of 40 to 60 mm diameter.

Sampling and testing shall be done on dry concrete surfaces. A covermeter shall be used to locate reinforcement and assist the extraction of cores without damage to the reinforcement.

A solution of 1 % phenolphthalein in neutral ethyl alcohol shall be used as a pH indicator. This solution shall be sprayed onto a fresh concrete sample or exposed concrete surface. Phenolphthalein is colourless at a pH of 8,5 or less but has a pink to deep red colour at a pH of 9,0 or greater. Uncarbonated concrete therefore turns red when sprayed while carbonated concrete retains its original colour.

The phenolphthalein test solution must be obtained from an approved supplier and be stored in suitable sealed airtight containers.

PS 12 905 Chloride content

The engineer will indicate where chloride tests are to be carried out.

Samples shall be taken by drilling and removing cores of concrete and cutting slices from each core, or by drilling into the concrete with a percussion drill and collecting the dust and fine grit from various depths. Water shall not be used when slicing cores or drilling holes.

The dust samples shall be analyzed for chloride ion content at an approved laboratory.

PS 12 906 Durability indexing tests

Durability predictions shall be based on the following tests.

Water sorptivity

Oxygen permeability

Chloride conductivity

Notes:

Test methods for the above tests are contained in a booklet entitled "Guide to the use of durability indexes for achieving durability in concrete structures" by MG Alexander, JR Mackechnie and Y Ballim. The booklet is issued by the departments of Civil Engineering at either the University of Cape Town or the University of the Witwatersrand.

Test No 3 may only be required for structures located in a severe, very severe or extreme environment (as defined in TMH7 Part 3 – 1987), as directed by the Engineer.

Test samples

All the above tests are conducted on 68 mm diameter cores drilled from the structure. The frequency of testing must be such that there is at least one test per discrete concrete element, or as directed by the Engineer.

Making good the holes left by the drilling of cores shall be the responsibility of the contractor and shall be carried out in an approved manner which will restore structural integrity and durability to the structure.

Tests on the cores for all three durability indexes shall be done at a laboratory approved by the engineer.

PS 12 907 Recording of results

The contractor shall prepare an agreed reference grid of lines on the concrete surface(s) to be tested and the engineer will mark all substandard areas. The location of each test shall be recorded on an approved reference drawing.

PS 12 908 Measurement and payment

Item	Unit
129.01 Concrete cover survey (description of location)	square metre (m2)

The unit of measurement shall be the square metre of concrete surface surveyed by means of a covermeter.

The tendered rate shall include full compensation for all labour, material and testing equipment required to execute the work and the recording of results.

Item	Unit
129.02 Carbonation testing (description)	number (No)

The unit of measurement shall be the number of carbonation tests carried out.

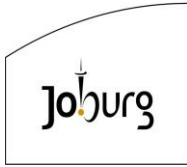
The tendered rate shall include full compensation for all labour, material and testing equipment required to execute the work and the recording of results.

Item	Unit
129.03 Chloride testing (description)	number (No)

The unit of measurement shall be the number of chloride tests carried out.

The tendered rate shall include full compensation for all labour, material and equipment required to execute the work including all testing and reporting by an approved laboratory.

Item	Unit
129.04 Durability Indexing Tests	
a) Water sorptivity	number (No)



-
b)	Oxygen permeability	number (No)
c)	Chloride conductivity	number (No)

The unit of measurement shall be the number of durability indexing tests carried out.

The tendered rate shall include full compensation for all labour, material and equipment required to execute the work including all tests and reporting by an approved laboratory.

SECTION 12X100 : JACKING OF BRIDGE STRUCTURES

PS 12X101 Scope

This section covers the requirements for the jacking of structural elements in both the vertical and horizontal directions.

PS 12X102 Definitions

Temporary works

The temporary works for jacking operations include all foundations, scaffolding and support structures, working platforms, temporary props and jacking equipment, etc required for the safe raising, lowering or moving of the structural members which will be removed after completion of the jacking operations.

Professional Engineer

All references in this section to a professional engineer, shall imply a person registered with the Engineering Council of South Africa as a Professional Engineer or a Professional Technologist (Eng.) in terms of the Engineering Profession of South Africa Act, 1990, and who has at least five years of appropriate experience in the jacking of structures.

Jacking equipment

The jacking equipment includes the mechanical and hydraulic equipment, plant, tools and systems required for the jacking of the specified members and, where necessary, include the jacks for bearing replacement.

PS 12X103 General requirements

The contractor shall provide the engineer with a method statement of the jacking procedures, compiled by a Professional Engineer with sufficient experience of jacking operations to design the temporary works and jacking procedures and to supervise the installation and operation thereof.

The contractor shall be responsible for the horizontal stability of the structural member during vertical jacking operations.

Jacking procedures shall be so designed that the effect on the member due to differential displacements shall not exceed 70 % of the effect of the bridge design loadings.

All temporary works shall be certified by a Professional Engineer on behalf of the contractor to comply with all applicable safety regulations regarding strength and stability for all imposed loads that are anticipated to arise from the specified jacking operations as well as the load carrying capacity and suitability of the proposed jacking equipment and procedures.

The jacking positions shall be as indicated on the drawings. Any deviation from those positions shall be subject to the engineer's approval.

The contractor shall establish at least two co-ordinated reference benchmarks at each support where jacking will take place. These benchmarks shall be of such description that they will be suitably protected against accidental damage for the duration of the jacking operations. No

separate payment will be made for these benchmarks and the costs of establishing and protecting the benchmarks will be deemed to be covered by the rates tendered for the other items.

PS 12X104 Founding of temporary supports

The temporary supports shall be supported on a stable and adequate founding system which will ensure compliance with the required tolerances during the deck jacking operation.

The contractor is responsible for the design of the foundations for the temporary works and must provide details to the satisfaction of the engineer indicating the ability of the proposed foundations to maintain the required tolerances under the construction loads.

The design shall be certified by a professional engineer on behalf of the contractor.

All temporary works above a level 0,5 m below ground level shall be removed from site unless otherwise instructed by the engineer.

PS 12X105 Temporary supports

The temporary supports shall be capable of transferring the loads from the jacks to the foundations. The support system must be stable and of sufficient rigidity and strength to safely carry all imposed temporary primary and foreseeable secondary loads from the deck to the foundation during the construction activity.

Where temporary supports are fixed to, or supported from the permanent structure, any temporary holes or other blemishes arising from the fixing of such temporary support shall be repaired to match the surface finish of the adjacent surface to the satisfaction of the engineer.

The design and construction of the temporary supports shall allow for protective measures, such as guardrails or barriers, around supports which may endanger the structure, or compromise its safety, if these are damaged by passing traffic. These measures are intended to ensure the safety of the jacked structure and will not be paid for separately.

This safeguarding of the structure is in addition to the Accommodation of Traffic measures that are paid for under Section 1500 of the COLTO Standard Specifications which are primarily intended to ensure the safety of workmen, traffic and the travelling public.

PS 12X106 Jacking equipment

a) General requirements

All hydraulic hoses and connections shall be capable of withstanding at least 150 % of the rated load capacity.

The jacking equipment shall be supplied with tested hoses and connections which shall be exchanged in accordance with the manufacturer's planned maintenance programme.

The jack system shall be provided with a positive means of arresting the dropping of the deck onto the temporary support in the event of a sudden failure of any element in the jack system.

The contractor is responsible for the design and supply of all the jacking equipment to suit his proposed jacking procedure.

The jacking forces for the various jacking procedures will be provided on the working drawings. Structural elements shall be checked dimensionally for the suitability of the proposed jacking equipment.

b) Vertical Alignment of members

The jacks are required to carefully facilitate the alignment of the jacked members according to the levels stated on the drawings. Once the members have been jacked to the required alignment the jacks must be mechanically locked or the dead load must be transferred to the temporary support via packers and wedges.

All jacking points of the jacking equipment acting on the member to be raised or lowered shall be jacked simultaneously and at the same rate.

The jacking system must be capable of gradually adjusting the vertical position of the member to within 1,0 mm of the design levels, and must be capable of the lifting forces and strokes as specified on the working drawings.

These requirements also apply where jacks are used to support the deck during the removal of the existing bearings and the installation of the new bearings and plinths, if required.

c) Alignment, deflection and jacking control

The deck alignment and levels at each deck end and at each support shall be monitored continuously during the jacking operation. Any deviation from the design alignment must be corrected immediately.

Adjacent level differences shall not differ relatively by more than 1,0 mm from the original value unless approved in writing by the engineer.

The contractor shall record and submit all results within 24 hours to the engineer for record purposes.

The jacking operation shall be controlled by a person with extensive and appropriate experience in the lifting procedure.

d) Installation of permanent bearings

Permanent bearings shall be installed after the deck has been jacked into its final position. Details of installation, bearing seats, rehabilitation work required to re-used bearings and protective measure to be applied, are indicated on the drawings.

Any excess height between the bearing assembly and the top of the substructure element shall be taken up by a high strength concrete plinth, structural steel stub column or epoxy mortar as applicable. The bearing shall be installed horizontally at the prescribed level in accordance with Section 6600 of the COLTO Standard Specifications.

All mortar and grout used to bed the plinths, bearing assembly and the deck shall be of an approved high strength, non-shrink type achieving minimum compressive strengths of 20 MPa at 24 hours and 50 MPa at 28 hours.

The contractor shall take adequate measures to ensure that the deck cannot move from its position during the bearing replacement and shall submit details of the proposed procedure to the engineer for comment and approval.

e) Loads on deck during construction

No equipment, material or plant may be placed or stored on or in a bridge deck during the lifting of the deck and until the permanent bearings have been installed, except such equipment, material or plant that is approved and forms an essential part of the temporary works and jacking operations.

Temporary closure of the bridge to vehicular traffic will be required during each bearing replacement operation.

PS 12X107 Design and detail amendments to the permanent works

Any amendments to the original design requested by the contractor to suit his proposed jacking equipment or procedure or his proposed construction procedure, which require extra work, material or other costs shall be at the expense of the contractor and subject to the engineer's approval.

Such approval shall further be subject to the condition that the costs are covered by the contractor's tender rates and amounts and shall be measured and paid in accordance with the original drawings and tendered schedule of quantities.

PS 12X108 Measurement and payment

The pay items in this clause shall include full compensation for all works associated with the jacking procedure which are not already covered by the measurement and payment items of the COLTO Standard Specification or the Project Specifications : Part B, e.g. all temporary works and associated plant and equipment required for the successful raising, lowering or moving of structural members of a bridge in its final position.

All work and material associated with the jacking operations for which no specific pay item is defined shall be deemed to be covered by the items in this section.

Item	Unit
12X.01 Temporary support and foundations	
a) Design, construct and erect temporary supports for the jacking of (bridge deck)	lump sum
b) Dismantle and remove from site	ump sum

The unit of measurement for each sub-item shall be the lump sum.

The tendered amount shall include full compensation for all labour, material and equipment required for the design, fabrication, supply and erection of the temporary supports and foundations or the dismantling and removal from site, as the case may be, as well as the operation and maintenance of the supports. The amount shall include protective measures such as guard rails or barriers around the temporary support structures which shall be installed such that it does not constitute a traffic hazard.

Payment shall be made on completion of each sub-item.

Item	Unit
12X.02 Jacking equipment	
a) Design, supply and install equipment for the jacking of (bridge deck)	lump sum
b) Dismantle and remove all jacking equipment from site	lump sum

The unit of measurement for each sub-item shall be the lump sum.

The tendered amount shall include full compensation for the work related to the design, supply and erection of the jacking equipment and all costs related to the maintenance of the equipment during the jacking operations. The equipment must include all mechanical and hydraulic units and the associated equipment and control units necessary for the jacking procedures.

Item	Unit
12X.03 Vertical jacking of the bridge deck to balance part of the dead load which loads are specified in the Project Specifications	Number (No)

The unit of measurement shall be the number of structural members of specified mass relocated vertically to the specified position by jacking.

The tendered rate shall include full compensation for all labour, materials, equipment and plant required for the execution of jacking operation, the alignment and deflection control during the operation and the recording and submission of results of the jacking operation and the alignment control.

Payment shall be made after the successful jacking and positioning of each specified member in the required location.

Johannesburg Water (SOC) Ltd



CONTRACT NO: JW14455

DIEPSLOOT SEWAGE AQUEDUCT

VOLUME 1

PART 4: SITE INFORMATION

Employer:		Contractor	
Witness:		Witness:	

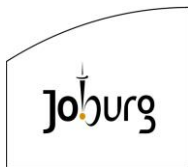


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Employer:		Contractor	
Witness:		Witness:	

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

Bridge 1 shown in Fig 1, is in Diepsloot and is the last pipe bridge before the Northern Areas Sewage Treatment Works. Bridge 2 site is situated in Riverside View and the pipe bridge crosses over the Diepsloot River.



FIGURE 1: BRIDGES 1 AND 2

Employer:		Contractor	
Witness:		Witness:	

Bridge 3 shown on Figure 2 below, is in Dainfern, crossing over the Jukskei River with part of the bridge running over the Dainfern College grounds.



FIGURE 2: BRIDGE 3

C4.3 ACCESS TO SITE AND RESTRICTIONS

Although the works are located on sites within the Employer's property and/or reserve, sections of the siphon pipeline cross existing water courses.

Bridge 1

The site can be accessed through Winnie Mandela (William Nicol) road from Sandton to Diepsloot, then through the access road to the Northern Area Sewage Treatment Works which runs parallel to this bridge. The western and eastern ends of the pipeline have no adjacent development except informal vegetable gardens on the northern side of the bridge.

Bridge 2

The site can be accessed through Winnie Mandela (William Nicol) road from Sandton to Diepsloot, then through the Porcupine Park Ave and Yellowwood Blvd roads to Riverside view. The northern end of the pipeline has no adjacent development while the southern end is flanked by new housing development. The pipeline crosses services and an existing road on the southern bank of the river.

Employer:		Contractor	
Witness:		Witness:	

Bridge 3

The site can be accessed through Winnie Mandela (William Nicol) road from Sandton to Diepsloot, then through the Porcupine Park Ave and Yellowwood Blvd roads to Riverside view. The northern end of the pipeline is surrounded by development on the eastern (Dainfern Valley Estate) and western side (Steyn City developments) while the southern end is within Dainfern College. The pipeline crosses existing services within Dainfern College and the northern side adjacent to Dainfern Valley Estate.

General to the Three Bridges

The route of the pipeline runs next to the substructure of the existing high level pipe bridge and it is anticipated that the trenching will be exposing the bridge foundations in places. EIA and WUL were obtained for the crossings of the water courses and conditions therein will be observed. Wayleaves conditions have been obtained from service authorities. Final wayleaves will need to be obtained in the name of the contractor. Any other 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 area is restored to a condition similar to when it was accessed at the end of the works.

C4.4 EXISTING SERVICES, SERVITUDES AND WAYLEAVES

For detailed specification the Contractor shall refer to clauses PS1.5 (Temporary Works), PS4.5 (Existing services), and PS4.8 (Permits and wayleaves). Wayleaves obtained to date are attached at the end of Section C4 : Annexure To Specifications.

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 PS6.1 (Security)

C4.6 NATURE OF GROUND AND SUBSOIL CONDITIONS

A geotechnical investigation for trenching was carried out in 2015. The Tenderer's attention is drawn to the following items;

- The water table is high and is about 1.5m below natural ground level. Dewatering of excavations will be required, especially if construction takes place during the wetter summer season.
- Shoring or battering back of the trench side walls must form part of the construction provisions.
- No trench materials are suitable for use as Selected Granular Material for the sewer line.
- No trench materials are suitable as selected Fill Material for the sewer line.
- All excavated trench materials screened of boulders may be used as General Backfill Material.
- All selected Granular Material and Selected Fill Material will have to be obtained from commercial sources.

Employer:		Contractor	
Witness:		Witness:	

A geotechnical investigation for the pipe bridges was completed in 2018. The following summaries the condition on the site;

- The geology beneath the site is covered by a substantial thickness of rubble fill beneath both banks at Bridge 2. In general, the bridge site is located at the invert of moderately steep river valley which has eroded any transported or residual material and exposed the bedrock.
- The weathered granite bedrock was found to be highly weathered, very closely to intensely fractured, very soft rock to soft rock consistency at between 3 and 4.5 m depth.
- All significant foundations (>500 kPa) need to be taken down to the weathered granite bedrock interface at an average of 3 m below surface. The piers carrying more substantial loads at Bridges 2 will need to be founded slightly deeper into the weathered bedrock at about 4.5 m.
- Potential construction materials for backfill to foundations could be sourced from the trench excavations for the diversion pipe further up slope at the Bridge site.

C4.7 GEOTECHNICAL REPORT AND BOREHOLE CORES

The Geotechnical report is attached in Annexure A to this document. 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

The floodlines and wetlands demarcation are as indicated on the drawings.

ANNEXURE A: GEOTECHNICAL REPORTS

Employer:		Contractor	
Witness:		Witness:	



- Site Investigations
- Slope Stability
- Rock Mechanics
- Soil Mechanics
- Foundations
- Borrow Pits and Materials
- Roads
- Groundwater
- NHBRC
- Geotechnical Instrumentation

Dainfern Sewer Pipe Bridges Upgrade: Foundation Investigation for Diversion Bridges: Preliminary Geotechnical Report

Client: Themba-Africa

Reference: 17-1084R01

Dated: 197 April 2018

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Dainfern Sewer Pipe Bridges Upgrade: Foundation Investigation for Diversion Bridges: Preliminary Geotechnical Report

Reference: 17-1084R01

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Dainfern Sewer Pipe Bridges Upgrade: Foundation Investigation for Diversion Bridges: Preliminary Geotechnical Report

Reference: 17-1084R01

Dated: 19 April 2018

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Appendix A:	Test Pit Profiles
Appendix B:	BH Logs
Appendix C:	DPSH Profiles
Appendix D:	Laboratory Test Results

Figure 1: Site Plan Showing Test Pit, DPSH and BH Positions

Dainfern Sewer Pipe Bridges Upgrade: Foundation Investigation for Diversion Bridges: Preliminary Geotechnical Report

Reference: 17-1084R01

Date: 19 April 2018

EXECUTIVE SUMMARY

This report presents the preliminary findings of the geotechnical investigation completed for the proposed diversion bridge structures to be constructed adjacent to the existing sewer pipe bridges at Dainfern in northern Johannesburg.

This report has been commissioned to provide information on in situ ground conditions and the constraints on the foundations of the proposed structures and the suitability of the near surface materials for re-use in the construction operations. In addition, the dimensions of the existing foundations required confirmation.

The investigation concentrated at three separate bridges located at the Northern Works WWTP (Bridge 1), Dainfern Village (Bridge 2) and Dainfern College and Village (Bridge 3). Bridges 1 and 2 appear to be underlain by deep fill and the exposed foundations may in fact be pile caps. This necessitated the use of DPSH penetrometers and rotary core drilling to determine the depth to bedrock at about 3 m below surface. Bridge 3 revealed weathered granite bedrock within the depth range of the TLB.

In general, however, the weathered granite bedrock is suitable for the medium and high foundation pressures that will be exerted by the proposed column/pier foundations to the new diversion bridges. Conventional pad foundations with allowable foundation bearing pressures in excess of 500 kPa should be transmitted to the weathered granite bedrock at an average of 3 m below surface.

The foundation conditions are considered adequate for the envisaged loads of 500 kPa at 3 m depth but an allowance should be made in the foundation design and structure for water ingress during foundation excavation and possibly temporary lateral support or shuttering.

A water table was encountered at most of the pier positions within the fill or at the weathered bedrock interface.

There is a paucity of good quality construction material on site. The coarser-grained material could qualify as G7.

Definitions and Abbreviations

Commercial:

GCS Geotechnical

Groundwater Consulting Services (Pty) Ltd Geotechnical

Technical:

CH	Chainage (metres)
mbgl	metres below ground level
masl	metres above sea level
NGL	Natural Ground Level
FL	Foundation Level
BH	Borehole
SPT	Standard Penetration Test
N	SPT N value (blows per 300 mm)
TLB	Tractor-mounted Loader Backhoe
TP	Test Pit
DCP	Dynamic Cone Penetrometer
EABC	Estimated Allowable Bearing Capacity
G1-G10	Standard classification of natural road building materials (TRH 14)
CBR	California Bearing Ratio
MDD	Maximum Dry Density (kg/m ³)
MADD	Modified AASHTO Dry Density
OMC	Optimum moisture Content (%)
PI	Plasticity Index
LL	Liquid Limit
LS	Linear Shrinkage
RMR	Rock Mass Rating
GSI	Geological Strength Index
m _i	Hoek-Brown Constant (origin & texture dependent)
RQD	Rock Quality Designation (%)
FF	Fracture frequency
UCS	Unconfined Compressive Strength (MPa)
C (c')	Cohesion (kPa) – total stress and (effective stress)
Φ (Φ')	Friction Angle (degrees) – total stress and (effective stress)
K _v	Modulus of Subgrade Reaction (MN/mm or kPa/mm)
CFA	Continuous Flight Auger (pile type)
DCI	Driven Cast In situ (pile type)
C _v	Coefficient of Consolidation (m ² /yr)
M _v	Modulus of Compressibility (m ² /MN)
MC1	Moisture Content Before Test (%)
MC2	Moisture Content After Test (%)
ρ	Dry Density (kg/m ³)
VSR	Very soft rock
SR	Soft rock
MHR	Medium hard rock
HR	Hard rock
VHR	Very hard rock

Dainfern Sewer Pipe Bridges Upgrade: Foundation Investigation for Diversion Bridges: Preliminary Geotechnical Report

Reference: 17-1084R01

Date: 19 April 2018

1. INTRODUCTION & TERMS OF REFERENCE

GCS Geotechnical (Pty) Ltd provided a cost proposal to Boyiki Dube of Themba-Africa on 27 February 2018 and was approved in a letter of appointment dated. The purpose of this preliminary report is to provide general guidance and recommended foundations for the proposed pier positions at the three bridge sites and also provide some indication of the dimensions of the existing bridge foundations.

2. STRUCTURES AND SPECIFICATIONS

The following table shows the main structures:

Table 2: Summary of Proposed Structures & Investigation Data

Structure	Profiles	Level (mbgl)	Aial Load (kN)	Foundation*
Bridge 1 (south bank)				
P1	TP7	3	4554	VSR
P2	TP6	3	4554	VSR
Bridge 1 (north bank)				
P3	TP1, 2B, DPSHP3	3	4554	VSR
P4	TP2, 2B, DPSHP4, BH1	3	4554	VSR
P5	TP3, 3B, DPSHP5, BH1	3	4554	VSR
P6	TP4, 4B, DPSHP6	3	4554	VSR
Bridge 2 (north bank)				
P1	TP1, 1B, DPSH1, BH2	4.5	8484	SR
P2	TP1, 1B, DPSH1, BH2	4.5	8484	SR
Bridge 2 (south bank)				
P3	TP2, DPSH2, BH3a	4.5	8484	SR
P4	TP3, DPSH1, BH3a	4.5	8484	SR
Bridge 3 (north bank)				
P1	TP6	3	6303	VSR-SR
P2	TP7	3	6303	VSR-SR
P3	TP4 & 5	3	6303	VSR-SR
Bridge 3 (river section)				
P4	Outcrop	0	6303	VSR-SR
Bridge 3 (south bank)				
P5	TP2	3	6303	VSR-SR
P6	TP2	3	6303	VSR-SR
P7	TP1	3	6303	VSR-SR
P8	TP1	3	6303	VSR-SR

*For standard 3x3m pad foundation on VSR (very soft rock) and SR (soft rock)

3. FIELDWORK RESULTS

The fieldwork was completed in March 2018 and comprised the excavation of test pits, DPSH penetrometers to refusal and limited rotary-cored boreholes where necessary. The positions of the test locations are shown on Figure 1.

3.1 Test Pits

Ten test pits were excavated at Bridge 1, four at Bridge 2 and six at Bridge 3 to investigate the shallow foundation conditions, determine the dimensions of the existing bridge foundations and also facilitate sampling and profiling. The full test pit profiles are included in Appendix A and a summary is provided below:

Table 3.1a: Summary of Foundation Conditions at Bridge 1 (North Bank)

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	Cohesion (kPa)
Fill				
0-2.4	Moist, dark grey to brown, LOOSE to MEDIUM DENSE, silty SAND with rubble refuse.	N/A	N/A	N/A
Saprolitic residuum				
2.4+	Wet, orange brown, MEDIUM DENSE to DENSE, silty fine SAND.	200+	30-60	72-144

Table 3.1b: Summary of Foundation Conditions at Bridge 1 (South Bank)

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	Cohesion (kPa)
Fill				
0-0.1.2	Moist, dark grey to brown, LOOSE to MEDIUM DENSE, silty fine SAND with rubble refuse.	N/A	N/A	N/A
Weathered Granite				
1.2+	Grey, highly weathered and jointed, MEDIUM HARD ROCK GRANITE.	500+	180+	150+

Table 3.1c: Summary of Foundation Conditions at Bridge 2 (North Bank)

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	Cohesion (kPa)
Fill				
0-2.5+	Moist, brown, gravelly silty SAND with boulders (800 to 900mm) and rubble refuse.	N/A	N/A	N/A

Table 3.1d: Summary of Foundation Conditions at Bridge 2 (South Bank)

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	Cohesion (kPa)
Fill				
0-0.7	Moist, brown, gravelly silty SAND with boulders (800 to 900 mm) and rubble refuse.	N/A	N/A	N/A
Residual Granite				
0.7-2.7+	Moist, grey brown, MEDIUM DENSE to DENSE, silty SAND with scattered boulders (400 mm).	200+	55-85	18-36

Table 3.1e: Summary of Foundation Conditions at Bridge 3 (North Bank)

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	Cohesion (kPa)
Fill				
0-0.8	Moist, brown, LOOSE, silty fine SAND with boulders (100 to 800 mm) and rubble refuse.	N/A	N/A	N/A
Residual Granite				
0.8-1.9	Moist to very moist, grey brown, MEDIUM DENSE to DENSE, silty SAND with scattered boulders (500 to 700 mm).	200+	55-85	18-36
Weathered Granite				
1.9+	Grey orange brown, highly weathered and jointed, friable, VERY SOFT to HARD ROCK GRANITE.	500+	180+	150+

Table 3.1f: Summary of Foundation Conditions at Bridge 3 (South Bank)

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	Cohesion (kPa)
Fill				
0-1.8	Moist, brown, LOOSE, silty fine SAND with boulders (100 to 800 mm) and rubble refuse.	N/A	N/A	N/A
Residual Granite				
1.8-2.2	Moist to very moist, grey brown, MEDIUM DENSE to DENSE, silty SAND with scattered boulders (500 to 700 mm).	200+	55-85	18-36
Weathered Granite				
2.2+	Grey orange brown, highly weathered and jointed, friable, VERY SOFT to HARD ROCK GRANITE.	500+	180+	150+

3.2 Groundwater and Seepage

The following table shows a summary of the water level measurements at each bridge site.

Table 3.2: Summary of Water Levels

Structure	Water Level (mbgl)	Average (mbgl)
Bridge 1 (north bank)	1.6-2.4	2.0
Bridge 1 (south bank)	2.7	2.7
Bridge 2 (north bank)	2.1-2.2	2.15
Bridge 2 (south bank)	2.8	2.8
Bridge 3 (north bank)	>2.3	>2.3
Bridge 3 (south bank)	>3.6	>3.6

3.3 DPSH Penetrometers

Ten dynamic probe super heavy (DPSH) penetrometers were used at Bridge 1 (north bank) and at Bridge 2 (north and south bank) only, since shallower granite bedrock was generally exposed in the test pits at Bridge 1 (south bank) and Bridge 3. The locations are shown on the site plan and a summary is provided below.

Table 3.3: Summary of DPSH Results

DPSH	Depth (m-m)	Blows	SPT N	Consistency	Layer	EABC (kPa)	Approx ϕ
Bridge 1 (north bank)							
P3	0-0.9	65-96	85-125	Very dense	Fill	500 800	40-50
	0.9-1.2	25	33	Dense	Fill		35-40
	1.2-1.5	17	22	Medium dense	Fill		30-35
	1.5-1.8	2	5	Loose	Fill		28-30
	1.8-2.1	100	130	Very dense	VSR		40-50
	2.1+				SR		
P4	0-0.9	57-97	92-126	Very dense	Fill	300 500 800	40-50
	0.9-1.8	8-16	10-21	Medium dense	Fill		30-35
	1.8-2.7	4-6	5-8	Loose	Fill		28-30
	2.7-5.1	12-50	20-65	Dense	Saprolite		35-40
	5.1-5.4	100	130	Very dense	VSR		40-50
	5.4+				SR		
P5	0-0.6	50-68	65-88	Very dense	Fill	300 500 800	40-50
	0.6-3.9	15-22	12-29	Medium dense	Fill		30-35
	3.9-4.2	29	38	Dense	Saprolite		35-40
	4.2-5.4	39-100	51-130	Very dense	VSR		40-50
	5.4+				SR		
P6	0-0.6	52-64	68-83	Very dense	Fill	300 500 800	40-50
	0.6-5.1	13-25	17-33	Medium dense	Saprolite		30-35
	5.1-5.7	78-100	100-130	Very dense	VSR		40-50
	5.7+				SR		
Bridge 2 (north bank)							
1	0-1.2	9-37	12-48	Med dense	Fill	500 800	30-35
	1.2-3.0	3-7	5-9	Loose	Fill		28-30
	3.0-3.6	60-100	78-130	Very dense	VSR		40-50
	3.6+				SR		
Bridge 2 (south bank)							
1	0-0.9	31-51	40-57	Very dense	Fill	500 800	40-50
	0.9-1.8	17-22	22-29	Medium dense	Fill		30-35
	1.8-2.7	30-100	39-130	Very dense	VSR		40-50
	2.7+				SR		
2	0-3.3	28-66	36-86	Very dense	Fill	500 800	40-50
	3.3-3.9	63-100	82-130	Very dense	VSR		40-50
	3.9+				SR		
Ave	4.1						

4. LABORATORY TESTING

Laboratory testing was not considered appropriate during this investigation since the confirmation of depth to high bearing strata was the main deliverable. A summary of the test results provided in previous investigations is included below:

Table 4a: Summary of Foundation Indicators (GeoZone, 2015)

TP	Depth (m-m)	LL	PI	GM	CBR (%)	Classifications		
						TRH14	PRA	USCS
Fill								
Various	0.1-1.0	23-25	5-9	1.9-2.4	34-41	G6-G7	A.1a-A.2.4	SM-SC
Residual Granite								
Various	0.5-1.3	28-35	7-16	1.5-1.9	32-43	G6-G8	A.2.6	SC-SM

All of the samples tested classify as low potential expansiveness.

Table 4b: Summary of Corrosivity Tests (GeoZone, 2015)

TP	Depth (m-m)	pH	EC (mS/m)	Resistivity (Ohm/cm)	Degree of Corrosivity
Fill					
Various	0.1-1.0	6.7-7.0	2.6-9.3	10k-38k	Negligibly corrosive
Residual Granite					
Various	0.5-1.3	6.8	2.0	50k	Negligibly corrosive

No additional precautionary measures will be required to protect buried metal piping or reinforced concrete.

Table 4c: Summary of Compaction Test Results (GeoZone, 2015)

TP	Depth (m-m)	MDD (kg/m3)	OMC (%)	Swell (%)	CBR (%)				
					90	93	95	98	100
Fill									
1	0.2-1.0	2184	6.8	0.0	32	37	41	49	-
3	0.1-1.0	2141	6.8	0.1	15	24	34	56	-
Residual Granite									
3	0.5-1.1	1989	7.8	0.0	21	30	38	58	76
4	0.5-1.0	1971	9.4	0.3	13	22	32	59	89
5	1.0-1.3	2062	7.7	0.1	15	27	40	57	69
Exp 2	1.2	1995	8.5	0.0	16	30	43	60	75

MDD = maximum dry density

OMC = optimum moisture content

5. CONSTRUCTION MATERIALS

There is a paucity of suitable construction materials beneath the site. The best quality material is the ferruginised residuum at G7 quality and appears to be about 1.5 m thick and where encountered should be temporarily stockpiled on site for later re-use in construction. This material will be generated from the foundation excavations and also the trench excavations where the pipe is buried.

The coarser-grained material reveals a moderate CBR strength of between 8 and 22% but once again the higher PI will need to be addressed by appropriate stabilisation.

6. EARTHWORKS RECOMMENDATIONS

The entire site is underlain by either rubble fill or granite residuum over weathered granite bedrock.

Soft excavation may be experienced in the fill and residuum to about 3 m on average. However, the more heavily-loaded piers may require deeper excavation into the more highly weathered, friable and intensely fractured granite bedrock and will probably be classified as intermediate to hard excavation. The excavated material from foundations will be at least G7 quality and suitable for backfill.

Provided these temporary excavations are battered back to a safe angle (at least 1:0.5 recommended), then conventional pad foundations can be placed at between nominal depth (Bridge 3) and not more than 3 m depth (Bridges 1 and 2) at 500 kPa allowable bearing pressure. The heavier-loaded piers may require localised deeper excavations into friable weathered granite bedrock to achieve 800 to 1 500 kPa bearing pressure at about 4.5 m below surface.

The proposed deeper earthworks will encounter shallow water seepage at Bridges 1 and 2 and will require pumping during construction to ensure a dry excavation and this should be allowed for in the tender documents.

7. FOUNDATION RECOMMENDATIONS

7.1 Potential Soil Movement

7.1.1 *Heave*

No fine-grained clayey material with high PI was encountered in any of the test locations. The possibility of heave is therefore not considered a possibility.

7.1.2 *Consolidation Settlement*

For the same reason provided in Section 7.1.1, it is considered that consolidation settlement will not be a constraint on this site.

7.1.3 Collapse Settlement

A potential for collapse settlement is usually indicated by a porous, pin-holed and voided soil matrix. This is always a possibility in loose fill and granite residuum. Although this constraint will not affect the proposed bridge foundations placed on weathered granite bedrock, any smaller structures (temporary construction infrastructure and also pump stations) to be placed at natural ground level should be cognisant of potential collapse settlement so that this can be mitigated by design.

7.1.4 Elastic Settlement

The elastic modulus E of the various soil horizons can be determined as the inverse of the modulus of volume compressibility (Mv) or 250 x SPT N value. The consistency descriptions from the profiling shows medium dense (which is equivalent to an SPT N range of 10 to 30). Therefore the E modulus is in the range 2.5 to 7.5 MPa and the elastic settlement amounts to between 15 and 40 mm but should be completed before the end of construction. This will affect any smaller structures to be located at natural ground level and should be mitigated by design.

7.1.5 Allowable Bearing Capacity

7.1.5.1 Soil

The allowable bearing capacity is dependent on the shear strength parameters of the soils (c, Phi) which can be estimated by empirical correlation. Once again, only smaller structures and temporary construction infrastructure will be affected by this soil parameter. The Terzaghi bearing capacity formula provides:

$$Q_f = (0.4 \times \gamma \times D \times N_\gamma) + (1.3 \times C \times N_c) + (\gamma \times D \times N_q)$$

Where if $\phi = 28$ degrees,

$$N_c = 32$$

$$N_q = 20$$

$$N_\gamma = 15$$

The ultimate bearing capacity $Q_f = (0.4 \times 15 \times 2 \times 15) + (1.3 \times 19 \times 32) + (15 \times 1 \times 20) = 1270$ kPa

The allowable bearing capacity is therefore about 400 kPa with a FoS of 3.

7.1.5.2 Rock

More appropriately for the proposed bridge piers, the estimated allowable bearing capacity of the weathered granite bedrock is provided as follows:

Table 7.1.5.2a: Generalised Summary of Rock Strength

Rock Description	Depth (mbgl)	Intact Rock Strength (MPa)	Rockmass Strength (MPa)
Very soft rock	3+	1-3	0.5 to 1.5
Soft rock	4.5+	3-10	1.5 to 5.0
Medium hard rock	5.5+	10-25	5.0 to 12.5

An RMR and GSI determination has been completed for the core recovered in the three boreholes at Bridge 1 (north bank) and Bridge 2 (north and south banks):

In order to determine the ‘actual’ rock mass characteristics, the Rock Mass Rating system (After Bieniawski, 1989) was used and considers the following rock properties:

- ☐ Uniaxial compressive strength of intact rock
- ☐ Rock Quality Designation (RQD)
- ☐ Spacing of discontinuities
- ☐ Condition of discontinuities
- ☐ Groundwater (assume dry or rating of 15)
- ☐ Adjustment for orientation (assume good and rating 0)

Using the rock strength results and rock mass structure (fracture, spacing, RQD and joint conditions), the Rock Mass Rating (RMR) can be estimated. Once this has been determined, then the Geological Strength Index (GSI) as proposed by Hoek & Brown (1997), is determined by using the following relationship: $GSI = RMR - 5$.

Table 7.1.5.2b: Rock Mass Rating (RMR) Parameters (Granite)

RMR Parameters	Value Range & (average)	Rating
UCS (MPa)	Soft to medium hard	2
RQD (%)	0-28	3-8
Spacing of joints	<60-600	5-10
Condition of joints	Slightly rough	20-25
Water	Assume dry	15
TOTAL RMR (average)		45 to 60 (53)

The range and average total suggests a fair rock mass (Class III) through the entire set of borehole profiles. The GSI is 40-55, with an average of 48.

The analysis of the rock mass parameters is summarised as follows:

Table 7.1.5.2c: Summary of Rock Mass Parameters (Granite)

Input Parameters			Output Parameters			
GSI	UCS (MPa)	Mi	Φ (°)	C (kPa)	σ (MPa)	E (GPa)
40	1-3	33	39	50-150	0.2-0.6	0.6-1.0
55	3-10	33	44	180-600	0.8-2.8	2.3-4.2

Therefore, the provisional estimated bearing capacity of the rock mass ranges from 200 to 600 kPa for very soft rock granite (usually at about 3 mbgl) and 800 kPa to 2.8 MPa for soft rock granite (usually at about 4.5 mbgl).

7.2 Light to Medium Loads

The results of the test pitting, profiling and laboratory testing suggest that conventional pad or strip foundations can be supported by the medium dense residual granite at 150 kPa provided the collapsible grain structure is mitigated.

7.3 Heavy and/or Dynamic Loads

For the majority of the pier foundations, the heavier loads will need to consider the following:

- The structural loads need to be suppressed by suitably large and heavy bases socketed into the very soft or soft rock granite which starts at about 3 m below existing ground level, with an allowable bearing capacity of 500 kPa or more.
- Foundation bases to be adjusted so the centre of gravity of the equipment and block are coincident to provide reasonably uniform foundation pressure and elastic settlement.
- The base dimensions should be proportioned so as not to exceed the estimated allowable bearing capacity of the rock formation at the foundation level. A minimum base dimension of 3x3m will be sufficient for the envisaged loads at each bridge (approximate range 4500 to 8500 kN).
- A base thickness of at least 0.6 m to produce a “rigid” foundation.
- The minimum foundation level should also be deep enough to pre-empt any scour erosion.

8. CONCLUSIONS AND RECOMMENDATIONS

The geology beneath the site is covered by a substantial thickness of rubble fill on the north bank of Bridge 1 and beneath both banks at Bridge 2. In general, the bridge sites are located at the invert of moderately steep river valleys which have eroded any transported or residual material and exposed the bedrock. However, the northern bank of Bridge 1 has experience both erosion and deposition of alluvium and later backfilled by builders rubble to maintain surrounding elevations and cover to existing bridge foundations.

The weathered granite bedrock was found to be highly weathered, very closely to intensely fractured, very soft rock to soft rock consistency at between 3 and 4.5 m depth.

All significant foundations (>500 kPa) need to be taken down to the weathered granite bedrock interface at an average of 3 m below surface. The piers carrying more substantial loads (at Bridges 2 and 3) will need to be founded slightly deeper into the weathered bedrock at about 4.5 m.

Potential construction materials for backfill to foundations could be sourced from the trench excavations for the diversion pipe further up slope at all three Bridge sites.



For **GCS Geotechnical**

19 April 2018

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DAINFERN SEWER PIPE BRIDGES
APPENDIX A
Test Pit Profiles

Job Description:	Dainfern Sewer Pipeline Bridge 1		
Job No.:	17-1084		
Client:	Themba Africa Pty Ltd		
Machine:	Bell TLB		
Location:	Diepsloot		
Logged by:	Joel		
Date:	09-Mar-18	Sheet:	1 of 1

	Test Pit Profile	Test Pit No. TP1
63 Wessel St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	2.90	2.90	Moist to wet, brown to grey with depth, LOOSE TO MEDIUM DENSE??, fine silty slightly clayey SAND with fine roots and refuse of broken pipes and bricks. FILL.

Notes:

- 1) Rapid groundwater seepage encountered
- 2) Measured water level at 2.8 m(12h00) and 2.3m(14h00).
- 3) Visible sidewall collapse
- 4) 1.4m x 1.1m (Length from the wall and depth of the exposed stepped pad footing)
- 5) 3.2m x 1.6m (Length and thickness of the wall)
- 6) Not refusal

	Test Pit Profile	Test Pit No. TP2
	Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz	

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	2.40	2.40	Moist to wet, brown to grey with depth, LOOSE TO MEDIUM DENSE??, fine silty slightly clayey SAND with fine roots and refuse of broken pipes and bricks. FILL.

Notes:

- 1) Moderate to slow groundwater seepage encountered
- 2) Measured water level at 2.3m(13h10) and 1.7m(14h00).
- 3) No visible sidewall collapse
- 4) 1.6m (Length from the wall of the exposed pad footing)
- 5) 3.2m x 1.6m (Length and thickness of the wall)
- 6) Not refusal



Test Pit Profile

Test Pit No.
TP2(B)

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	2.70	2.00	Moist to wet, brown to grey with depth, LOOSE TO MEDIUM DENSE??, fine silty slightly clayey SAND with fine roots and refuse of bricks. FILL.

Notes:

- 1) Slow to moderate groundwater seepage encountered
- 2) Measured water level at 2.0m(14h05) and 2.0m(15h00).
- 3) No visible sidewall collapse
- 4) Not refusal



Test Pit Profile

Test Pit No.

TP3

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	1.80	1.80	Moist to wet, brown to grey with depth, LOOSE TO MEDIUM DENSE??, fine silty slightly clayey SAND with fine roots and refuse of bricks. FILL.

Notes:

- 1) Very slow groundwater seepage encountered
- 2) Measured water level is 1.6m(13h25) and 1.6m(14h25).
- 3) Visible sidewall collapse
- 4) 1.5m (Length from the wall of the exposed stepped pad footing)
- 5) 3.2m x 1.6m (Length and thickness of the wall)
- 6) Not refusal



Test Pit Profile

Test Pit No.
TP3(B)

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	2.50	2.50	Moist to wet, brown to grey with depth, LOOSE TO MEDIUM DENSE??, fine silty slightly clayey SAND with fine roots, bricks and plastics. FILL.

Notes:

- 1) Slow to moderate groundwater seepage encountered
- 2) Measured water level at 2.3m(13h50) and 1.9m(15h00).
- 3) Visible sidewall collapse
- 4) Not refusal



Test Pit Profile	Test Pit No. TP4
Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz	

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.30	0.30	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.
0.30	2.60	2.30	Very moist to wet, brown to greyish, MEDIUM DENSE (pp=25mm), intact, silty fine to medium SAND with scattered sub-angular and angular light brown and white weathered, very soft rock(friable) granite gneiss and refuse of bricks and pipes. FILL - possible backfilled material from spoil.

Notes:

- 1) Moderate groundwater seepage encountered
- 2) Measured water level is 2.4m(15h10) and 2.4m(16h00).
- 3) Visible sidewall collapse
- 4) 1.6m x 1m+ (Length from the wall and width of the exposed stepped pad footing)
- 5) 3.2m x 1.6m (Length and thickness of the wall)
- 6) Not refusal



Test Pit Profile	Test Pit No. TP4(B)
Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz	

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.50	0.50	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.
0.50	2.10	2.10	Very moist to wet, brown to greyish, MEDIUM DENSE (pp=25mm), intact, silty fine to medium SAND with scattered sub-angular and angular light brown and white weathered, very soft rock(friable) granite gneiss and refuse of bricks and pipes. FILL - possible backfilled material from spoil.

Notes:

- 1) Very slow groundwater seepage encountered
- 2) Visible sidewall collapse.
- 3) Not refusal



Test Pit Profile

Test Pit No.

TP5

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.30	0.30	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.
0.3	2.40	2.10	Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered sub-angular and angular light brown and white weathered, very soft rock(friable) granite gneiss and refuse of bricks and pipes. FILL - possible backfilled material from spoil.
2.4+			Wet, red brown, MEDIUM DENSE TO DENSE, intact, silty fine to medium SAND. Reworked residual granite gneiss.

Notes:

- 1) Moderate groundwater seepage encountered
- 2) Measured water level at 2.2m(16h10) and 2.2m(16h45).
- 3) No visible sidewall collapse
- 4) 1.5m x 1.1+ (Length from the wall and width of the exposed stepped pad footing)
- 5) 3.2m x 1.6m (Length and thickness of the wall)
- 6) Not refusal



Test Pit Profile

Test Pit No.

TP5(B)

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (north bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	09-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.50	0.50	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.
0.50	2.50	2.00	Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered sub-angular and angular light brown and white weathered, very soft rock(friable) granite gneiss and refuse of bricks and pipes. FILL - possible backfilled material from spoil.
2.50+			Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered sub-angular and angular light brown and white weathered, very soft rock(friable) granite gneiss and refuse of bricks and pipes. FILL - possible backfilled material from spoil.

Notes:

- 1) Moderate groundwater seepage encountered
- 2) Measured water level at 1.9m(16h20) and 1.7m(17h00).
- 3) No sidewall collapse



Test Pit Profile

Test Pit No.

TP6

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (south bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	13-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.40	0.50	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.
0.40	1.90	1.50	Moist, brown and orange speckled black, MEDIUM DENSE (pp=20mm), intact, silty fine to medium SAND. FILL - possible backfilled material from spoil.
1.90	2.90	1.00	Very moist to wet, orange and brown, blotched black, DENSE, intact, cemented and ferruginised, silty fine to medium SAND. Reworked residual granite gneiss.

Notes:

- 1) Very slow groundwater seepage encountered
- 2) Measured water level at 2.8m(10h10) and 2.7m(10h50).
- 3) No visible sidewall collapse
- 4) 0.5m x 0.52m x 1.7m+(Length from the wall,width and sloping width of the exposed sloped pad foot
- 5) 3.2m x 1.6m (Length and thickness of the wall)
- 6) Not refusal

ting)



Test Pit Profile

Test Pit No.

TP7

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 (south bank)
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	Bell TLB
Co-ord System:	Logged by:	Joel
	Date:	13-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.50	0.50	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots and refuse of bricks and pipes. FILL - possible backfilled material from spoil.
0.50	1.50	1.00	Grey, speckled orange and brown, jointed, MEDIUM HARD ROCK granite GNEISS. Sizes ranges from 100mm to 300mm.

Notes:

- 1) No groundwater seepage encountered
- 2) No visible sidewall collapse
- 3) 2.10m x 1.50m (Length from the wall and width of the exposed stepped pad footing)
- 4) Not refusal

Job Description:	Dainfern Sewer Pipeline Bridge 2			
Job No.:	17-1084			
Client:	Themba Africa Pty Ltd			
Machine:	Bell TLB			
Location:	Diepsloot			
Logged by:	Joel			
Date:	13-Mar-18	Sheet:	1	of 1

	Test Pit Profile	Test Pit No.
		TP1
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	13-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.60	0.60	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.
0.60	2.20	1.60	Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered boulders (800 to 900mm) of angular and sub-angular, dark grey, slightly weathered, medium hard to hard rock granite gneiss and refuse of bricks. FILL - possible
2.20	2.30	0.10	Grey, slightly weathered, BOULDERS of medium hard rock granite. FILL - backfilled material. Sizes ranges from 100mm to 400mm.

Notes: 1) Moderate groundwater seepage encountered 2) Measured water level at 2.1m(13h00) and 2.2m(14h00). 3) Visible sidewall collapse 4) Unable to expose pad footing 5) Refusal on backfilled medium hard rock granite gneiss

	Test Pit Profile	Test Pit No. TP1B										
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz												
Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 (north bank)										
	Job No.:	17-1084										
	Client:	Themba Africa Pty Ltd										
	Machine:	Bell TLB										
	Logged by:	Joel										
	Date:	13-Mar-18										
<table border="1"> <thead> <tr> <th>From:</th> <th>To:</th> <th>Thickness (m)</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0.00</td> <td>0.60</td> <td>0.60</td> <td>Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.</td> </tr> <tr> <td>0.60</td> <td>2.20</td> <td>1.60</td> <td>Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered boulders (800 to 900mm) of angular and sub-angular, dark grey, slightly weathered, MEDIUM HARD TO HARD ROCK granite gneiss and refuse of bricks. FILL - possible backfilled material.</td> </tr> </tbody> </table>	From:	To:	Thickness (m)	Description	0.00	0.60	0.60	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.	0.60	2.20	1.60	Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered boulders (800 to 900mm) of angular and sub-angular, dark grey, slightly weathered, MEDIUM HARD TO HARD ROCK granite gneiss and refuse of bricks. FILL - possible backfilled material.
From:	To:	Thickness (m)	Description									
0.00	0.60	0.60	Moist, light grey to brown speckled white, LOOSE, intact, medium to coarse gravelly silty fine SAND with fine roots. FILL - possible backfilled material from spoil.									
0.60	2.20	1.60	Very moist to wet, brown to greyish, MEDIUM DENSE, intact, silty fine to medium SAND with scattered boulders (800 to 900mm) of angular and sub-angular, dark grey, slightly weathered, MEDIUM HARD TO HARD ROCK granite gneiss and refuse of bricks. FILL - possible backfilled material.									
Notes: 1) Very slow groundwater seepage encountered at 2.10m 2) Measured water level at 2.2m(12h00) and 2.1m(12h30). 3) Visible sidewall collapse at 1.20m 4) Unable to expose pad footing												

	Test Pit Profile	Test Pit No. TP2
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	14-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.80	0.80	Slightly moist, light brown,VERY LOOSE TO LOOSE, intact, fine gravelly silty fine to medium SAND with scattered cobbles and boulders of brown orangish, highly weathered (friable), VERY SOFT ROCK, granite GNEISS and fine roots. Alluvium.
0.80	2.60	1.80	Moist to very moist, grey brown, MEDIUM DENSE TO DENSE (pp=20mm), intact, silty slightly clayey fine SAND. Residual granite gneiss.
2.60+			Grey, slightly weathered BOULDERS (400mm) of hard rock gneiss.

Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) Refusal on hard rock granite gneiss boulder			

	Test Pit Profile	Test Pit No. TP3

63 Wessels St, Rivonia	Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	Bell TLB
	Logged by:	Joel
	Date:	14-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.60	0.60	Slightly moist, light brown, LOOSE, intact, fine gravelly silty fine to medium SAND with scattered cobbles and boulders of brown orangish, highly weathered (friable), VERY SOFT ROCK, granite GNEISS and fine roots. Alluvium.
0.60	2.50	0.80	Moist to very moist, grey brown speckled orange, MEDIUM DENSE (pp=30mm), intact, silty slightly clayey fine to medium SAND. Residual granite gneiss
2.50	2.80	0.30	Wet, light grey brown, MEDIUM DENSE TO SOFT (pp=40mm), intact, silty slightly clayey fine to medium SAND. Residual granite gneiss

Notes: 1) Very slow groundwater seepage encountered 2) No visible sidewall collapse 3) Not refusal

		Test Pit Profile		Test Pit No. TP4	
63 Wessels St, Rivonia		Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz			
Co-ordinates: x y Elevation: Co-ord System:		Job Description: Job No.: Client: Machine: Logged by: Date:		Dainfern Sewer Pipeline Bridge 2 (north bank) 17-1084 Themba Africa Pty Ltd JCB 3CX Eco Joel 21-Mar-18	
From:	To:	Thickness (m)	Description		
0.00	3.00	3.00	Moist, light grey to brown, LOOSE TO MEDIUM DENSE with depth, intact, silty fine SAND with scattered cpbbles(50mm to 100mm) light grey brown, highly weathered, sub-angular, very soft rock granite gneiss, fine roots and refuse of plastics and sponges. FILL.		
Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) Not refusal					

	Test Pit Profile	Test Pit No. TP4(B)
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	21-Mar-18

From:	To:	Thickness (m)	Description
0.00	3.00	3.00	Moist, light grey to brown, LOOSE TO MEDIUM DENSE with depth, intact, silty fine SAND with scattered cobbles(50mm to 100mm) light grey brown, highly weathered, sub-angular, very soft rock granite gneiss, fine roots and refuse of plastics and sponges.. FILL.

Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) Not refusal			

Job Description:	Dainfern Sewer Pipeline Bridge 3			
Job No.:	17-1084			
Client:	Themba Africa Pty Ltd			
Machine:	Bell TLB			
Location:	Dainfern			
Logged by:	Joel			
Date:	16-Mar-18	Sheet:	1 of 1	

	Test Pit Profile	Test Pit No. TP1

63 Wessels St, Rivonia	Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	3CX Eco TLB
	Logged by:	Joel
	Date:	16-Mar-18

From:	To:	Thickness (m)	Description
0.00	1.10	1.10	Moist, light brown and orange, VERY LOOSE, intact, silty fine to medium SAND in a matrix of highly weathered cobbles and boulders (300-900mm) of medium hard rock granite GNEISS and fine roots. FILL - Cobbles and boulders used to backfill.
1.10	3.60	2.50	Moist, brown, MEDIUM DENSE, intact, silty fine to medium SAND in a matrix of highly weathered cobbles and boulders (300-900mm) of medium hard rock granite and fine roots. FILL - Cobbles and boulders used to backfill.

Notes:

- 1) No groundwater seepage encountered
- 2) No visible sidewall collapse
- 3) TLB could not go further

	Test Pit Profile	Test Pit No. TP2

63 Wessels St, Rivonia	Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	16-Mar-18

From:	To:	Thickness (m)	Description
0.00	1.20	1.20	Slightly moist, light brown, VERY LOOSE, intact, medium to coarse gravelly silty fine SAND in a matrix of grey brown, highly weathered cobbles of very soft rock (friable) granite gneiss, bricks, plastics and fine roots. FILL - possible backfilled material from spoil.
1.20	1.70	0.50	Very moist, brown, DENSE (pp=10mm), intact, silty fine SAND. Residual granite.
1.70	2.20	0.50	Moist, brown and orange speckled black, VERY DENSE, intact, cemented and ferruginised, silty fine to medium SAND. Reworked residual granite gneiss
2.20	2.30	0.10	Grey and brown and mottled orange, highly weathered, VERY SOFT ROCK(friable) granite GNEISS.

Notes:

- 1) No groundwater seepage encountered
- 2) No visible sidewall collapse
- 3) Refusal on highly weathered, very soft rock granite gneiss

	Test Pit Profile	Test Pit No. TP3

63 Wessels St, Rivonia	Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	21-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.95	0.95	Moist, grey blackish to light brown, VERY LOOSE TO MEDIUM DENSE , intact, silty fine SAND with scattered cobbles (100-200mm) of light grey brown, highly weathered, very soft rock granite gneiss and refuse of bricks, steel and fine roots. FILL.

Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) South Bank (Dainfern College grounds)

	Test Pit Profile	Test Pit No. TP3(B)
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	21-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.95	1.10	Moist, grey blackish to light brown, VERY LOOSE TO MEDIUM DENSE , intact, silty fine SAND with scattered cobbles (100-200mm) of light grey brown, highly weathered, very soft rock granite gneiss and refuse of bricks, steel and fine roots. FILL.

Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) South Bank (Dainfern College grounds)

	Test Pit Profile	Test Pit No. TP3(C)
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (south bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	21-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.95	1.10	Moist, grey blackish to light brown, VERY LOOSE TO MEDIUM DENSE , intact, silty fine SAND with scattered cobbles (100-200mm) of light grey brown, highly weathered, very soft rock granite gneiss and refuse of bricks, steel and fine roots. FILL.

Notes: 1) Groundwater seepage encountered at 1.0m 2) Measured water level at 0.86m(9h30) and 0.85m(10h00). 2) No visible sidewall collapse 3) South Bank (Dainfern College grounds)			

	Test Pit Profile	Test Pit No.
		TP4
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	27-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.40	0.40	Very moist, brown, LOOSE, intact, medium to coarse gravelly silty fine SAND. Alluvium.
0.40	0.60	0.20	Very moist, brown, MEDIUM DENSE (pp=10mm), intact, silty fine SAND in a matrix of light grey, sub-angular to angular, medium to coarse grained gravel of weathered, granite gneiss. Pebble marker.
0.60	2.30	1.70	Very moist, brown, MEDIUM DENSE (pp=10mm), intact, silty fine SAND but with scattered BOULDERS (500-700mm) of grey, sub-angular, slightly weathered, hard rock granite gneiss. Residual granite gneiss.
2.30	2.40	0.10	Grey and brown, slightly weathered, jointed, HARD ROCK, granite GNEISS.

Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) North Bank (Dainfern Valley) 4) Refusal on slightly weathered, hard rock granite gneiss

	Test Pit Profile	Test Pit No. TP5
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	29-Mar-18

From:	To:	Thickness (m)	Description
0.00	1.50	1.50	Moist, light brown to dark brown, LOOSE TO MEDIUM DENSE, intact, silty fine to medium SAND with refuse of concrete slabs (200-300mm), steel, plastics and fine roots. FILL.
1.50	1.60	0.10	Grey and brown, slightly weathered, jointed, HARD ROCK, granite GNEISS.

Notes: 1) No groundwater seepage encountered 2) Visible sidewall collapse at 1.10m 3) North Bank (Dainfern Golf Estate) 4) Refusal on slightly weathered, hard rock granite gneiss

	Test Pit Profile	Test Pit No. TP6

63 Wessels St, Rivonia

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	29-Mar-18

From:	To:	Thickness (m)	Description
0.00	2.10	2.10	Moist, light brown to yellow brown with depth, VERY LOOSE TO MEDIUM DENSE , intact, silty fine SAND in a matrix of light grey brown and orange, boulders (600-800mm slaps), moderately weathered, MEDIUM HARD ROCK granite gneiss and refuse of

Notes:

- 1) No groundwater seepage encountered
- 2) No visible sidewall collapse
- 3) North Bank (Dainfern Golf Estate)

	Test Pit Profile	Test Pit No.
		TP7
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 3 (north bank)
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	JCB 3CX Eco
	Logged by:	Joel
	Date:	29-Mar-18

From:	To:	Thickness (m)	Description
0.00	0.40	0.40	Moist, brown, LOOSE, intact, silty fine SAND with fine roots and refuse of plasti bags and steel pipes. FILL.
0.40	0.80	0.40	Very moist, brown, MEDIUM DENSE (pp=20mm), intact, silty fine SAND. RESIDUAL granite gneiss
0.80	1.40	0.60	Moist, brown and orange speckled black, DENSE, intact, cemented and ferruginised, silty fine SAND. REWORKED RESIDUAL granite gneiss
1.40	1.50	0.10	Grey orange and brown, highly weathered, jointed, VERY SOFT ROCK (friable), granite GNEISS.

Notes: 1) No groundwater seepage encountered 2) No visible sidewall collapse 3) North Bank (Dainfern Golf Estate) 4) Refusal on slightly weathered, hard rock granite gneiss

DAINFERN SEWER PIPE BRIDGES
APPENDIX B
BH Logs



Borehole Profile

Borehole No.

BH1 (North)

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Dainfern Sewer Pipeline Bridge 1 North
x	Job No.:	17-1084
y	Client:	Themba Africa Pty Ltd
Elevation:	Machine:	
Co-ord System:	Logged by:	Joel
	Date:	16-Apr-18

From:	To:	Thickness (m)	Description
0.00	3.00	3.00	Moist to wet, light grey to brown speckled white, LOOSE TO MEDIUM DENSE with depth, intact, medium to coarse gravelly silty fine SAND. FILL - possible backfilled material from spoil.
3	4.50	1.50	Grey mottled and stained orange and black, highly to weathered, fine-medium grained, VERY SOFT TO SOFT ROCK (friable), GRANITE GNEISS.
4.50	6.50	1.50	Grey and white, highly weathered, highly fractured, fine-coarse grained, SOFT TO MEDIUM HARD ROCK, GRANITE GNEISS.

Notes:

- 1) BH1 position place in-between DPSH 2&3.
- 2) Water level not measured but recorded from surface TP2.
- 3) No samples taken.
- 4) Casing depth not recorded.



Borehole Profile

Borehole No.

BH2 (North)

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 North
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	
	Logged by:	Joel
	Date:	16-Apr-18

From:	To:	Thickness (m)	Description
0.00	2.00	2.00	Moist to wet, light grey to brown speckled white, LOOSE TO MEDIUM DENSE with depth, intact, medium to coarse gravelly silty fine SAND. FILL - possible backfilled material from spoil.
2.00	3.50	1.50	Boulders of grey brown mottled and stained orange, highly weathered, fine-medium grained, SOFT ROCK (friable), GRANITE GNEISS and concrete block. FILL.
3.50	4.10	0.60	Grey mottled and stained orange and black, highly to moderately weathered, fine-medium grained, very closely jointed with sub-horizontal jointing, atleast MEDIUM HARD ROCK, GRANITE GNEISS.
4.10	5.60	1.10	Grey mottled and stained orange and black, highly to moderately weathered, fine-medium grained, very closely jointed with pervasive sub-vertical jointing, atleast MEDIUM HARD ROCK, GRANITE GNEISS.
5.60	6.10	0.50	Grey mottled and stained orange and brown, moderately to slightly weathered, fine-grained, very closely (5.80-5.90m) to closely jointed, MEDIUM HARD ROCK, GRANITE GNEISS.
6.10	7.60	1.50	Grey, slightly weathered, closely to widely jointed, fine-grained, HARD ROCK, GRANITE GNEISS.

Notes:

- 1) .DPSH adjacent to BH2 (north).
- 2) Water level not measured but recorded as 2.1m on TP1
- 3) No samples taken.
- 4) Casing depth recorded at 3.50.



Borehole Profile

Borehole No.

BH3a (South)

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Dainfern Sewer Pipeline Bridge 2 South
	Job No.:	17-1084
	Client:	Themba Africa Pty Ltd
	Machine:	
	Logged by:	Joel
	Date:	16-Apr-18

From:	To:	Thickness (m)	Description
0.00	2.00	2.00	Moist to wet, light grey to brown speckled white, LOOSE TO MEDIUM DENSE with depth, intact, medium to coarse gravelly silty fine SAND. FILL - possible backfilled material from spoil.
2.00	3.50	1.50	Grey mottled and stained orange and black, highly to moderately weathered, widely jointed with sub-horizontal jointing, fine-medium grained, MEDIUM HARD TO HARD ROCK, GRANITE GNEISS.
3.50	5.00	1.50	Grey mottled and stained orange and brown, moderately to slightly weathered, fine-grained, closely jointed with sub-vertical jointing, HARD ROCK, GRANITE GNEISS. Highly fractured rock at 4.56 to 4.7m but hard pieces of rock.
5.00	6.10	1.10	Grey and white, highly weathered, closely to widely jointed, fine-coarse grained, HARD ROCK, GRANITE GNEISS.

Notes:

- 1) DPSH adjacent to BH2(south).
- 2) Water level not measured but no groundwater encountered on TP4.
- 3) No samples taken.
- 4) Casing depth at 3.0m.

DAINFERN SEWER PIPE BRIDGES
APPENDIX C
DPSH Profiles

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	09 APRIL 2018	Test No	DPSH 1- North Bank,Bridge 2
Job No	18086	Checked By	EB

Graph of Depth Below Ground (m) vs. Number of Blows per 300mm for Example 1. The curve starts at 0m depth with 15 blows, drops to a minimum of 2.5m depth at 5 blows, and then rises to 0.7m depth at 37 blows.

Number of Blows per 300mm	Depth Below Ground (m)
15	0.0
10	1.2
5	2.5
37	0.7

Programme Data

Revision No 2 (19/04/2002)

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	09 APRIL 2018	Test No	DPSH 1- South Bank,Bridge 2
Job No	18086	Checked By	EB

The graph plots the relationship between the number of blows per 300mm (x-axis) and the depth below ground in meters (y-axis). The x-axis ranges from 0 to 100 with major grid lines every 10 units. The y-axis ranges from 0 to -11 with major grid lines every 1 unit. A red line represents the data, showing a path that starts at approximately 32 blows per 300mm at 0m depth, moves to about 50 blows per 300mm at -0.7m, then to about 18 blows per 300mm at -1.5m, and finally to about 100 blows per 300mm at -2.7m.

Depth Below Ground (m)	Number of Blows per 300mm
0	32
-0.7	50
-1.5	18
-2.7	100

Programme Data
Revision No 2 (19/04/2002)

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	09 APRIL 2018	Test No	DPSH 2- South Bank,Bridge 2
Job No	18086	Checked By	EB

Depth Below Ground (m)	Number of Blows Per 300mm
0.0	18
-0.5	42
-1.0	25
-1.5	35
-2.1	65
-3.3	28
-3.0	42
-3.9	100

Programme Data

Revision No 2 (19/04/2002)

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	14 MARCH 2018	Test No	DPSH P3
Job No	18086	Checked By	EB

Figure 1 is a line graph showing the relationship between the number of blows per 300mm (X-axis) and the depth below ground in meters (Y-axis). The X-axis ranges from 0 to 100, and the Y-axis ranges from 0 to -11. Two data series are plotted: 'Normal Soil' and 'Soft Soil'.

The 'Normal Soil' series starts at approximately (5, -1.8), rises to (25, -1.2), and then levels off to (95, -0.7). The 'Soft Soil' series starts at approximately (5, -1.8) and gradually decreases to (95, -2.1).

Programme Data

Revision No 2 (19/04/2002)

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	14 MARCH 2018	Test No	DPSH P4
Job No	18086	Checked By	EB

Depth Below Ground (m)	Number of Blows per 300mm
0.0	72
-1.2	15
-3.9	50
-5.4	100

Programme Data

Revision No 2 (19/04/2002)

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	14 MARCH 2018	Test No	DPSH P5
Job No	18086	Checked By	EB

Programme Data

Revision No 2 (19/04/2002)

Client	GCS GEOTECHNICAL ENGINEERING		
Location	NORTHERN OUTFALL SEWER		
Date	14 MARCH 2018	Test No	DPSH P6
Job No	18086	Checked By	EB

Programme Data

Revision No 2 (19/04/2002)

DAINFERN SEWER PIPE BRIDGES
APPENDIX D
Laboratory Test Results

DAINFERN SEWER PIPE BRIDGES SITE PLANS

DAINFERN PIPE BRIDGES: BRIDGE 1 - TEST PIT SITE PLAN



LEGEND

- Test Pits
- Dynamic Probe Super Heavy
- Boreholes Positions
- Proposed Column Positions

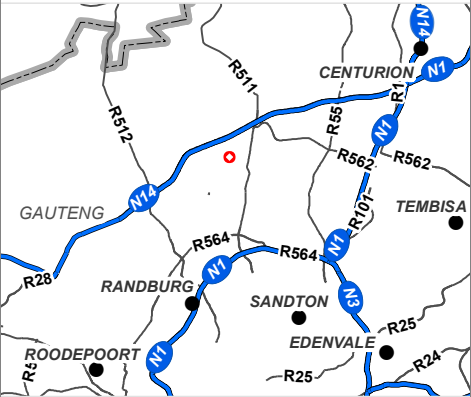
Road Network

- National Route
- Main Road
- Secondary Road
- Street

Rivers and Streams

- Non-Perennial
- Perennial

Parent Farms



Data Sources:
Google Earth™ mapping service: 2018
Imagery Date: 13/09/2017

0 5 10 20 Meters	
SCALE: 1:600	
FIGURE NO.:	MAP NUMBER: 17-1084-04-V2
DRAWN BY: AMT MKHWANAZI GIS INTERN	REVIEWED BY: P CHETTY GIS SPECIALIST
DATUM: WGS84 PROJECTION: GEOGRAPHIC	DATE: 03 APRIL 2018
PROJECT: DAINFERN PIPE BRIDGES (JOHANNESBURG) CLIENT: THEMBA AFRICA	



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DAINFERN PIPE BRIDGES: BRIDGE 2 - TEST PIT SITE PLAN



LEGEND

Borehole Positions

Test Pits

Proposed Column Positions

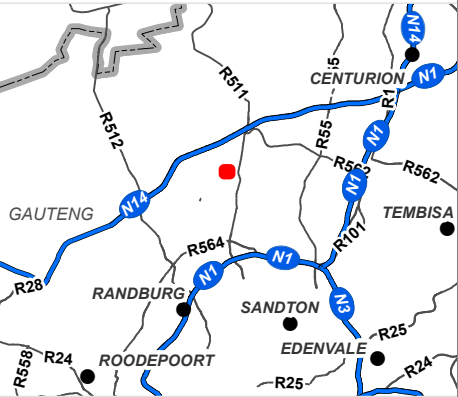
Existing Base Positions

Rivers and Streams

Non-Perennial

Perennial

Parent Farms



Data Sources:
Google Earth™ mapping service: 2018
Imagery Date: 13/09/2017

0 25 50 100 Meters	
SCALE: 1:2 000	
FIGURE NO.:	MAP NUMBER: 17-1084-05-V3
DRAWN BY: AMT MKHWANAZI GIS INTERN	REVIEWED BY: P CHETTY GIS SPECIALIST
DATUM: WGS84 PROJECTION: GEOGRAPHIC	DATE: 03 APRIL 2018
PROJECT: DAINFERN PIPE BRIDGES (JOHANNESBURG) CLIENT: THEMBA AFRICA	



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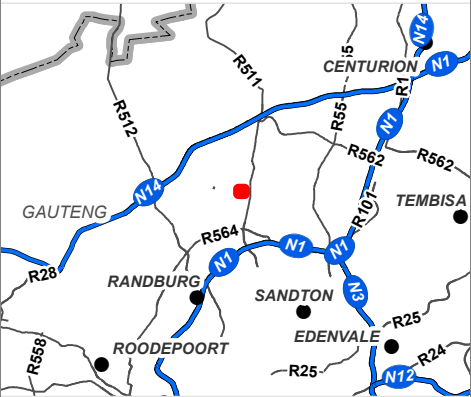
DAINFERN PIPE BRIDGES: BRIDGE 3 - TEST PIT SITE PLAN



- LEGEND**
- Test Pits
 - Extent of Exposed Pipe
 - Proposed Column Positions
 - Existing Base Positions

- Road Network**
- National Route
 - Main Road
 - Secondary Road
 - Street

- Rivers and Streams**
- Non-Perennial
 - Perennial
 - Parent Farms



Data Sources:
Google Earth™ mapping service: 2018
Imagery Date: 13/09/2017

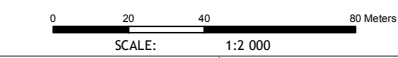


FIGURE NO.:	-	MAP NUMBER:	17-1084-06-V2
DRAWN BY:	AMT MKHWANAZI GIS INTERN	REVIEWED BY:	P CHETTY GIS SPECIALIST
DATUM:	WGS84	DATE:	03 APRIL 2018
PROJECTION:	GEOGRAPHIC		
PROJECT:	DAINFERN PIPE BRIDGES (JOHANNESBURG)		
CLIENT:	THEMBA AFRICA		



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- Site Investigations
- Slope Stability
- Rock Mechanics
- Soil Mechanics
- Foundations
- Borrow Pits and Materials
- Roads
- Groundwater
- NHBRC
- Geotechnical Instrumentation

The Results of a Geotechnical Investigation for the Diepsloot Sewer Upgrade and Bridge Repairs, Gauteng Province.

Client: Themba Infrastructure Consulting

Reference: 15-052

Dated: 28th October 2015

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The Results of a Geotechnical Investigation for the Diepsloot Sewer Upgrade and Bridge Repairs, Gauteng Province

Reference: 15-052R01

Dated: 28th October 2015

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Appendix A: Test Pit Profiles
Appendix B: Laboratory Test Results

Figure 1: Site Plan Bridge 1
Figure 2: Site Plan Bridge 2
Figure 3: Site Plan Bridge 3
Figure 4: Long Section and Geology – Bridge 1
Figure 5: Long Section and Geology – Bridge 2
Figure 6: Long Section and Geology – Bridge 3

The Results of a Geotechnical Investigation for the Diepsloot Sewer Upgrade and Bridge Repairs, Gauteng Province

Reference: 15-052R01

Dated: 28th October 2015

Definitions and Abbreviations

Commercial:

GeoZone GeoZone GeoServices

Technical:

mbgl	metres below ground level
mamsl	metres above mean sea level
NGL	Natural Ground Level
FL	Foundation Level
BH	Borehole
SPT	Standard Penetration Test
TP	Test Pit
DCP	Dynamic Cone Penetrometer
DPSH	Dynamic Probe Super Heavy
G1-G10	Standard classification of natural road building materials according to TRH 14
CBR	California Bearing Ratio
MDD	Maximum Dry Density (kg/m ³)
MADD	Modified AASHTO Dry Density
OMC	Optimum moisture Content (degrees)
PI	Plasticity Index
LL	Liquid Limit
LS	Linear Shrinkage

1. INTRODUCTION & TERMS OF REFERENCE

Themba Infrastructure Consulting requested GeoZone GeoServices to provide a cost estimate to carry out a geotechnical investigation of the proposed Diepsloot sewer pipeline outfall and bridge upgrade. This cost estimate, referenced 081-15, was submitted via electronic mail on the 29th July 2015, following which GeoZone GeoServices were formally appointed by Mr G Chiwadzwa of Themba Infrastructure Consulting in a letter dated 27th August 2015.

The proposed development comprises the investigation of three routes immediately adjacent to the pipe bridges located between Diepsloot sewerage works and Dainfern.

This report presents the findings of the geotechnical investigation and discusses the subsurface geotechnical conditions prevailing along the route and how to manage them optimally to ensure a successful installation.

2. AVAILABLE INFORMATION & DESK STUDY

The following information was drawn upon for the purposes of the investigation:

- 1:250 000 geological map (2526 Rustenburg), Government Printer, 1986.
- 1:500 000 hydrogeological map (2526 Johannesburg), DWAF, 1999.
- Drawings supplied by Themba Infrastructure Consulting in electronic format titled Bridge 1 Current Flow Permanent, Bridge 2 Current Flow, Permanent, Bridge 3 Current Flow.
- CAD drawings supplied by Themba Infrastructure Consulting in electronic format titled Diepsloot Pipeline Bridge 1.dwg, Diepsloot Pipeline Bridge 2.dwg, and Diepsloot Pipeline Bridge 2.dwg.
- A geotechnical report titled “Dainfern College Astro turf Playing Field: Geotechnical Assessment” by Bear Geotechnical, referenced J14-083 - CL1 and dated August 2014.
- Google Earth imagery of the site.
- Garmaps Africa 2010.

3. PIPELINE ROUTE DESCRIPTION

The proposed pipeline traverses three river crossings between Dainfern in the south and the Johannesburg Water sewerage works to the northwest. These river crossings are as follow, the Jukskei River adjacent to Dainfern, the Diepsloot and the third being a minor tributary of the Jukskei. These bridge crossings have been designated Bridges 1, 2 and 3, with the numbering beginning at the sewerage works end of the project.

Table 1 below is a summary of the three bridge crossings and characteristics thereof:

Table 1: Summary of River Crossing Details

Designation	Co-ordinates	River Crossing	Comment
Bridge 1	Start: 25° 56' 42.7" S 27° 59' 51.1" E End: 25° 56' 56.6" S 28° 0' 12.8" E	Tributary	Northernmost bridge crossing adjacent to the Diepsloot Sewerage Works.
Bridge 2	Start: 25° 57' 05.5" S 28° 0' 20.7" E End: 25° 57' 36.8" S 28° 0' 26.6" E	Diepsloot	Middle crossing across Diepsloot River.
Bridge 3	Start: 25° 58' 51.8" S 28° 0' 25.4" E End: 25° 59' 21.9" S 28° 0' 28.2" E	Jukskei	Southernmost bridge located within the Dainfern precinct. Difficult access through Dainfern College and adjacent golf course.

4. FIELDWORK

The fieldwork was carried out from the 3rd to 7th September 2015 and comprised the mechanical excavation of six test pits to refusal, the logging of exposure profiles on the southern side of Bridge 2 and mapping of the geology and geotechnical features along the route of the three bridges. The positions of the various tests are shown in Figure 1.

Table 2 below is a summary of the test pits, exposure profiles and desk top study data used to elucidate the geology of the three bridges.

Table 2: Summary of Test Pits, Exposure Profiles and Geotechnical Mapping

Bridge No.	Test Type	Comment
Bridge 1	TP1, TP2, TP 3, TP4	TP1 possibly not a true reflection of geotechnical conditions due to encountering the JW bulk water pipeline into the sewerage works.
Bridge 2	TP5, TP 6, EXP1, EXP 2, EXP 3	Test pits excavated on eastern side of aqueduct. On south bank access and service issues prevented test pitting in this area but data obtained from existing machine dug test holes and exposure profiles
Bridge 3	BTP001, BTP002, BTP003, BTP004, BTP005	Impossible access due to school and golf course grounds. Access refused by golf course manager. Use made of Bear Geoconsultant's geotechnical report logs for an investigation carried out immediately adjacent to aqueduct.

Note: The BTP designation refers to the Bear Geotechnical test pits excavated for the Dainfern College astro turf grounds in 2014.

The detailed test pit and exposure profiles are presented in Appendix A.

5. GEOLOGY

The site is underlain by fill, colluvium, alluvium and residual soils which overlie Archaean granite and gneiss of the Halfway House Granite Suite. Weathering of the bedrock is moderate due to the relationship between the mean annual precipitation (600 to 800mm) and the mean annual temperature (17.5 to 20.0° C) of the area (Fookes et. al., 1971). According to Weinert's "N" value of 2, the residual soils will be of average depth, transported soils will be shallow, and pedocretes, where present, will be ferruginous.

The geology of the various bridge crossings is discussed in more detail below.

5.1 Bridge 1

5.1.1 *Fill*

Inferred fill was encountered in TP1 in the vicinity of the bulk water supply line into the sewerage works. It was seen to comprise orange brown clayey gravelly sand which extended to depths in excess of 2.3 m below existing ground level.

5.1.2 *Colluvium*

Colluvium was encountered in TP3 and TP4 which extended to depths ranging from 0.2 to 0.1 for TP3 and TP4 respectively. It comprises dark greyish brown, loose, silty, slightly clayey fine to medium Sand.

5.1.3 *Alluvium*

Alluvium was encountered in TP 2 to a depth of 1.0 m below existing ground level and was seen to comprise moist to wet, greyish brown, very clayey Sand.

5.1.4 *Residual Soils*

Residual soils were encountered in TP2 and were seen to extend to a depth in excess of 2.6 m below existing ground level. These materials are best described as wet, yellowish brown, clayey Sands.

5.1.5 *Rock Head*

Rockhead comprising completely to highly weathered, yellowish brown, very closely jointed very soft to soft rock Granite and Granite Gneiss was encountered at depths of 0.1 and 0.2 m in TP4 and TP3 respectively. Refusal ranged from 1.1 m for TP3 and 2.3 m for TP4.

5.1.6 *Groundwater*

Shallow perched groundwater seepage was encountered only in TP 2 which was excavated adjacent to the Diepsloot. The water table in this pit was seen to lie at a depth of 1.1 m

below existing ground level. Very strong flows into the pit were recorded which led to the area around the pit turning into a morass of saturated sand and clay on backfilling.

5.2 Bridge 2

5.2.1 Fill

No fill was encountered in any of the test pits and exposure profiles logged on the site, although there is evidence of filled wedge on the north bank of the Diepsloot immediately adjacent to the river.

5.2.2 Colluvium

Colluvium was encountered in TP5 and TP6 which extended to a depth of 0.5 m in both instances. It was also recorded in Exp1 to Exp3 with depths ranging from 0.2 to 0.6 with an average depth of 0.4 m. It was seen to comprise dry, dark greyish brown, loose, slightly clayey or clayey, silty fine to medium Sand.

5.2.3 Alluvium

Alluvium was not encountered in any of the test pits excavated on the site. However during the mapping thicknesses of alluvium in the order of 1.5 to 2 m were encountered as low bluffs on either side of the river course.

5.2.4 Residual Soils

Residual soils were encountered in TP6 and Exp1 and Exp2 and were seen to comprise light brown mottled orange brown, medium dense Sand with much angular fine gravel or gravelly Sand.

5.2.5 Rock Head

Rock was encountered at depths ranging from 0.3 m (Exp3) to 1.3 m (Exp2) with an average depth of 0.6 m. The material comprises completely to highly weathered, yellowish brown/olive brown, closely jointed, soft to medium hard rock Granite. Refusal depths ranged from 1.1 m (TP6) to 2.7 m (TP5).

5.2.6 Groundwater

Slight groundwater seepage was recorded in Exp2 at a depth of 2.5 m.

5.3 Bridge 3

5.3.1 Fill

Large quantities of fill were recorded on the south bank of the Jukskei River in BTP001 to BTP005 with depths ranging from 0.6 m to 2.7 m with an average depth of 1.5 m. It was seen to range from light brown, silty coarse Sand with abundant gravel minor boulders and

scattered builders rubble to grey brown, silty coarse Sand with minor builders rubble and organic material and scattered boulders up to 0.8 m in diameter. Overall consistency is medium dense.

Due to access issues on the north bank it is not known if fill occurs in this area.

5.3.2 Colluvium

Colluvium was not encountered in any of the test pits excavated on the site due in part to the bulk earthworks which have taken place in the Dainfern College vicinity. However from the walkover survey that was carried out in the Steyn City development it is anticipated to occur on the north bank of the Jukskei River and expected to comprise greyish brown, loose, slightly clayey/clayey silty Sand, extending to anticipated depths of approximately 0.5 m below existing ground level.

5.3.3 Alluvium

Limited alluvium is expected within the immediate vicinity of the Jukskei River with depths of approximately 2 m anticipated.

5.3.4 Residual Soils

Residual soils on both sides of the river are expected to comprise slightly moist, yellow brown mottled pink, dense to very dense, relict jointed, silty coarse Sand derived from the weathering of the underlying soils. Thicknesses in the region of 0.5 m to 1.0 m are expected although some variability may occur due to variations in the weathering profile along the route.

5.3.5 Rock Head

Based on experience elsewhere, on the two bridges to the north and the information obtained from the Dainfern College investigation, rock is anticipated at depths ranging from 0.3 to possibly 1.5 m below existing ground level. This material is expected to be excavatable to depths ranging from 1.0 to 2.5 m below current ground level, except where overlain by thick wedges of fill material.

5.3.6 Groundwater

No groundwater was recorded in any of the test pits dug in the vicinity of Bridge 3.

6. LABORATORY TESTING

The results of the laboratory testing to determine the suitability of the soils for pipe bedding is included in Table 3. The soil conductivity test results are included in Table 4.

Table 3: Summary of Laboratory Test Results

TP No.	Depth (m)	Description	Particle Size Percent retained			Atterberg Limits (%)			GM	MDD (kg/m ³)	OMC (%)	CF	CBR Values						Swell (%)	Group Index & Class
			Clay & Silt	Sand	Gravel	LL	PI	LS					Compaction MDD %							
													90	93	95	97	98	100		
TP3	0.5-1.1	Completely to highly weathered, yellowish brown, Granite.	13	53	34	28	7	3.5	1.93	1989	7.8	0.26	21	30	38	51	58	76	0.0	A-2-4(0) G6
TP4	0.5-1.0	Completely to highly weathered, olive brown, Granite.	24	55	21	35	16	8.0	1.53	1971	9.4	0.32	13	22	32	48	59	89	0.3	A-2-6(1) G8
TP5	1.0-1.3	Completely to highly weathered, olive brown, mottled orange brown, Granite.	21	46	33	28	10	5.0	1.71	2062	7.7	0.26	15	27	40	51	57	69	0.1	A-2-4(0) G6
Exp.2	1.2	Light brown, mottled orange brown, silty, fine to medium Sand – Residual Granite.	12	66	22	29	8	4.0	1.83	1995	8.5	0.28	16	30	43	54	60	75	0.0	A-2-4(0) G6
TP001	0.2-1.0	Light brown, silty, coarse Sand, with abundant gravel – Fill.	8	29	63	23	5	2.5	2.38	2184	6.8	-	32	37	41	-	49	-	0.0	A-1-a(0) G6
TP003	0.1-1.0	Light brown, silty, coarse Sand, with abundant gravel – Fill.	18	40	42	25	9	4.5	1.90	2141	6.8	-	15	24	34	-	56	-	0.1	A-2-4(0) G7

Key

LL – Liquid Limit

PI – Plasticity Index

LS – Linear Shrinkage

OMC – Optimum Moisture Content

MDD – Maximum Dry Density

G6 – Classification in Terms of TRH14 (1985)

A-2-6(1) – Revised US Classification

CBR – California Bearing Ratio

GM – Grading Modulus

CF – Compaction Factor

Green indicates values falling within the acceptable limits, Red the opposite.

Table 4: Soil Conductivity Test Results

Test Pit No.	Conductivity (mS/m)	Resistivity (ohm.cm)	pH	Corrosion Class
TP3	9.3	10204	6.8	Negligibly Corrosive
TP4	7.8	12821	7.0	Negligibly Corrosive
TP5	2.6	38462	6.7	Negligibly Corrosive
TP8	2.0	50000	6.8	Negligibly Corrosive

7. DISCUSSION

7.1 Proposed Pipeline Infrastructure.

It is understood that the proposed development will comprise a steel sewer pipeline set into the underlying substrate at invert levels ranging from 3 m to 4 m below existing ground level.

The geotechnical issues affecting the pipeline at the three bridge positions are discussed below.

7.2 Geotechnical Considerations – Bridge 1

7.2.1 Trenchability

The excavation requirements have been assessed according to SABS 1200 (1988). Three of the four test pits excavated along the route were excavated to depths in excess of 2.0 m as per Table 5 below: It is understood that invert levels range from approximately 3.0 to 4.0 metres below existing ground level.

Table 5: Summary of Geotechnical Conditions – Bridge 1

TP No	Refusal Depth (m)	Comment
TP1	>2.3	Possibly doesn't reflect the true situation on site due to the location of the existing bulk water supply line.
TP2	2.6	Soft excavation due to the invert of river and location of scour channels and deeper alluvial and weathered rock.
TP3	1.1	Shallow refusal on granite rockhead
TP4	2.3	Moderately shallow refusal on granite rockhead

7.2.2 *Groundwater*

High groundwater levels can be expected in the valley invert where the pipeline crosses the stream. Very strong groundwater seepage was recorded in TP2 at and below 1.1 metres which rapidly filled the test pit and made it difficult to dig below these depths due to collapsing pit sidewalls.

7.2.3 *Sidewall Stability*

Test pits TP1, TP3 and TP4 were seen to be stable with no collapse of the excavation sidewalls observed. However this cannot be said of TP2 which was dug in the saturated zone in the valley invert and where collapse was recorded between 0.5 and 1.5 m below existing ground level.

As a matter of course it is considered that trenches excavated in any sandy material will require temporary lateral support, as will trenches excavated in areas with strong groundwater seepage. Trenches deeper than 1.5 metres should be shored in any event, particularly if left open for significant periods.

As a guide, batter slopes for excavation sidewalls should be restricted to the following:

- i) Fill and transported soils (alluvial, and to a lesser degree sandy colluvial soils) – 1:2 (vertical: horizontal).
- ii) Residual clay soils (not anticipated) – 1:1.
- iii) Completely to highly weathered bedrock – 1:0.25.
- iv) Highly to moderately weathered bedrock with few discontinuity apertures – vertical.

It is recommended that excavations be carried out in the dry season and that temporary lateral support be used in all situations where shallow groundwater is encountered.

It is recommended that regular inspections of the trenches be carried out by qualified professionals in order to detect potentially unstable sidewall conditions during the construction phase.

The areas of soft, compressible clays in the valley invert may require undercutting when exposed at or near formation level in the trench to improve working conditions.

7.2.4 *Backfill and Erosion Aspects*

Areas underlain by silty, clayey alluvium, ferricrete gravel and residual deposits may be susceptible to erosion. The pipe trench line can also become a preferential route for surface water and associated ongoing erosion, and with time could develop into an erosion gully (donga) with resultant failure of the proposed pipeline. To alleviate this problem, where the pipeline runs perpendicular to the contours over gradients steeper than about 1 vertical to 6 horizontal, it is recommended that at 3 to 5 metre intervals, a section of the

backfill be stabilised with approximately 4 percent cement or lime. The stabilised section should be about 1 to 2 metres in length. It is recommended that grass cover be reinstated as soon as possible after backfilling of the trench to reduce the threat of erosion. In some areas it may be prudent to allow for Biojute or hydroseeding to assist with rapid reinstatement of the vegetation.

Compaction of the general backfill soils in trenches over the bedding layer should be carried out in layers of maximum loose thickness of 200 mm and compacted to a minimum of 93% Modified AASHTO dry density. This is critical to ensure that settlements over pipes and within the trench are kept to a minimum.

7.3 Geotechnical Considerations – Bridge 2

7.3.1 Trenchability

The excavation requirements have been assessed according to SABS 1200 (1988). One of the two test pits excavated along the route were excavated to depths of 2.7 m as per Table 6 below: It is understood that invert levels range from approximately 3.0 to 4.0 metres below existing ground level.

Table 6: Summary of Geotechnical Conditions – Bridge 2

TP No	Refusal Depth (m)	Comment
TP5	2.7	Moderately shallow refusal on granite rockhead
TP6	1.1	Shallow refusal on granite rockhead
Exp1	1.8	Refusal depths are estimated. Moderately shallow refusal on granite rockhead
Exp2	2.5	Refusal depths are estimated. Moderately shallow refusal on granite rockhead
Exp3	2.2	Refusal depths are estimated. Moderately shallow refusal on granite rockhead

7.3.2 Groundwater and Surface Water

High groundwater levels can be expected in the valley invert where the pipeline crosses the stream. However the flows do seem to be confined to the immediate valley and dry conditions were encountered in TP 6 which was carried out quite close to the valley bottom. Almost no groundwater was seen in any of the excavations and platforms logged on the south bank of the Diepsloot, with the exception of some slight seepage recorded in Exp 2 at a depth of 2.5 m. However it must be borne in mind that the work was carried out

toward the end of the dry winter season and groundwater seepage could increase during the wet summer months, particularly after periods of heavy rain.

In terms of surface water, the area in the vicinity of TP5 was seen to be saturated from surface run-off further up the slope which may impact on the construction process.

7.3.3 Sidewall Stability

All of the test pits were seen to be stable with no collapse of the excavation sidewalls observed.

As a matter of course it is considered that trenches excavated in any sandy material will require temporary lateral support, as will trenches excavated in areas with strong groundwater seepage. Trenches deeper than 1.5 metres should be shored in any event, particularly if left open for significant periods.

As a guide, batter slopes for excavation sidewalls should be restricted to the following:

- i) Fill and transported soils (alluvial, and to a lesser degree sandy colluvial soils) – 1:2 (vertical: horizontal).
- ii) Residual clay soils (not anticipated) – 1:1.
- iii) Completely to highly weathered bedrock – 1:0.25.
- iv) Highly to moderately weathered bedrock with few discontinuity apertures – vertical.

It is recommended that excavations be carried out in the dry season and that temporary lateral support be used in all situations where shallow groundwater is encountered.

It is recommended that regular inspections of the trenches be carried out by qualified professionals in order to detect potentially unstable sidewall conditions during the construction phase.

The areas of soft, compressible clays in the valley invert may require undercutting if exposed at or near formation level in the trench to improve working conditions.

7.3.4 Backfill and Erosion Aspects

Areas underlain by silty, clayey alluvium, ferricrete gravel and residual deposits may be susceptible to erosion. The pipe trench line can also become a preferential route for surface water and associated ongoing erosion, and with time could develop into an erosion gully (donga) with resultant failure of the proposed pipeline. To alleviate this problem, where the pipeline runs perpendicular to the contours over gradients steeper than about 1 vertical to 6 horizontal, it is recommended that at 3 to 5 metre intervals, a section of the backfill be stabilised with approximately 4 percent cement or lime. The stabilised section should be about 1 to 2 metres in length. It is recommended that grass cover be reinstated

as soon as possible after backfilling of the trench to reduce the threat of erosion. In some areas it may be prudent to allow for Biojute or hydroseeding to assist with rapid reinstatement of the vegetation.

Compaction of the general backfill soils in trenches over the bedding layer should be carried out in layers of maximum loose thickness of 200 mm and compacted to a minimum of 93% Modified AASHTO dry density. This is critical to ensure that settlements over pipes and within the trench are kept to a minimum.

7.4 Geotechnical Considerations – Bridge 3

7.4.1 Trenchability

The excavation requirements have been assessed according to SABS 1200 (1988). One of the two test pits excavated along the route were excavated to depths of 2.7 m as per Table 7 below: It is understood that invert levels range from approximately 3.0 to 4.0 metres below existing ground level.

Table 7: Summary of Geotechnical Conditions – Bridge 3

TP No	Refusal Depth (m)	Comment
BTP001	>1.4	Partial refusal. Excavated in Fill and Granite
BTP002	>1.6	No refusal. Excavated in Fill and Granite
BTP003	>2.7	No refusal. Excavated in Fill
BTP004	>2.0	No refusal. Excavated in Fill
BTP005	1.8	Moderately shallow refusal on granite rockhead. Excavated in fill, residual soils and granite

7.4.2 Groundwater and Surface Water

High groundwater levels can be expected in the valley invert where the pipeline crosses the stream. However the flows do seem to be confined to the immediate valley and dry conditions. No groundwater was encountered in any of the test pits dug in the Dainfern College. However it must be borne in mind that the work was carried out during the dry winter months and groundwater seepage could increase during the wet season, particularly after periods of heavy rain.

7.4.3 Sidewall Stability

All of the test pits were seen to be stable with no collapse of the excavation sidewalls observed.

As a matter of course it is considered that trenches excavated in any sandy material will require temporary lateral support, as will trenches excavated in areas with strong groundwater seepage. Trenches deeper than 1.5 metres should be shored in any event, particularly if left open for significant periods.

As a guide, batter slopes for excavation sidewalls should be restricted to the following:

- i) Fill and transported soils (alluvial, and to a lesser degree sandy colluvial soils) – 1:2 (vertical: horizontal).
- ii) Residual clay soils (not anticipated) – 1:1.
- iii) Completely to highly weathered bedrock – 1:0.25.
- iv) Highly to moderately weathered bedrock with few discontinuity apertures – vertical.

It is recommended that excavations be carried out in the dry season and that temporary lateral support be used in all situations where shallow groundwater is encountered.

It is recommended that regular inspections of the trenches be carried out by qualified professionals in order to detect potentially unstable sidewall conditions during the construction phase.

Should areas of soft, compressible clays in the valley invert be encountered, these may require undercutting if exposed at or near formation level in the trench to improve working conditions.

7.4.4 Backfill and Erosion Aspects

Areas underlain by silty, clayey alluvium, ferricrete gravel and residual deposits may be susceptible to erosion. The pipe trench line can also become a preferential route for surface water and associated ongoing erosion, and with time could develop into an erosion gully (donga) with resultant failure of the proposed pipeline. To alleviate this problem,

where the pipeline runs perpendicular to the contours over gradients steeper than about 1 vertical to 6 horizontal, it is recommended that at 3 to 5 metre intervals, a section of the backfill be stabilised with approximately 4 percent cement or lime. The stabilised section should be about 1 to 2 metres in length. It is recommended that grass cover be reinstated as soon as possible after backfilling of the trench to reduce the threat of erosion. In some areas it may be prudent to allow for Biojute or hydroseeding to assist with rapid reinstatement of the vegetation.

Compaction of the general backfill soils in trenches over the bedding layer should be carried out in layers of maximum loose thickness of 200 mm and compacted to a minimum of 93% Modified AASHTO dry density. This is critical to ensure that settlements over pipes and within the trench are kept to a minimum.

8. MATERIALS EVALUATION AND PIPE BEDDING

The materials evaluation is based on the laboratory test results and on the visual assessment of the materials encountered in the field.

Generally speaking most pipelines require a bedding cradle of “selected granular material” and fill blanket of “selected fill”, if designed to conform to the requirements of “*Flexible Pipe on Class C Bed*” as laid down in SABS 1200 LB (1983). Where possible backfill will comprise the material removed from the pipe trench during excavation.

Selected granular material is defined as “*granular, non-cohesive and singularly graded between 0.6 and 19mm. The material must be free-draining and have a compactibility factor not exceeding 0.4*”.

Selected fill is defined as “*a material with a plasticity index (PI) not exceeding 6, free from lumps, vegetation and stones of a diameter exceeding 30mm*”.

At this stage the laboratory test results are still pending. However the following inferences have been made regarding the suitability of the in-situ materials for use in the construction of the bedding layers of the pipeline.

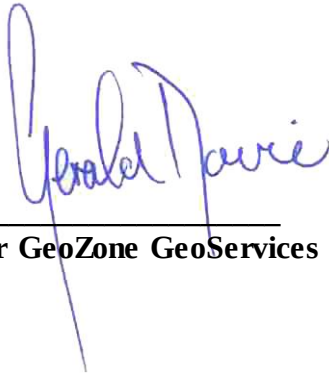
- None of the materials fully meet the grading requirements for “selected granular material”. Bedding material meeting these requirements would need to be imported due to the prevalence of fines within the residual material and on occasion exceeding the upper size limit of 19 mm. The compactibility factor results however meet the 0.4 requirement.
- It is considered that the more granular deposits will be suitable for “selected fill” provided that no material in excess of 30 mm is included. It is considered that the upper more weathered material should break down to fractions less than the 30 mm limit by applying some mechanical effort during excavation and processing.
- Most of the materials will not meet the “selected fill” requirements as they generally have a plasticity index in excess of 6 with the exception of the result from TP 001. The materials, however, may meet the general backfill requirements.

From experience, the selected granular material requirements in terms of SABS 1200LB (1983) are very seldom met by natural soils. The very strict grading requirements generally only coincide with artificially blended sands and gravels. Furthermore, the natural variability in composition within in-situ materials will make the establishment of a consistent quality very difficult. This could be problematic where the bedding is relied upon for foundation support and additional hoop strength may be required in the design of pipelines.

9 CONCLUSIONS & RECOMMENDATIONS

- This report presents the findings of a geotechnical investigation for the proposed upgrade of the Diepsloot Sewer Outfall and Bridges.
- The fieldwork for the investigation was carried out between the 4th and 7th September 2015 and comprised the excavation of test pits using a 20 tonne tracked excavator, logging of existing exposure profiles and geotechnical mapping of the area.
- The three sites are underlain by fill, alluvium, colluvium, residual soils and granites of the Halfway House Granite Suite. Fill was encountered mostly at Bridge 3 within the Dainfern College grounds. Alluvium is mostly present at the Bridge 1 crossing in the valley invert.
- Refusal depths range from 1.1 m to in excess of 2.7 m with an average depth of 2.0 m. Deeper excavation depths were encountered in the deep fills in the Dainfern College and in the valley inverts.
- Water seepage was only encountered at the river crossing at Bridge 1 and in one of the exposure profiles on the south bank of Bridge 2. All of the test pits appeared stable in the short term (during construction) except at the Bridge 1 river crossing where strong groundwater flows led to sidewall collapse. That said, the materials are non-cohesive and the danger of collapse cannot be ruled out and battering and shoring should be carried out to ensure the safety of workmen in the trenches.
- The soils encountered along the pipeline route do not qualify for selected granular material and selected fill due to PI's in excess of 6, the presence of fine material and in places oversized fractions.
- The invert levels for the proposed pipeline range from approximately 3.0 m to 4.0 m below existing ground level. The test pits were dug along the pipeline route using a 20 tonne tracked excavator which refused at depths ranging from 1.1 to in excess of 2.7 m with the average lying somewhere in the region of 2.0 m. To attain the necessary depths provision will need to be made for heavy ripping of the substrate and possibly blasting of material in the order of 1 to 2 metres below the excavation depths discussed above.
- In terms of corrosion protection the pH and electrical conductivity indicate that the soils are not corrosive. That said, some care should be taken at the river crossing at Bridge 1 where wet conditions occur. Higher groundwater levels are associated with increased threat of corrosion and the necessary cathodic protection should be included in this area. The same recommendations should be followed for any wet areas encountered along the pipeline route.
- Finally, the ground conditions described in this report refer specifically to those encountered at the test pit positions on the site. It is therefore possible that conditions

at variance with those discussed above may be encountered elsewhere on the property. In this regard it is important that GeoZone GeoServices carry out periodic inspections of the site during construction to ensure that any variation in the anticipated ground conditions can be assessed and revised recommendations made to avoid unnecessary delays and expense. Furthermore it is important that the construction phase of the project be treated as an augmentation of the geotechnical investigation.



For GeoZone GeoServices

28th October 2015

GeoZone GeoServices
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FIGURES



Key:

TP1
(>2,3)
>2,3

Approximate position of Test Pit, showing depth to bedrock () and refusal depth in meters below existing ground level.

Site plan showing approximate positions of Test Pits.

Notes:

Scale : Not to Scale

Satellite imagery courtesy of Google Earth.

Themba Infrastructure Consulting

Diepsloot Sewer Pipe – Bridge 1

GeoZone
GeoServices

- Slope Stability
- Mine Stability
- Rock Engineering
- Soil Mechanics
- Materials
- Foundation Design

- Site Investigations
- Groundwater
- Mineral Exploration
- Instrumentation
- NHBRC
- Rockfall Protection

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DATE
16th Oct. 2015

DRAWN
S. Ndlovu

CHECK
G.Davie

REFERENCE No.
15-052

Dwg. No.
Figure 1



Key:

TP5

 (0,5)
 2,7

Approximate position of Test Pit, showing depth to bedrock () and refusal depth in meters below existing ground level.

Exp.1

 (0,4)
 N/A

Approximate position of Exposure Profile, showing depth to bedrock () in meters below existing ground level.

Site plan showing approximate positions of Test Pits and Exposure Profiles.

Notes:

Scale : Not to Scale

Satellite imagery courtesy of Google Earth.

Themba Infrastructure Consulting

Diepsloot Sewer Pipe – Bridge 2

GeoZone
 GeoServices

- Slope Stability
- Mine Stability
- Rock Engineering
- Soil Mechanics
- Materials
- Foundation Design
- Site Investigations
- Groundwater
- Mineral Exploration
- Instrumentation
- NHBRC
- Rockfall Protection

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DATE
 16th Oct. 2015

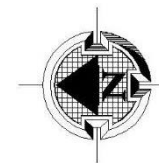
DRAWN
 S. Ndlovu

CHECK
 G.Davie

REFERENCE No.
 15-052

Dwg. No.

Figure 2



Key:

TP001

 (1.4)
 1.4

Approximate position of Test Pit, showing depth to bedrock () and refusal depth in meters below existing ground level.

Site plan showing approximate positions of Test Pits.

Notes:

Scale : Not to Scale

Satellite imagery courtesy of Google Earth.

Test pit logs, with depth to bedrock and refusal depths obtained from Bear GeoConsultants.

Themba Infrastructure Consulting

Diepsloot Sewer Pipe – Bridge 3

GeoZone
 GeoServices

- Slope Stability
- Mine Stability
- Rock Engineering
- Soil Mechanics
- Materials
- Foundation Design

- Site Investigations
- Groundwater
- Mineral Exploration
- Instrumentation
- NHBRC
- Rockfall Protection

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DATE
 16th Oct. 2015

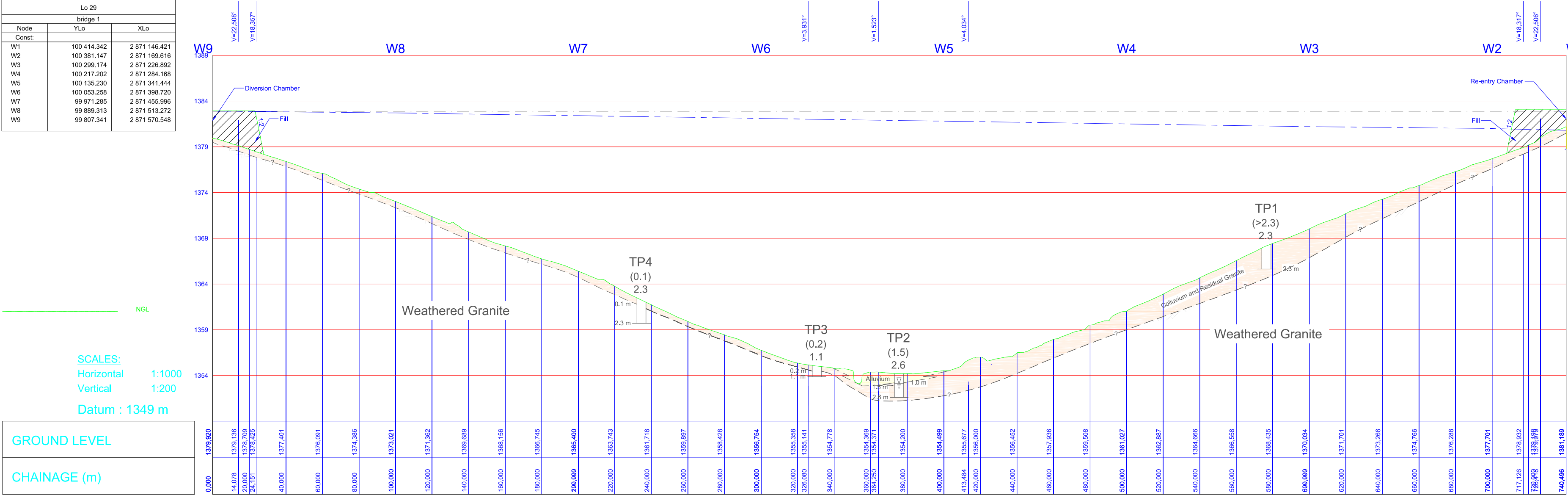
DRAWN
 S. Ndlovu

CHECK
 G.Davie

REFERENCE No.
 15-052

Dwg. No.
 Figure 3

Coordinate List		
Lo 29		
bridge 1		
Node	YLo	XLo
Const:		
W1	100 414.342	2 871 146.421
W2	100 381.147	2 871 169.616
W3	100 299.174	2 871 226.892
W4	100 217.202	2 871 284.168
W5	100 135.230	2 871 341.444
W6	100 053.258	2 871 398.720
W7	99 971.285	2 871 455.996
W8	99 889.313	2 871 513.272
W9	99 807.341	2 871 570.548



Geotechnical Instrumentation
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Rock Engineering
Slope Stability
Soil Mechanics
Foundation Design
Rockfall Protection Systems

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Geotechnical & Geotechnical Instrumentation Consultants.

Themba Infrastructure Consulting

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Diepsloot Sewer Pipe and Bridge Repairs: Cross section through Bridge 1 showing approximate positions of Test Pits, with depth to bedrock and refusal depth shown in metres below existing ground level.

Drawn: S Ndlovu

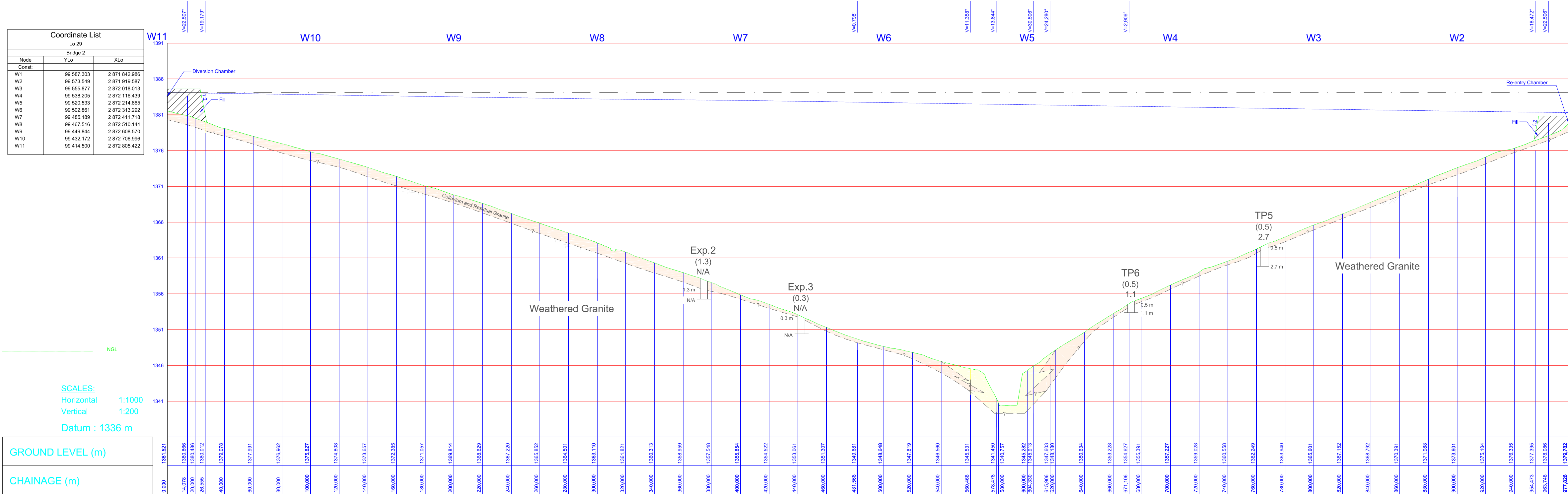
Checked: G Davie

Date: 23 Sept. 2015

Job No.: 15-052

Drawing Title: Figure 4

Coordinate List		
Lo 29		
Node	YLo	XLo
Const:		
W1	99 587.303	2 871 842.986
W2	99 573.549	2 871 919.587
W3	99 555.877	2 872 018.013
W4	99 538.205	2 872 116.439
W5	99 520.533	2 872 214.865
W6	99 502.861	2 872 313.292
W7	99 485.189	2 872 411.718
W8	99 467.516	2 872 510.144
W9	99 449.844	2 872 608.570
W10	99 432.172	2 872 706.996
W11	99 414.500	2 872 805.422



Key:

- TP5 (0.5) 2.7
Exp.2 (1.3) N/A
- Approximate position of Test Pit, showing depth to bedrock () and refusal depth in metres below existing ground level.
- Approximate position of Exposure Profile, showing depth to bedrock () in metres below existing ground level.
- Alluvium Colluvium and residual granite.



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Themba Infrastructure Consulting

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Diepsloot Sewer Pipe and Bridge Repairs: Cross section through Bridge 2 showing approximate positions of Test Pits and Exposure Profiles, with depth to bedrock and refusal depth shown in metres below existing ground level.

Drawn: S Ndlovu	Checked: G Davie	Date: 23 Sept. 2015
	Job No.: 15-052	Drawing Title: Figure 5

Coordinate List		
Lo 29		
Bridge 3		
Node	YLo	XLo
Const:		
W1	99 431.464	2 875 113.933
W2	99 428.851	2 875 142.480
W3	99 419.735	2 875 242.064
W4	99 410.619	2 875 341.648
W5	99 401.503	2 875 441.231
W6	99 392.387	2 875 540.815
W7	99 383.271	2 875 640.398
W8	99 374.156	2 875 739.982
W9	99 365.040	2 875 839.566
W10	99 355.924	2 875 939.149
W11	99 346.808	2 876 038.733

NGL

SCALES:

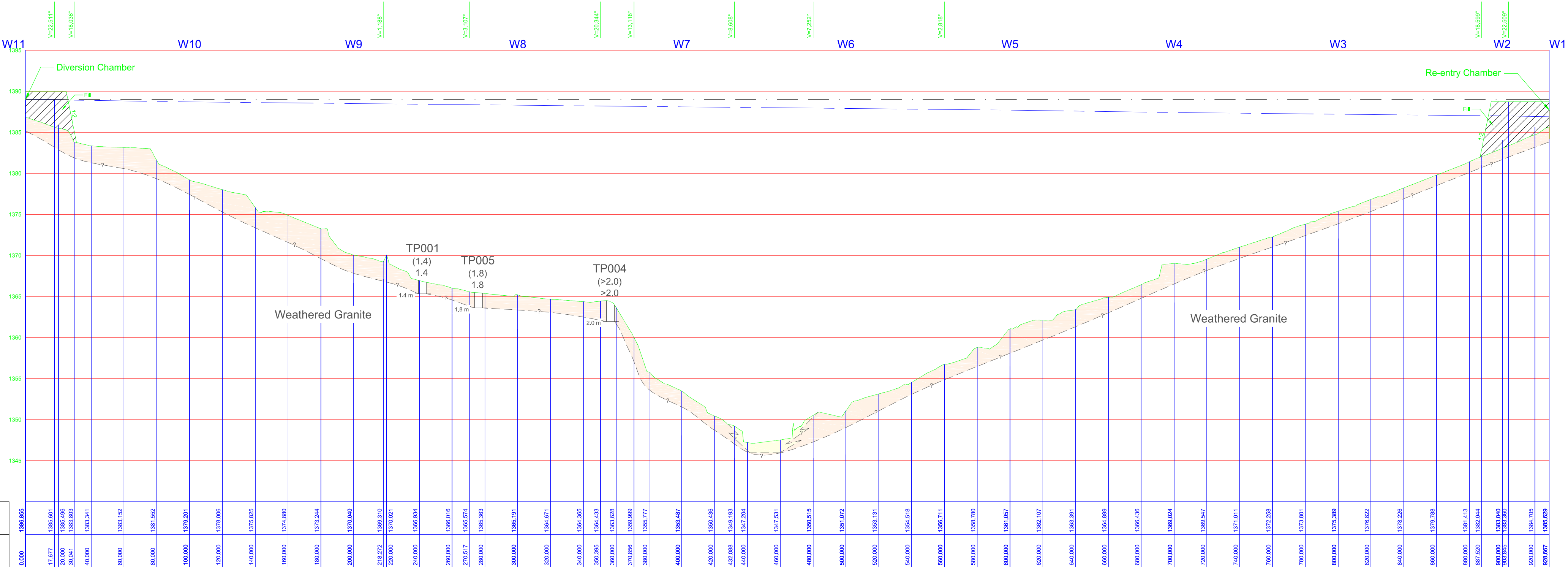
Horizontal 1:1000

Vertical 1:200

Datum : 1340 m

GROUND LEVEL

CHAINAGE (m)



Key:

TP001 (1.4) 1.4
Approximate position of Test Pit, showing depth to bedrock () and refusal depth in metres below existing ground level.

Alluvium
Fill, colluvium and residual granite.

Note: For discussion purposes only.

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Diepsloot Sewer Pipe and Bridge Repairs: Cross section through Bridge 3 showing approximate positions of Test Pits, with depth to bedrock and refusal depth shown in metres below existing ground level.

Drawn: S Ndlovu

Checked: G Davie

Date: 20 Oct. 2015

Job No.: 15-052

Drawing Title: Figure 6

Appendix A

Test Pit and Exposure Profiles

	Test Pit Profile	Test Pit No. TP1
6A, 39 Hilton Avenue, Hilton, 3245	Tel: +27 (0)33 3433915	e-mail: info@geozone.co.za

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Upgrade and Bridge Repairs
	Job No.:	15-052
	Client:	Themba Infrastructure Consulting
	Machine:	Machine excavated
	Logged by:	G. Davie
	Date:	29-Sep-15 Sheet: 1 of 1

From:	To:	Thickness (m)	Description
0,00	2,30	2,30	Orange brown, clayey, gravelly SAND - Fill.

Notes:

- 1) No groundwater seepage encountered.
- 2) No samples taken
- 3) Excavation terminated at a depth of 2,3 m due to location of bulk water supply pipeline.

	Test Pit Profile	Test Pit No.
		TP2
6A, 39 Hilton Avenue, Hilton, 3245 Tel: +27 (0)33 3433915 e-mail: info@geozone.co.za		

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Upgrade and Bridge Repairs	
	Job No.:	15-052	
	Client:	Themba Infrastructure Consulting	
	Machine:	Machine Excavated	
	Logged by:	G. Davie	
	Date:	29-Sep-15	Sheet:

From:	To:	Thickness (m)	Description
0,00	1,00	1,00	Moist to wet, greyish brown, very clayey SAND - Alluvium.
1,00	2,60	1,60	Wet, yellowish brown, clayey SAND - Residual Granite

Notes:

- 1) Very strong groundwater encountered at a depth of 2,60 m.
- 2) No samples taken.
- 3) Refusal / very hard digging on clayey SAND at a depth of 2,60 m

	Test Pit Profile	Test Pit No. TP3
6A, 39 Hilton Avenue, Hilton, 3245	Tel: +27 (0)33 3433915	e-mail: info@geozone.co.za

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Upgrade and Bridge Repairs
	Job No.:	15-052
	Client:	Themba Infrastructure Consulting
	Machine:	Machine Excavated
	Logged by:	G. Davie
	Date:	29-Sep-15 Sheet: 1 of 1

From:	To:	Thickness (m)	Description
0,00	0,20	0,20	Dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.
0,20	1,10	0,90	Completely to highly weathered, yellowish brown, closely jointed, very soft rock, GRANITE / GNEISS - Halfway House Granite Suite.

Notes:

- 1) No groundwater encountered.
- 2) 2 x Bulk Bags taken at a depth of 0,50 m to 1,10 m.
- 3) Refusal on soft rock GRANITE at a depth of 1,10 m.

	Test Pit Profile	Test Pit No.
		TP4
6A, 39 Hilton Avenue, Hilton, 3245 Tel: +27 (0)33 3433915 e-mail: info@geozone.co.za		

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Upgrade and Bridge Repairs	
	Job No.:	15-052	
	Client:	Themba Infrastructure Consulting	
	Machine:	Machine Excavated	
	Logged by:	G. Davie	
	Date:	29-Sep-15	Sheet:

From:	To:	Thickness (m)	Description
0,00	0,10	0,10	Dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.
0,10	2,30	2,20	Completely to highly weathered, yellowish brown, very closely jointed, very soft to soft rock, GRANITE / GNEISS - Halfway House Granite Suite.

Notes: 1) No groundwater encountered. 2) 2 x Bulk samples taken at a depth of 0,50 m to 1,10 m. 3) Refusal on soft rock GRANITE at a depth of 2,30 m.

	Test Pit Profile	Test Pit No. TP5
6A, 39 Hilton Avenue, Hilton, 3245	Tel: +27 (0)33 3433915	e-mail: info@geozone.co.za

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Upgrade and Bridge Repairs
	Job No.:	15-052
	Client:	Themba Infrastructure Consulting
	Machine:	Machine Excavated
	Logged by:	G. Davie
	Date:	29-Sep-15 Sheet: 1 of 1

From:	To:	Thickness (m)	Description
0,00	0,50	0,50	Dry, dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.
0,50	2,70	2,20	Completely to highly weathered, yellowish brown, closely jointed, soft to medium hard rock, GRANITE / GNEISS - Halfway House Granite Suite.

Notes:

- 1) No groundwater encountered.
- 2) 2 x Bulk and 1 x indicator sample taken at a depth 1,00 m to 1,30 m.
- 3) Refusal on medium hard rock GRANITE at a depth of 2,70 m.

	Test Pit Profile	Test Pit No. TP6
6A, 39 Hilton Avenue, Hilton, 3245	Tel: +27 (0)33 3433915	e-mail: info@geozone.co.za

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Pipe and Bridge Upgrade
	Job No.:	15-052
	Client:	Themba Infrastructure Consulting
	Machine:	Machine Excavated
	Logged by:	G. Davie
	Date:	29-Sep-15 Sheet: 1 of 1

From:	To:	Thickness (m)	Description
0,00	0,50	0,50	Dry, dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.
0,50	1,10	0,60	Completely to highly weathered, olive brown, closely jointed, soft to medium hard rock, GRANITE / GNEISS - Halfway House Granite Suite.

Notes:

- 1) No groundwater encountered.
- 2) No samples taken.
- 3) Refusal on medium hard rock GRANITE at a depth of 1,10 m.

	Test Pit Profile	Test Pit No. Exp. 1
6A, 39 Hilton Avenue, Hilton, 3245	Tel: +27 (0)33 3433915	e-mail: info@geozone.co.za

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Dipesloot Sewer Pipe and Bridge Upgrade
	Job No.:	15-052
	Client:	Themba Infrastructure Consulting
	Machine:	Machine Excavated
	Logged by:	G. Davie
	Date:	29-Sep-15 Sheet: 1 of 1

From:	To:	Thickness (m)	Description
0,00	0,20	0,20	Dry, dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.
0,20	0,40	0,20	Light brown, mottled orange brown, medium dense, silty, fine to medium SAND, with much angular fine gravel - Residual Granite.

Notes:

- 1) No groundwater encountered.
- 2) No samples taken.
- 3) Refusal on medium hard rock GRANITE at a depth of 0.40 m.

	Test Pit Profile		Test Pit No. Exp.2																
			6A, 39 Hilton Avenue, Hilton, 3245 Tel: +27 (0)33 3433915 e-mail: info@geozone.co.za																
Co-ordinates: x: y: Elevation: Co-ord System:	Job Description: Job No.: Client: Machine: Logged by: Date:	Diepsloot Sewer Pipe and Bridge Upgrade 15-052 Themba Infrastructure Consulting Machine Excavated G. Davie 29-Sep-15 Sheet: 1 of 1																	
<table border="1"> <thead> <tr> <th>From:</th> <th>To:</th> <th>Thickness (m)</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0,00</td> <td>0,60</td> <td>0,60</td> <td>Dry, dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.</td> </tr> <tr> <td>0,60</td> <td>1,30</td> <td>0,70</td> <td>Light brown, mottled orange brown, medium dense, silty, fine to medium SAND, with much angular fine gravel - Residual Granite.</td> </tr> <tr> <td>1,30</td> <td>2,50</td> <td>1,20</td> <td>Completely to highly weathered, olive brown, closely jointed, soft to medium hard rock, GRANITE / GNEISS - Halfway House Granite Suite.</td> </tr> </tbody> </table>	From:	To:	Thickness (m)	Description	0,00	0,60	0,60	Dry, dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.	0,60	1,30	0,70	Light brown, mottled orange brown, medium dense, silty, fine to medium SAND, with much angular fine gravel - Residual Granite.	1,30	2,50	1,20	Completely to highly weathered, olive brown, closely jointed, soft to medium hard rock, GRANITE / GNEISS - Halfway House Granite Suite.	Notes: 1) Slow groundwater seepage encountered at a depth of 2,50 m. 2) 2 x Bulk samples taken a depth of 0,60 m to 1,30 m.		
From:	To:	Thickness (m)	Description																
0,00	0,60	0,60	Dry, dark greyish brown, loose, slightly clayey, silty, fine to medium SAND - Colluvium.																
0,60	1,30	0,70	Light brown, mottled orange brown, medium dense, silty, fine to medium SAND, with much angular fine gravel - Residual Granite.																
1,30	2,50	1,20	Completely to highly weathered, olive brown, closely jointed, soft to medium hard rock, GRANITE / GNEISS - Halfway House Granite Suite.																

	Test Pit Profile	Test Pit No.
		Exp.3
6A, 39 Hilton Avenue, Hilton, 3245 Tel: +27 (0)33 3433915 e-mail: info@geozone.co.za		

Co-ordinates: x: y: Elevation: Co-ord System:	Job Description:	Diepsloot Sewer Pipe and Bridge Upgrade	
	Job No.:	15-052	
	Client:	Themba Infrastructure Consulting	
	Machine:	Machine Excavated	
	Logged by:	G. Davie	
	Date:	29-Sep-15	Sheet:

From:	To:	Thickness (m)	Description
0,00	0,30	0,30	Dry, dark greyish brown, loose, clayey, silty, fine to medium SAND - Colluvium.
0,30	1,10	0,80	Completely to highly weathered, olive brown, closely jointed, soft to medium hard rock, GRANITE / GNEISS - Halfway House Granite Suite.

Notes:

- 1) No groundwater encountered.
- 2) No sample taken.
- 3) Refusal on medium hard rock GRANITE at a depth of 1.10 m.

APPENDIX B

Laboratory Test Results

CLIENT : GeoZone GeoServices
ADDRESS : Suite H69
Private Bag X9118
Pietermaritzburg
Ulundi
KwaZulu Natal
3200
ATTENTION : Mr G. Davie
PROJECT : Diepsloot Pipeline

TEST REPORT REFERENCE NUMBER: 22019

Dear Sir/Madam,

Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

disclosed here-in, please find the original reports pertaining to the above mentioned project.

Date Received	15.09.2015		
Date Tested	17.09.2015 to 25.09.2015		
Sample Location	Refer to Report		
Sampling Method	N/A		
Sample Condition	Slightly Moist		
Sampling Environmental Condition	N/A		
Sampler(s) Name	Client		
Total Number of Pages	11		
Test Carried Out			
TMH1 Method A1 & A5		TMH1 Method C3	
TMH1 Method A2, A3, A4		TMH1 Method C4a	
TMH1 Method A7		TMH1 Method B6	
TMH1 Method A8, A9		Hydrometer Analysis - ASTM D422	
SABS 1200#		SANS 5863	
TMH1 Method A13T + A14app		SANS 5862-1	
TMH1 Method A15d		SANS 5860, 5861-1, 5861-2, 5861-3	
TMH1 Method A13T + A16T		TMH1 Method B9	
 - Tick denotes tests that were carried out. # - Denotes non-accredited tests.			

SABS 1200 – Compactibility Factor is not in our SANAS Schedule of Accreditation.

We would like to take this opportunity of thanking you for your continued support.

Should you have any queries please do not hesitate to contact me.

Yours faithfully

K. Veeran

Technical Signatory,

Kris Veeran for Geosure (Pty) Ltd.

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Head Office 122 Intersite Avenue, Umgeni Business Park, Durban 4091, South Africa PO Box 1461, Westville, 3630, South Africa Tel.: +27 (0)861 GEOSURE / 0861 436 7873 Fax: +27 (0)86 689 5506 Mobile: +27 (0)82 784 0544 E-mail: geosure@iafrica.com	Civil Engineering Laboratory 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, South Africa PO Box 1461, Westville, 3630, South Africa Tel: 031 701 9732 Fax: +27 (0) 86 684 9785 Mobile: 072 870 2621 E-mail: lab@geosure.co.za	Gauteng Branch P. O. Box 32381, Kyalami 1684 Tel.: 0861 GEOSURE / 0861 436 7873 Fax: 086 689 8327 Mobile: 083 377 6559 Email: gauteng@geosure.co.za

LABORATORY:	Reg. No. : 92/03145/07	HEAD OFFICE:
122 Intersite Avenue, Umgeni Business Park, Durban, 4091		122 Intersite Avenue, Umgeni Business Park,
P.O. Box 1461, Westville 3630		Durban, 4091, KwaZulu Natal, South Africa.
Mobile: +27(0)72 870 2621	Fax: 086 684 9785	Tel: +27 (0)31 266 0458 Fax: 086 689 5506
Tel.: +27 (0)31 701 9732	email: lab@geosure.co.za	email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
 Project : Diepsloot Pipeline
 Attention : Mr G. Davie

Your Ref No. : 15-052
 Our Ref No. : 22019
 Date Reported : 05/10/2015

Test Report

Sample No.	38652	38653	38654	38655	
Field No.	TP 3	TP 4	TP 5	TP 8	
Position	-	-	-	-	
Depth (m)	0.5-1.1	0.5-1.00	1.0-1.30	1.2	
Material Description	Yellowish brown completely to highly weathered very soft rock - GRANITE	Olive brown completely to highly weathered extremely soft rock - GRANITE with dark greyish brown slightly clayey Sand	Olive brown mottled orange brown completely to highly weathered extremely soft rock - GRANITE with clayey Sand	Light brown mottled orange brown silty fine to medium SAND with much angular fine gravel. Residual Granite	

Sieve Analysis (Wet Preparation) TMH1 - Method A1 (a) - Percent Passing Sieve Size					
Sieve Aperture (mm)	75.00				
	63.00				
	53.00			100	
	37.50			91	
	26.50			88	
	19.00	100	100	87	100
	13.20	98	99	85	99
	4.750	86	93	78	95
	2.000	66	79	67	78
	0.425	28	44	41	28
	0.075	13	24	21	12
Grading Modulus		1.93	1.53	1.71	1.83
Mechanical analysis - TMH1 - Method A5 - Percent of Soil Mortar (<2 mm) for Grain Size range					
Coarse Sand	2.000 - 0.425	58	45	40	65
Coarse-Fine Sand	0.425 - 0.250	11	11	13	12
Medium-Fine Sand	0.250 - 0.150	6	6	9	5
Fine-Fine Sand	0.150 - 0.075	6	7	8	4
Silt and Clay	< 0.075	19	31	31	15
Atterberg Limits TMH 1 - Methods A2, A3, A4 on <0.425 mm fraction					
Liquid Limit	% or symbol	28	35	28	29
Plasticity Index	% or symbol	7	16	10	8
Linear Shrinkage	%	3.5	8.0	5.0	4.0
Maximum Dry Density and Optimum Moisture Content - TMH1 - Method A7					
Maximum Dry Density (kg/m³)		1989	1971	2062	1995
Optimum moisture content (%)		7.8	9.4	7.7	8.5
California Bearing Ratio - TMH1 - Method A8					
CBR @100% Compaction	%	76	89	69	75
CBR @ 98% Compaction	%	58	59	57	60
CBR @ 97% Compaction	%	51	48	51	54
CBR @ 95% Compaction	%	38	32	40	43
CBR @ 93% Compaction	%	30	22	27	30
CBR @ 90% Compaction	%	21	13	15	16
Swell @100% Compaction	%	0.0	0.3	0.1	0.0
TRH 14 Classification (1985)**		G6	G8	G6	G6
AASHTO Classification (Group Index)**		A-2-4 (0)	A-2-6 (1)	A-2-4 (0)	A-2-4 (0)
Unified Classification **		SM-SC	SC	SC	SW-SC

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Remarks: *Subject to further testing as required by TRH14.

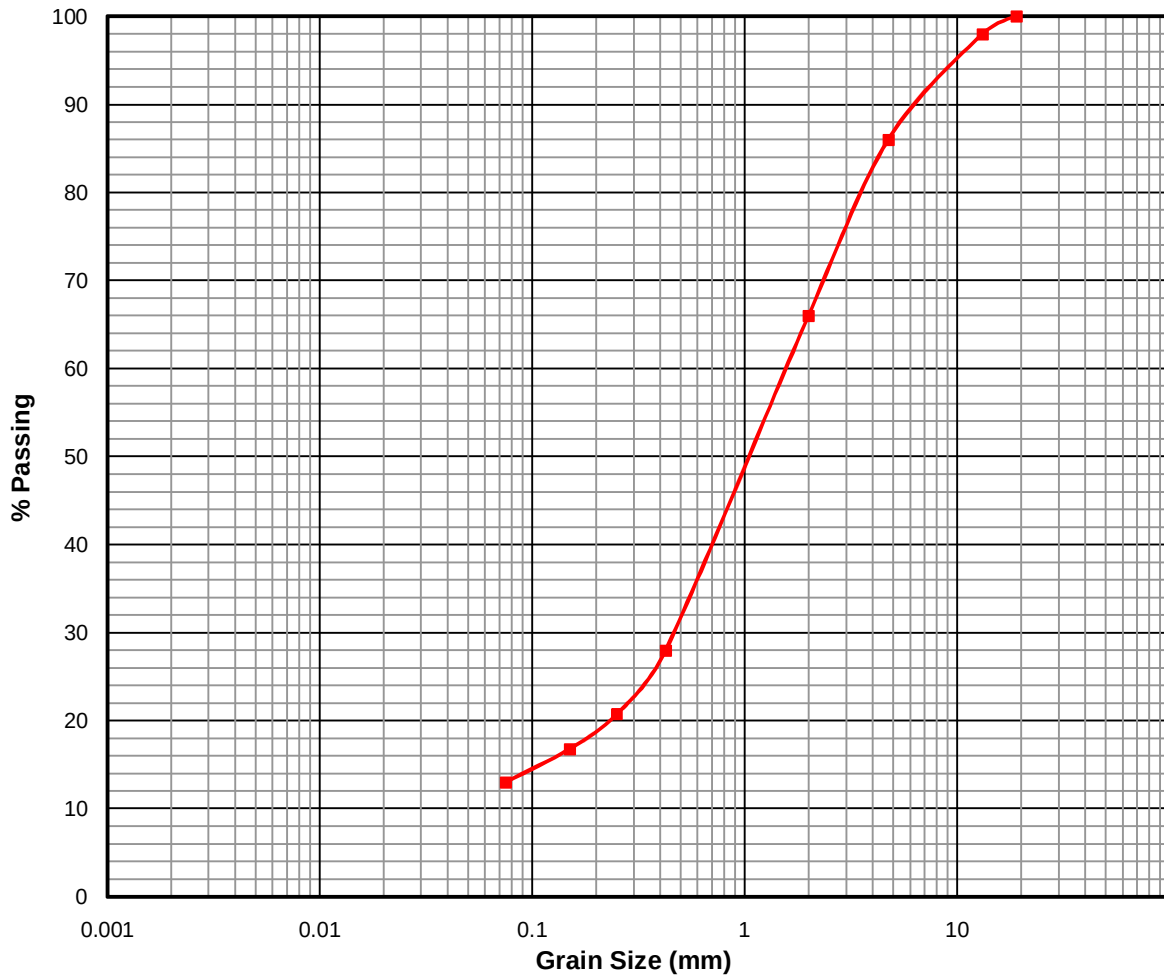
LABORATORY:
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Tel.: +27 (0)31 701 9732 email: lab@geosure.co.za

HEAD OFFICE:
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Durban, 4091, KwaZulu Natal, South Africa.
Tel: +27 (0)31 266 0458 Fax: 086 689 5506
email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No. : 22019
Date Reported : 05/10/2015

Grading Curve for Sample 38652 – TMH1 Method A1 (a)



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

Thick Red Line is the Grading Curve (TRH 14 Classification = G6)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	13%	17%	21%	28%	66%	86%	98%	100%					

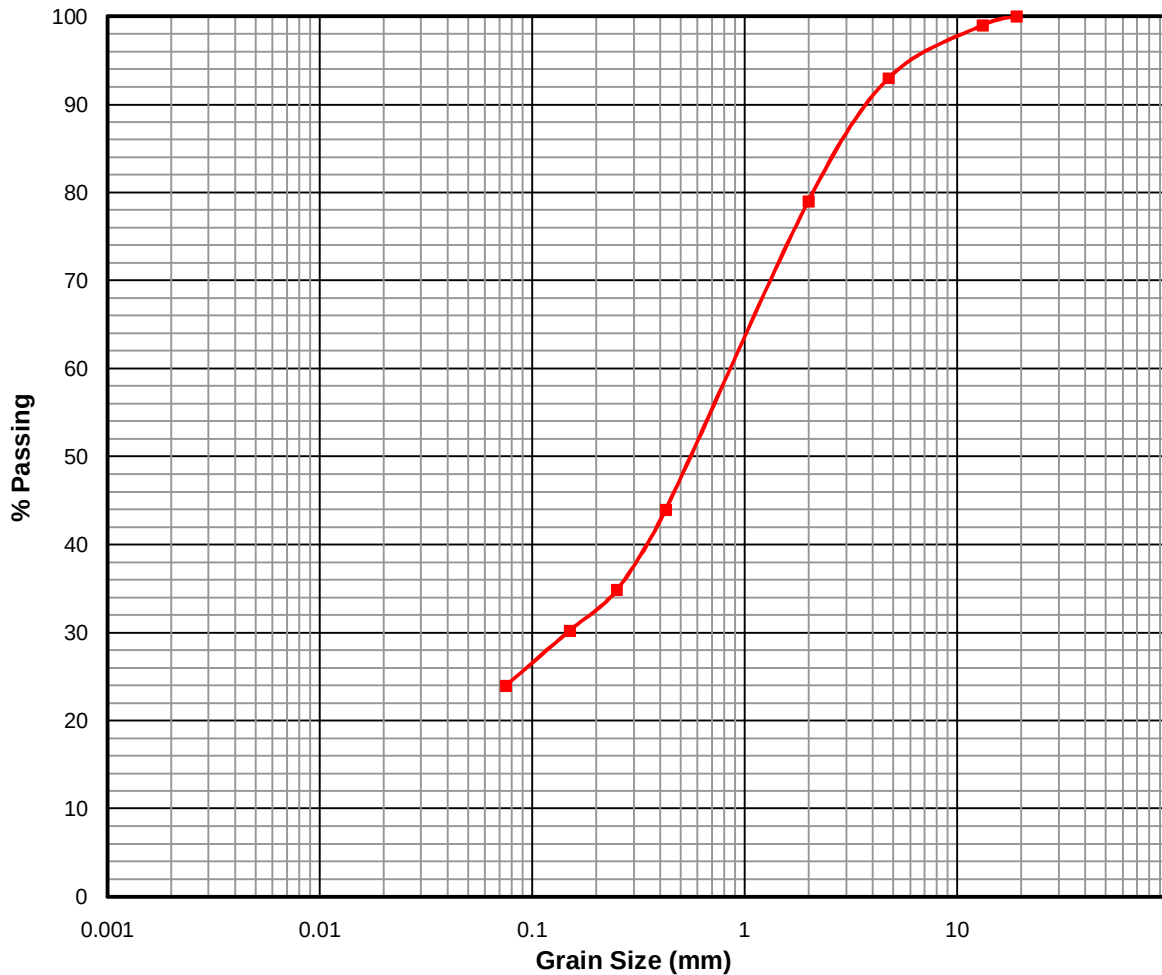
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 email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No. : 22019
Date Reported : 05/10/2015

Grading Curve for Sample 38653 – TMH1 Method A1 (a)



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

Thick Red Line is the Grading Curve (TRH 14 Classification = G8)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	24%	30%	35%	44%	79%	93%	99%	100%					

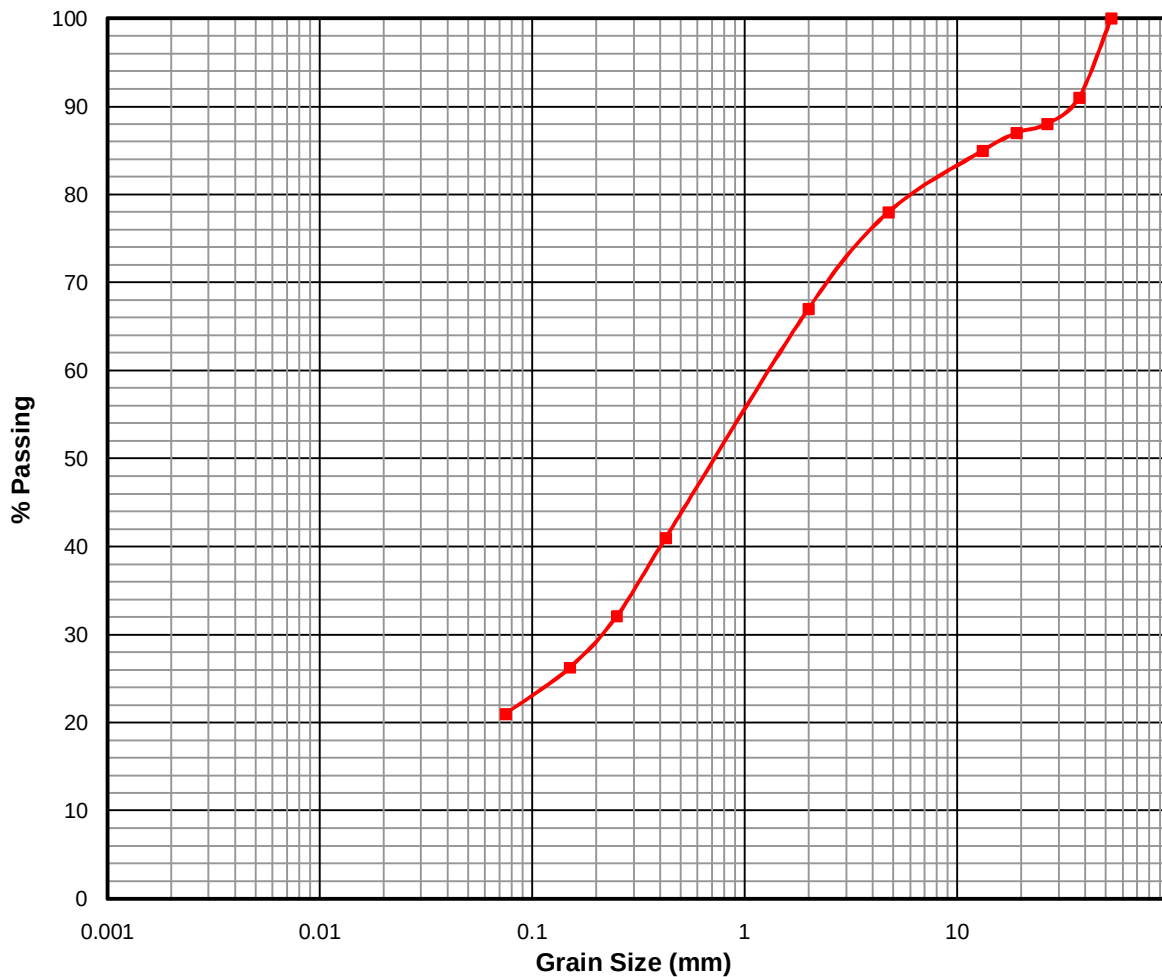
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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No. : 22019
Date Reported : 05/10/2015

Grading Curve for Sample 38654 – TMH1 Method A1 (a)



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

Thick Red Line is the Grading Curve (TRH 14 Classification = G6)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	21%	26%	32%	41%	67%	78%	85%	87%	88%	91%	100%		

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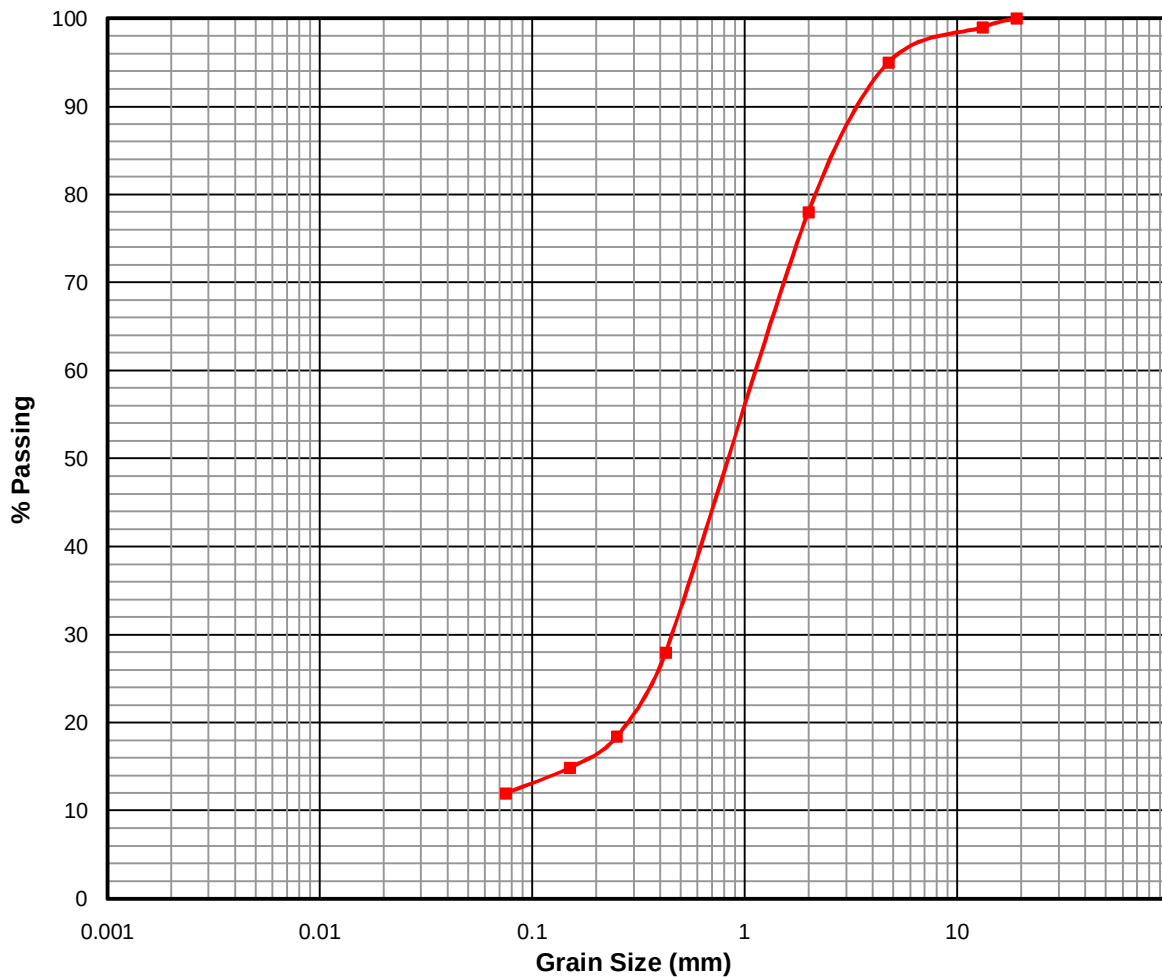
Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052

Our Ref No. : 22019

Date Reported : 05/10/2015

Grading Curve for Sample 38655 – TMH1 Method A1 (a)



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

Thick Red Line is the Grading Curve (TRH 14 Classification = G6)

Sieve Aperture Size
 Percentage Passing

0.075 0.150 0.250 0.425 2.00 4.75 13.2 19.0 26.5 37.5 53 63 75
 12% 15% 18% 28% 78% 95% 99% 100%

Reg.No.: 92/03145/07	
LABORATORY AND HEAD OFFICE ADDRESS:	122 Intersite Avenue, Umgeni Business Park, Durban, 4091
LABORATORY CONTACT INFO.:	Tel.: +27(0) 31 701 9732 Fax: 086 684 9785 Mobile: +27(0) 72 870 2621 e-mail: lab@geosure.co.za
HEAD OFFICE CONTACT INFO.:	Tel.: +27(0) 31 266 0458 Fax: 086 689 5506 Mobile: +27(0) 82 784 0544 e-mail: geosure@iafrica.com
WEBSITE:	www.geosure.co.za

Client : GeoZone GeoServices
 Project : Diepsloot Pipeline
 Attention : Mr G. Davie

Our Ref. : 22019
 Your Ref. : -
 Date Reported : 02.10.2015

TEST REPORT : COMPACTIBILITY FACTOR
(METHOD: SABS 1200)

Sample No.	Field No.	Depth (m)	Material Description	Position (Km)	Compactibility Factor
38652	TP 3	0.5-1.1	Yellowish brown completely to highly weathered very soft rock - GRANITE	-	0.26
38653	TP 4	0.5-1.0	Olive brown completely to highly weathered extremely soft rock - GRANITE with dark greyish brown slightly clayey Sand	-	0.32
38654	TP 5	1.0-1.3	Olive brown mottled orange brown completely to highly weathered extremely soft rock - GRANITE with clayey Sand	-	0.26
38655	TP 8	1.2	Light brown mottled orange brown silty fine to medium SAND with much angular fine gravel. Residual Granite	-	0.28
Remarks:	Date Received: 15.09.2015				
	Date Tested: 29.09.2015				
	Sampled by Client.				

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LABORATORY:

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 P.O. Box 1461, Westville 3630
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Fax: 086 684 9785
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HEAD OFFICE:

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 Durban, 4091, KwaZulu Natal, South Africa.
 Tel: +27 (0)31 266 0458 Fax: 086 689 5506
 email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

Sample No. : 38652

Field No. : TP 3

Natural/Stabilised : Natural

Depth (m) : 0.5-1.1

Material Description : Yell.Br.v.soft rock. GRANITE

Origin : -

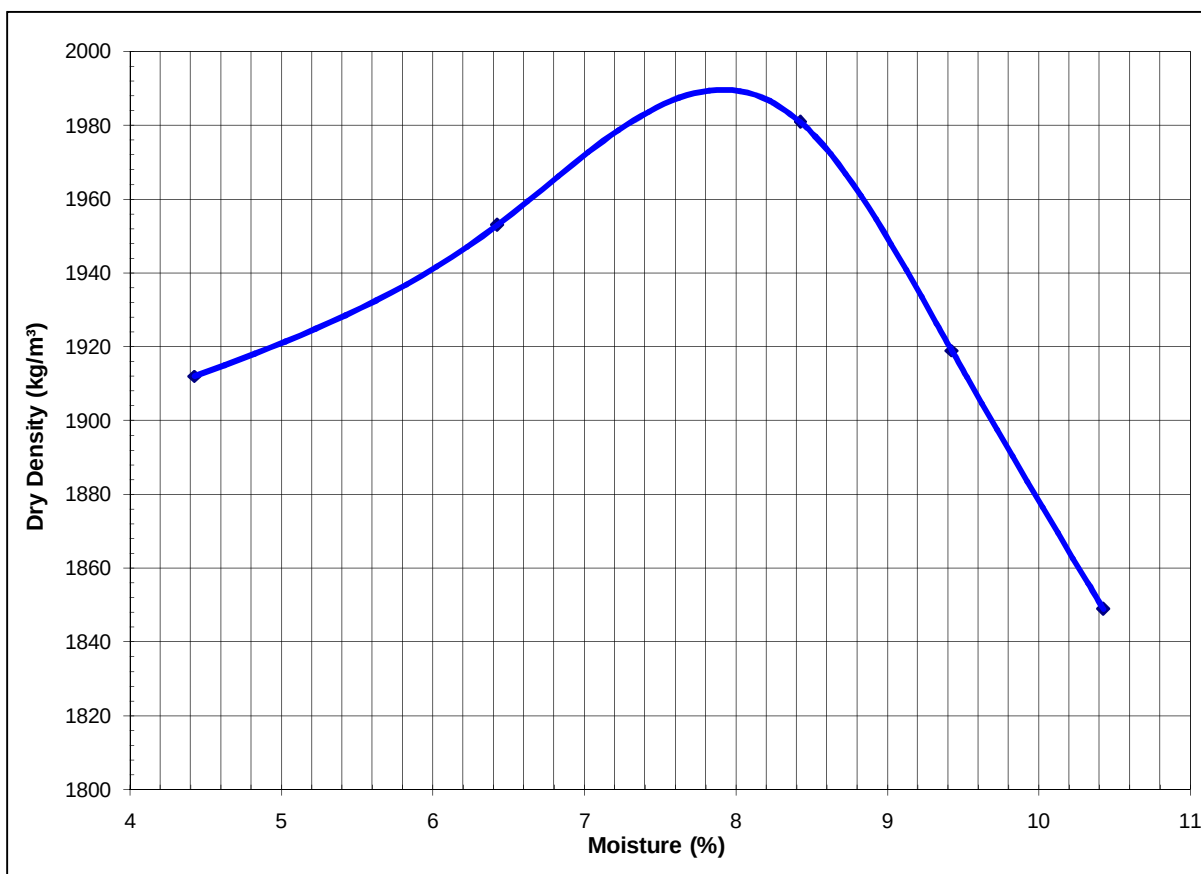
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) : 1989

Optimum Moisture Content (%) : 7.8

Plotted Values:

Moisture (%)	4.4	6.4	8.4	9.4	10.4
Dry Density (kg/m ³)	1912	1953	1981	1919	1849



Remarks: This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

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 Tel: +27 (0)31 266 0458 Fax: 086 689 5506
 email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

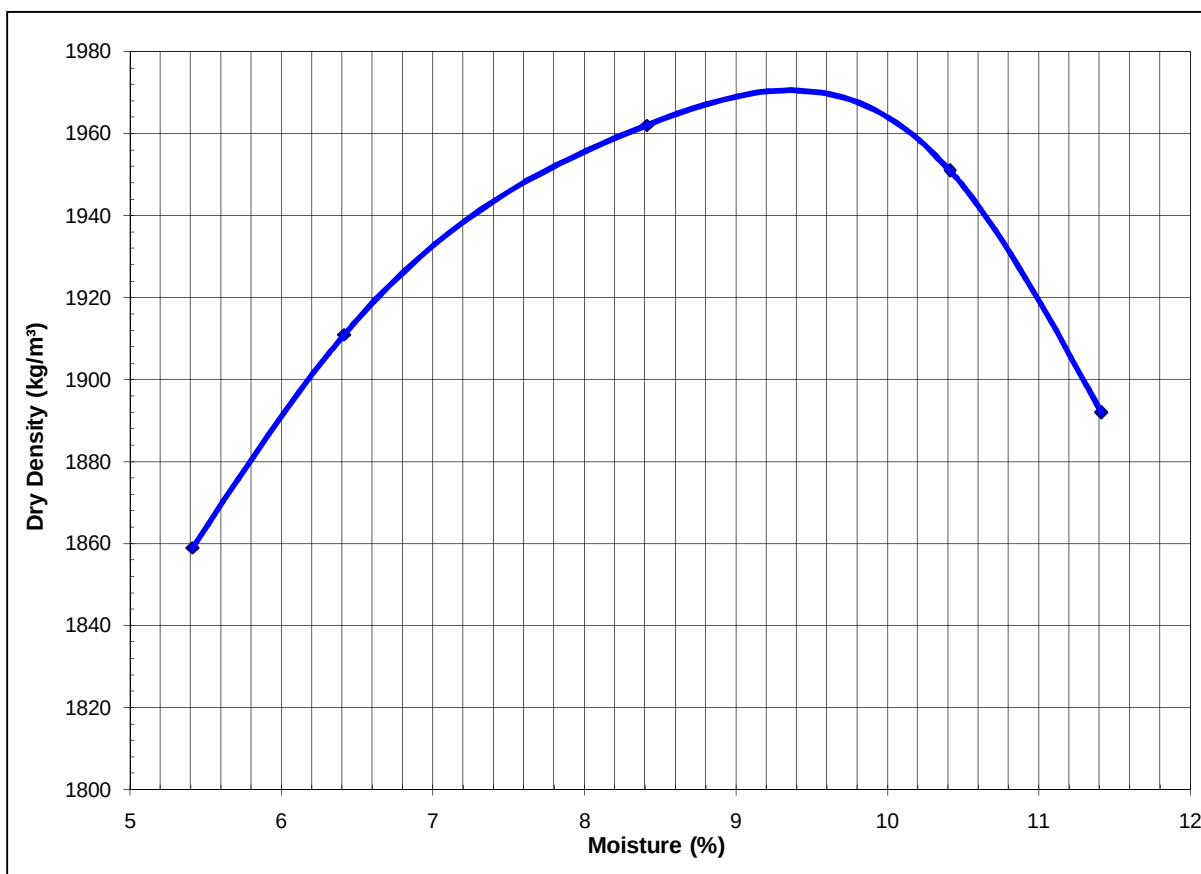
Sample No. : 38653 Field No. : TP 4
 Depth (m) : 0.5-1.0
 Natural/Stabilised : Natural Origin : -
 Material Description : Dk.Gr.Br.Sl.silty clayey SAND (completely to highly Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **1971**

Optimum Moisture Content (%) **9.4**

Plotted Values:

Moisture (%)	5.4	6.4	8.4	10.4	11.4
Dry Density (kg/m ³)	1859	1911	1962	1951	1892



Remarks: This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

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 Durban, 4091, KwaZulu Natal, South Africa.
 Tel: +27 (0)31 266 0458 Fax: 086 689 5506
 email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

Sample No. : 38654
Natural/Stabilised : Natural
Material Description : Ol.Br.Mot.Or.Br.ext. soft rock. GRANITE

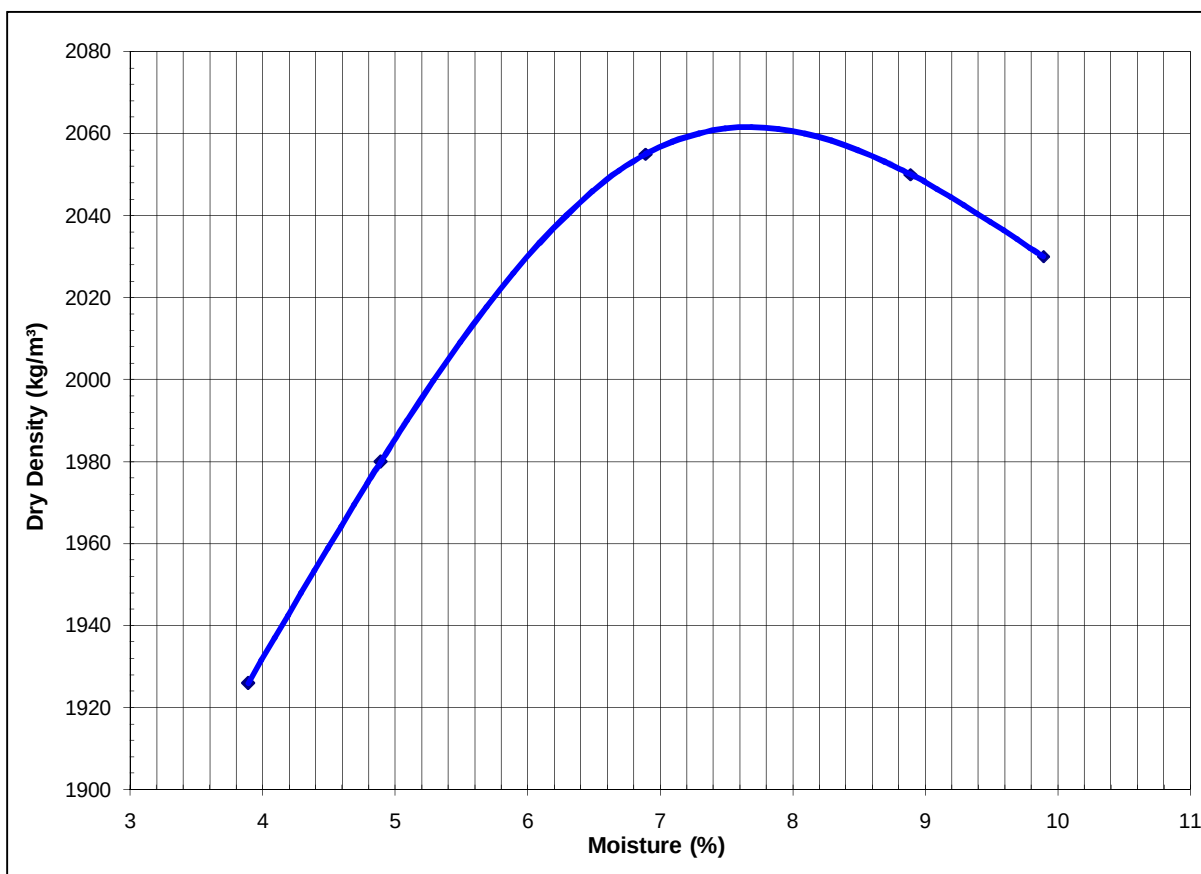
Field No. : TP 5
Depth (m) : 1.0-1.3
Origin : -
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) : 2062

Optimum Moisture Content (%) : 7.7

Plotted Values:

Moisture (%)	3.9	4.9	6.9	8.9	9.9
Dry Density (kg/m ³)	1926	1980	2055	2050	2030



Remarks: This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

LABORATORY:

Reg. No. : 92/03145/07
 122 Intersite Avenue, Umgeni Business Park, Durban, 4091
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 Mobile: +27(0)72 870 2621
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HEAD OFFICE:

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 Durban, 4091, KwaZulu Natal, South Africa.
 Tel: +27 (0)31 266 0458 Fax: 086 689 5506
 email: geosure@iafrica.com www.geosure.co.za

Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

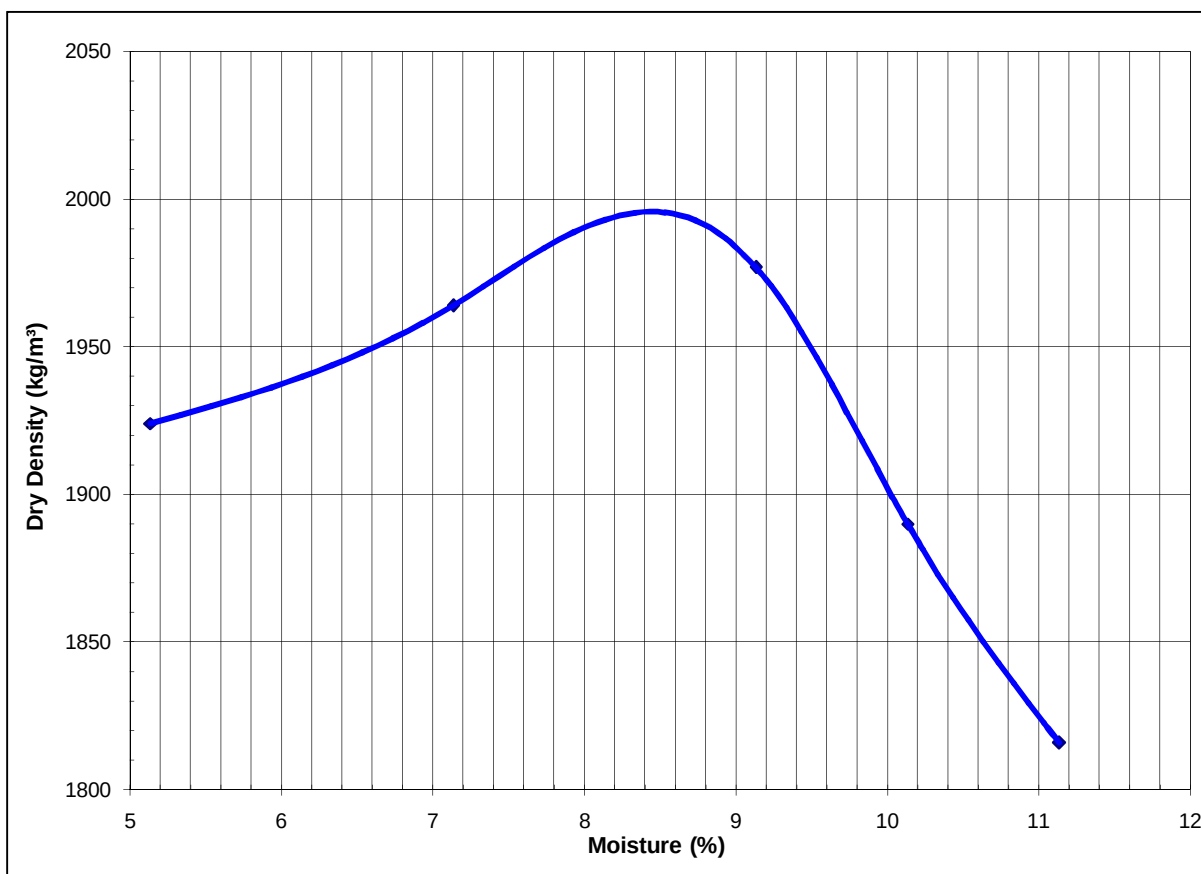
Sample No. : 38655 Field No. : TP 8
 Depth (m) :
 Natural/Stabilised : Natural Origin : -
 Material Description : Lt.Br.Mot.Or.Br.silty fine to med. SAND with gravel. Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) 1995

Optimum Moisture Content (%) 8.5

Plotted Values:

Moisture (%)	5.1	7.1	9.1	10.1	11.1
Dry Density (kg/m ³)	1924	1964	1977	1890	1816



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CLIENT : GeoZone GeoServices
 ADDRESS : Suite H69
 Private Bag X9118
 Pietermaritzburg
 Ulundi
 KwaZulu Natal
 3200
 ATTENTION : Mr G. Davie
 PROJECT : Diepsloot Pipeline

TEST REPORT REFERENCE NUMBER: 22019

Dear Sir/Madam,

Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

Enclosed herewith, please find the original reports pertaining to the above mentioned project.

Date Received	15.09.2015		
Date Tested	17.09.2015 to 25.09.2015		
Sample Location	Refer to Report		
Sampling Method	N/A		
Sample Condition	Slightly Moist		
Sampling Environmental Condition	N/A		
Sampler(s) Name	Client		
Total Number of Pages	11		
Test Carried Out			
TMH1 Method A1 & A5	☒	TMH1 Method C3	
TMH1 Method A2, A3, A4	☒	TMH1 Method C4a	
TMH1 Method A7	☒	TMH1 Method B6	
TMH1 Method A8, A9	☒	Hydrometer Analysis - ASTM D422	
SABS 1200#	☒	SANS 5863	
TMH1 Method A13T + A14app		SANS 5862-1	
TMH1 Method A15d		SANS 5860, 5861-1, 5861-2, 5861-3	
TMH1 Method A13T + A16T		TMH1 Method B9	
☒ - Tick denotes tests that were carried out. # - Denotes non-accredited tests.			

SABS 1200 – Compactibility Factor is not in our SANAS Schedule of Accreditation.

We would like to take this opportunity of thanking you for your continued support.

Should you have any queries please do not hesitate to contact me.

Yours faithfully



Technical Signatory,

Kris Veeran for Geosure (Pty) Ltd.

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Client	: GeoZone GeoServices	Your Ref No. : 15-052
Project	: Diepsloot Pipeline	Our Ref No. : 22019
Attention	: Mr G. Davie	Date Reported : 05/10/2015

Test Report

Sample No.	38652	38653	38654	38655	
Field No.	TP 3	TP 4	TP 5	TP 8	
Position	-	-	-	-	
Depth (m)	0.5-1.1	0.5-1.00	1.0-1.30	1.2	
Material Description	Yellowish brown completely to highly weathered very soft rock - GRANITE	Olive brown completely to highly weathered extremely soft rock - GRANITE with dark greyish brown slightly clayey Sand	Olive brown mottled orange brown completely to highly weathered extremely soft rock - GRANITE with clayey Sand	Light brown mottled orange brown silty fine to medium SAND with much angular fine gravel. Residual Granite	

Sieve Analysis (Wet Preparation) TMH1 - Method A1 (a) - Percent Passing Sieve Size						
Sieve Aperture (mm)	75.00					
	63.00					
	53.00			100		
	37.50			91		
	26.50			88		
	19.00	100	100	87	100	
	13.20	98	99	85	99	
	4.750	86	93	78	95	
	2.000	66	79	67	78	
	0.425	28	44	41	28	
	0.075	13	24	21	12	
Grading Modulus		1.93	1.53	1.71	1.83	
Mechanical analysis - TMH1 - Method A5 - Percent of Soil Mortar (<2 mm) for Grain Size range						
Coarse Sand	2.000 - 0.425	58	45	40	65	
Coarse-Fine Sand	0.425 - 0.250	11	11	13	12	
Medium-Fine Sand	0.250 - 0.150	6	6	9	5	
Fine-Fine Sand	0.150 - 0.075	6	7	8	4	
Silt and Clay	< 0.075	19	31	31	15	
Atterberg Limits TMH 1 - Methods A2, A3, A4 on <0.425 mm fraction						
Liquid Limit	% or symbol	28	35	28	29	
Plasticity Index	% or symbol	7	16	10	8	
Linear Shrinkage	%	3.5	8.0	5.0	4.0	
Maximum Dry Density and Optimum Moisture Content - TMH1 - Method A7						
Maximum Dry Density (kg/m³)		1989	1971	2062	1995	
Optimum moisture content (%)		7.8	9.4	7.7	8.5	
California Bearing Ratio - TMH1 - Method A8						
CBR @100% Compaction	%	76	89	69	75	
CBR @ 98% Compaction	%	58	59	57	60	
CBR @ 97% Compaction	%	51	48	51	54	
CBR @ 95% Compaction	%	38	32	40	43	
CBR @ 93% Compaction	%	30	22	27	30	
CBR @ 90% Compaction	%	21	13	15	16	
Swell @100% Compaction	%	0.0	0.3	0.1	0.0	
TRH 14 Classification (1985)**		G6	G8	G6	G6	
AASHTO Classification (Group Index)**		A-2-4 (0)	A-2-6 (1)	A-2-4 (0)	A-2-4 (0)	
Unified Classification **		SM-SC	SC	SC	SW-SC	

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Remarks: ***Subject to further testing as required by TRH14.**

** Opinions and interpretations expressed herein are outside the scope of SANAS accreditation
 Version 4.02 - 24 March 2014

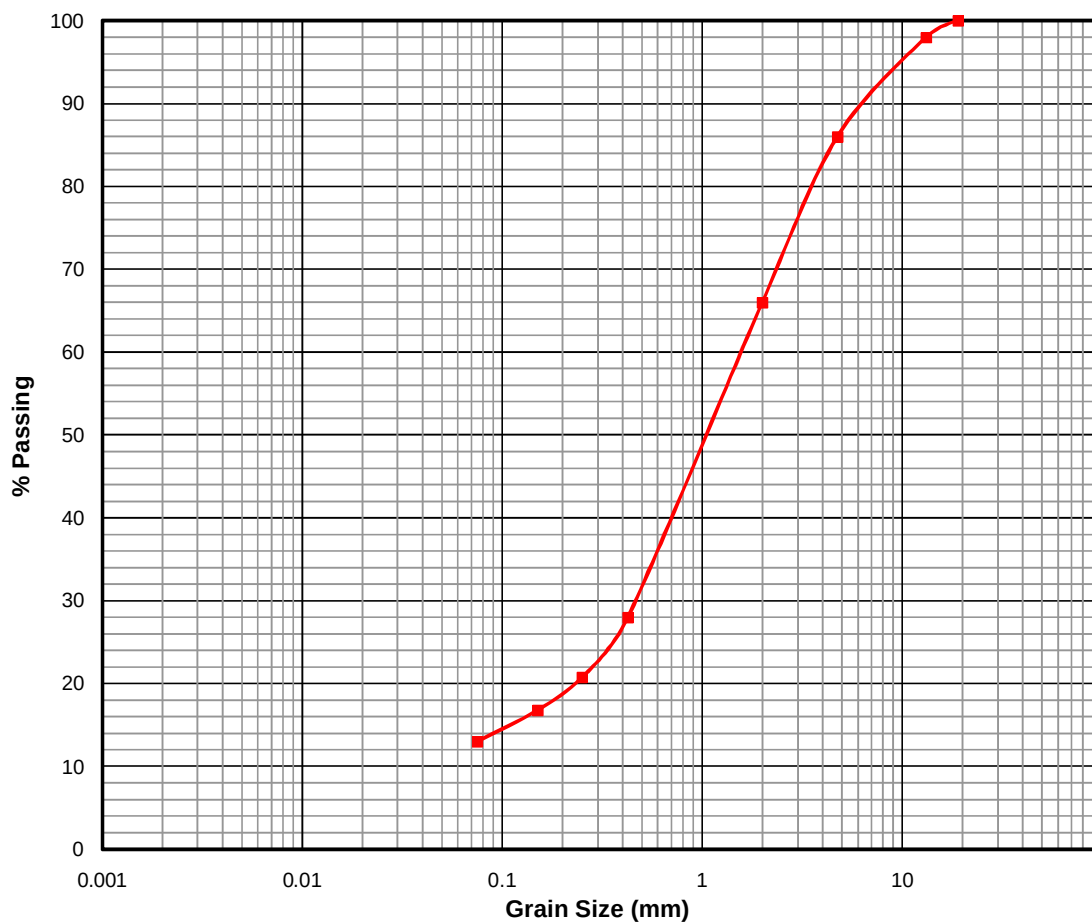
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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No.: 22019
Date Reported: 05/10/2015

Grading Curve for Sample 38652 – TMH1 Method A1 (a)



Thick Red Line is the Grading Curve (TRH 14 Classification = G6)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	13%	17%	21%	28%	66%	86%	98%	100%					

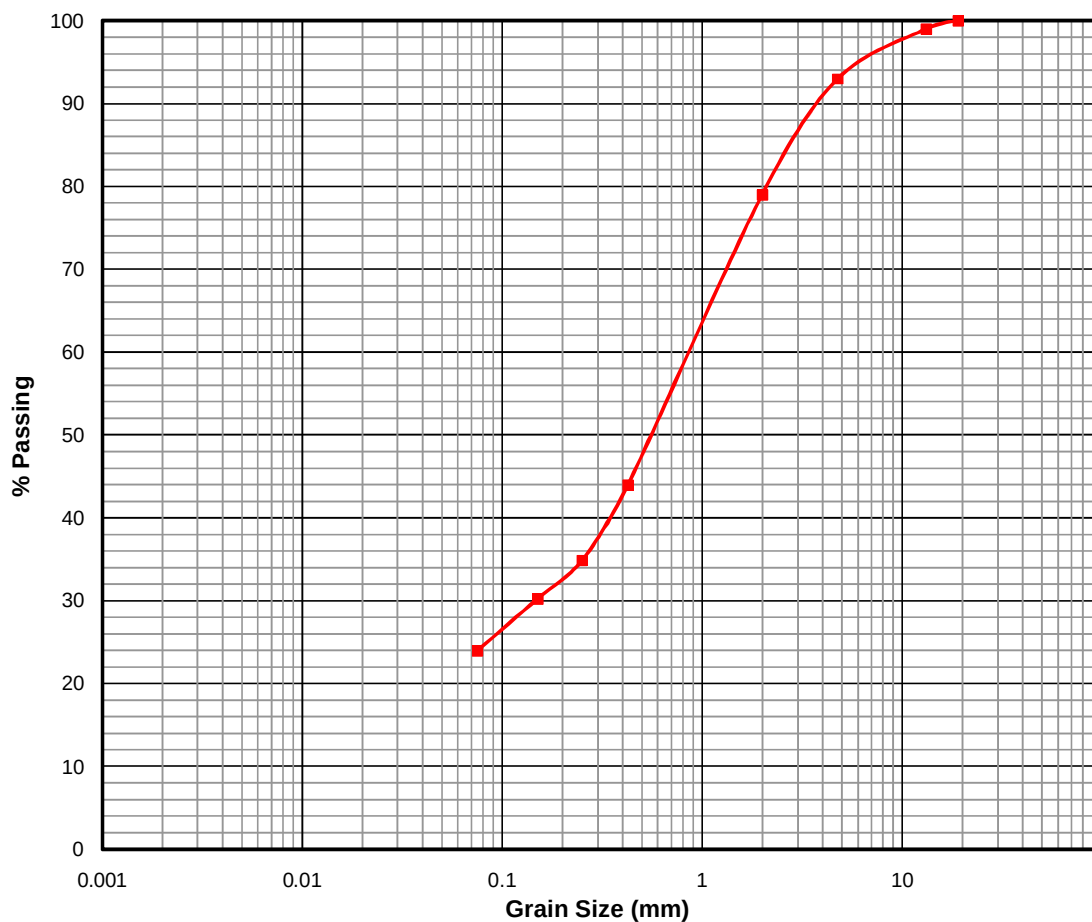
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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No.: 22019
Date Reported : 05/10/2015

Grading Curve for Sample 38653 – TMH1 Method A1 (a)



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

Thick Red Line is the Grading Curve (TRH 14 Classification = G8)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	24%	30%	35%	44%	79%	93%	99%	100%					

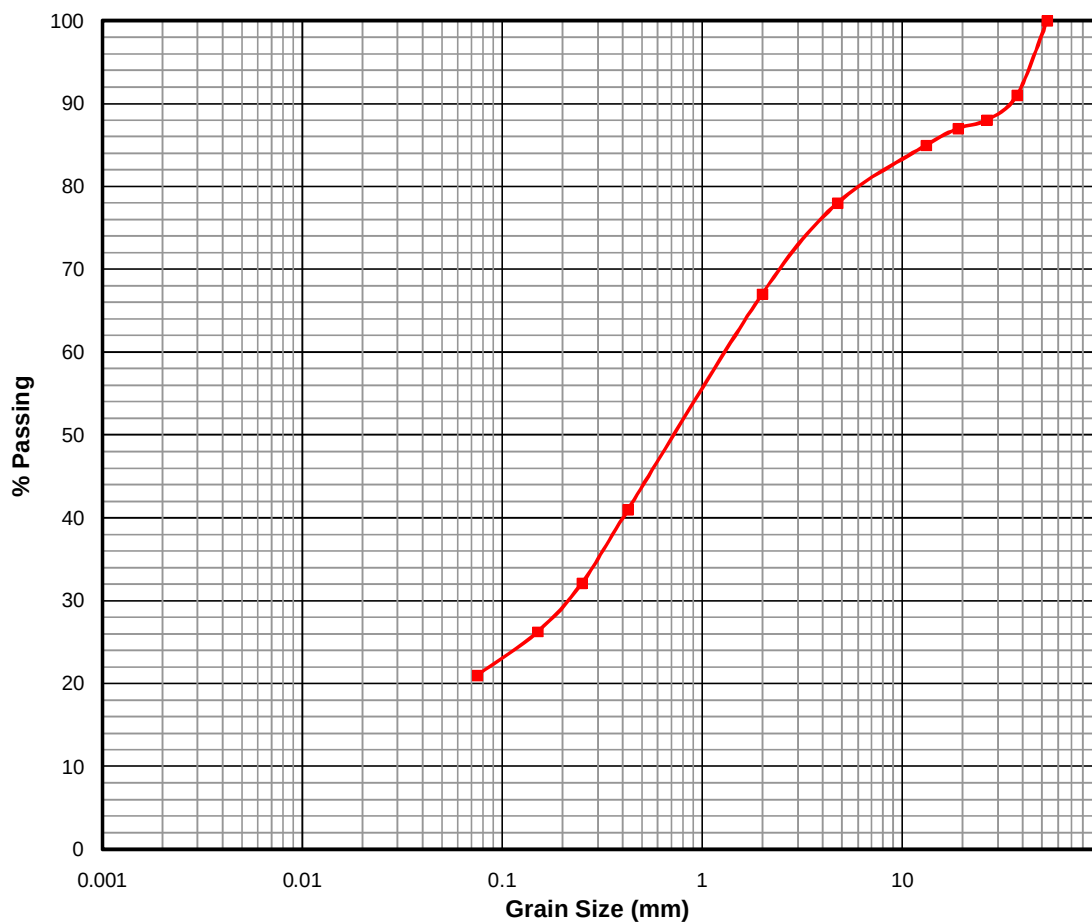
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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No.: 22019
Date Reported: 05/10/2015

Grading Curve for Sample 38654 – TMH1 Method A1 (a)



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

Thick Red Line is the Grading Curve (TRH 14 Classification = G6)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	21%	26%	32%	41%	67%	78%	85%	87%	88%	91%	100%		

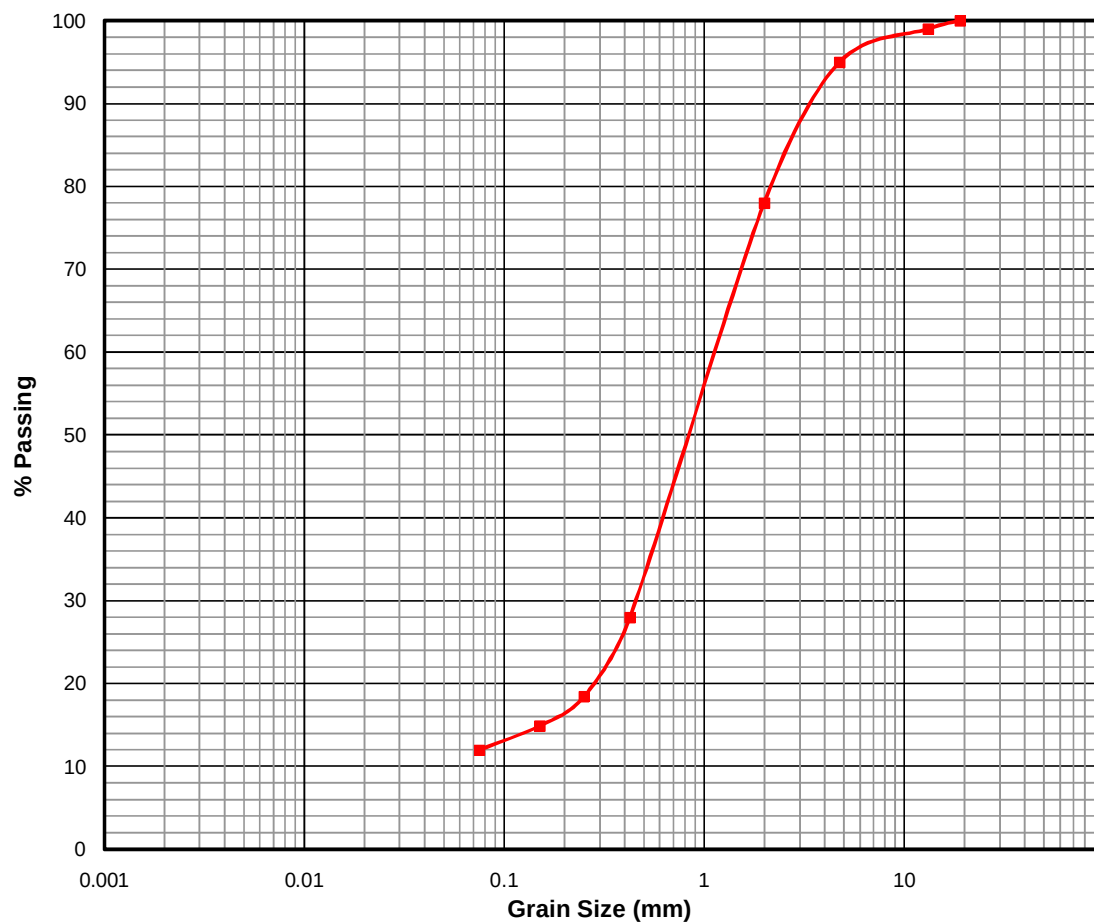
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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No.: 15-052
Our Ref No.: 22019
Date Reported: 05/10/2015

Grading Curve for Sample 38655 – TMH1 Method A1 (a)



Thick Red Line is the Grading Curve (TRH 14 Classification = G6)

Sieve Aperture Size	0.075 0.150 0.250 0.425 2.00 4.75 13.2 19.0 26.5 37.5 53 63 75
Percentage Passing	12% 15% 18% 28% 78% 95% 99% 100%



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WEBSITE:	www.geosure.co.za

Client : GeoZone GeoServices Our Ref. : 22019
 Project : Diepsloot Pipeline Your Ref. : -
 Attention : Mr G. Davie Date Reported : 02.10.2015

TEST REPORT : COMPACTIBILITY FACTOR
(METHOD: SABS 1200)

Sample No.	Field No.	Depth (m)	Material Description	Position (Km)	Compactibility Factor
38652	TP 3	0.5-1.1	Yellowish brown completely to highly weathered very soft rock - GRANITE	-	0.26
38653	TP 4	0.5-1.0	Olive brown completely to highly weathered extremely soft rock - GRANITE with dark greyish brown slightly clayey Sand	-	0.32
38654	TP 5	1.0-1.3	Olive brown mottled orange brown completely to highly weathered extremely soft rock - GRANITE with clayey Sand	-	0.26
38655	TP 8	1.2	Light brown mottled orange brown silty fine to medium SAND with much angular fine gravel. Residual Granite	-	0.28
Remarks:					
Date Received: 15.09.2015					
Date Tested: 29.09.2015					
Sampled by Client.					

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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

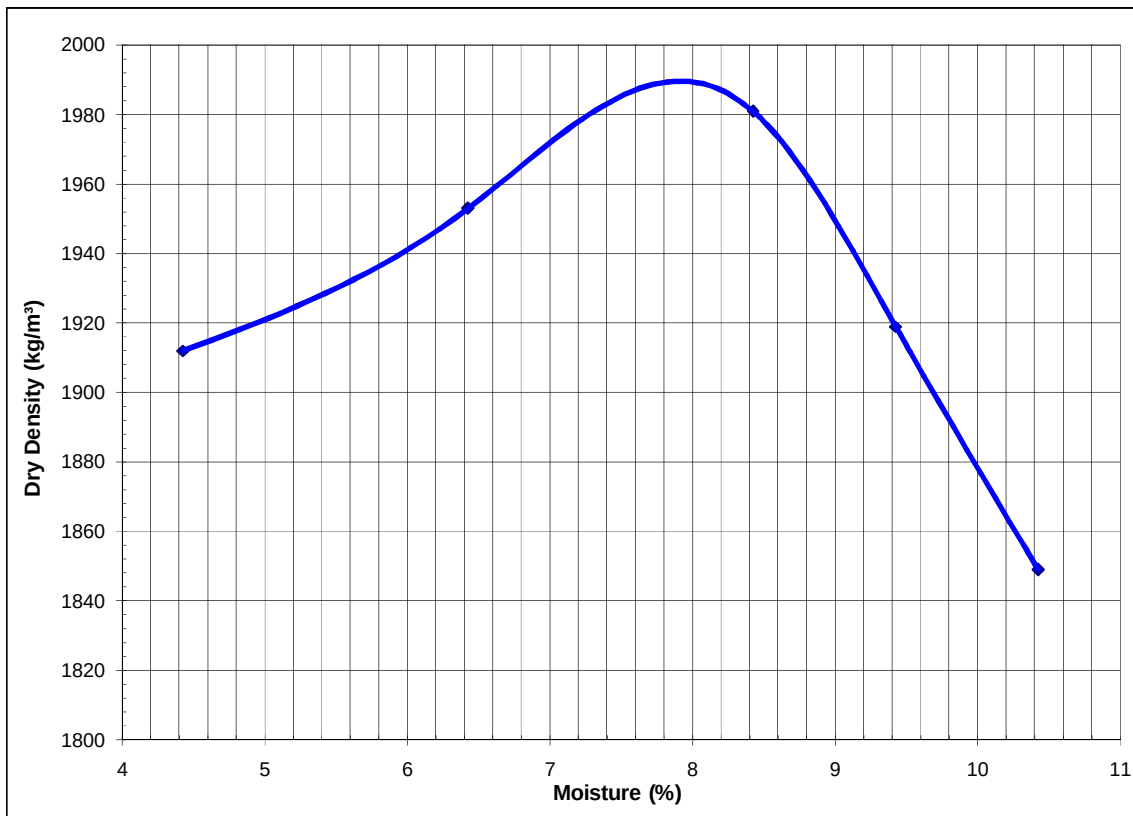
Sample No. : 38652	Field No. : TP 3
Natural/Stabilised : Natural	Depth (m) : 0.5-1.1
Material Description : Yell.Br.v.soft rock. GRANITE	Origin : -
	Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **1989**

Optimum Moisture Content (%) **7.8**

Plotted Values:

Moisture (%)	4.4	6.4	8.4	9.4	10.4
Dry Density (kg/m ³)	1912	1953	1981	1919	1849



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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

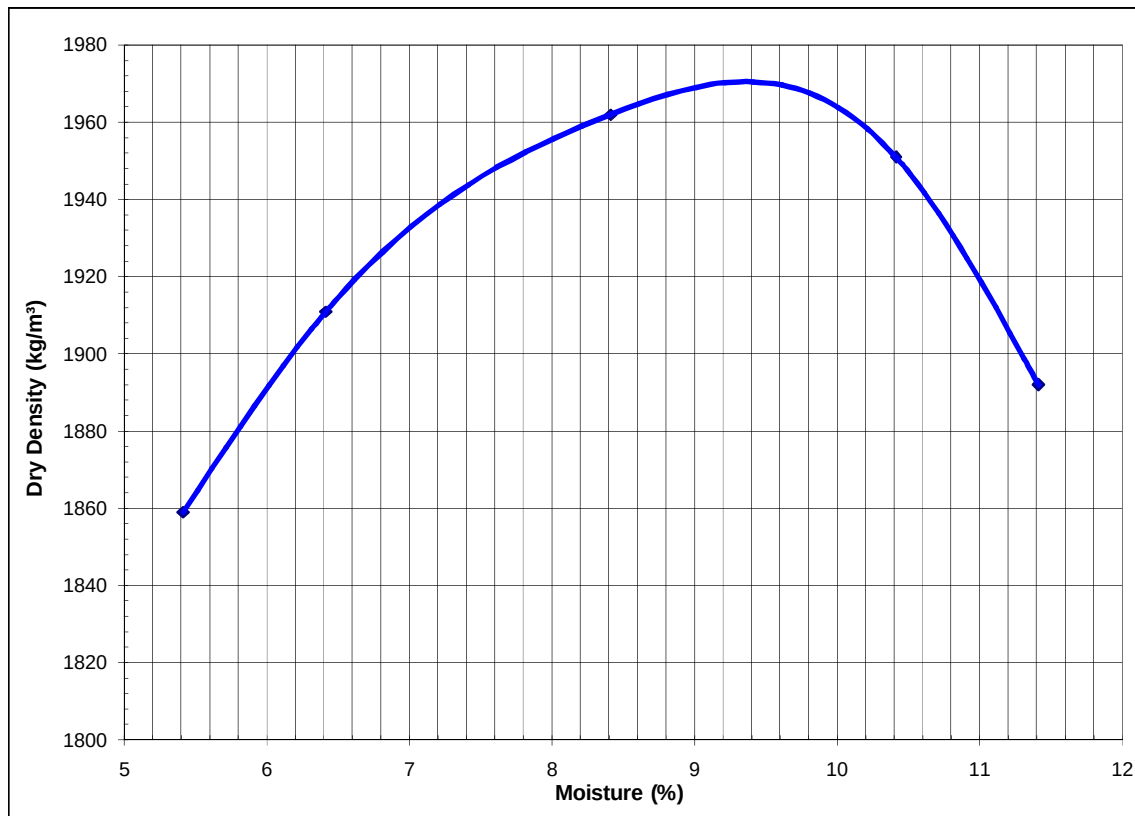
Sample No.	: 38653	Field No.	: TP 4
Natural/Stabilised	: Natural	Depth (m)	: 0.5-1.0
Material Description	: Dk.Gr.Br.Sl.silty clayey SAND (completely to highly	Origin	: -
	Compaction Effort	: Mod AASHTO	

Maximum Dry Density (kg/m³) **1971**

Optimum Moisture Content (%) **9.4**

Plotted Values:

Moisture (%)	5.4	6.4	8.4	10.4	11.4
Dry Density (kg/m ³)	1859	1911	1962	1951	1892



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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

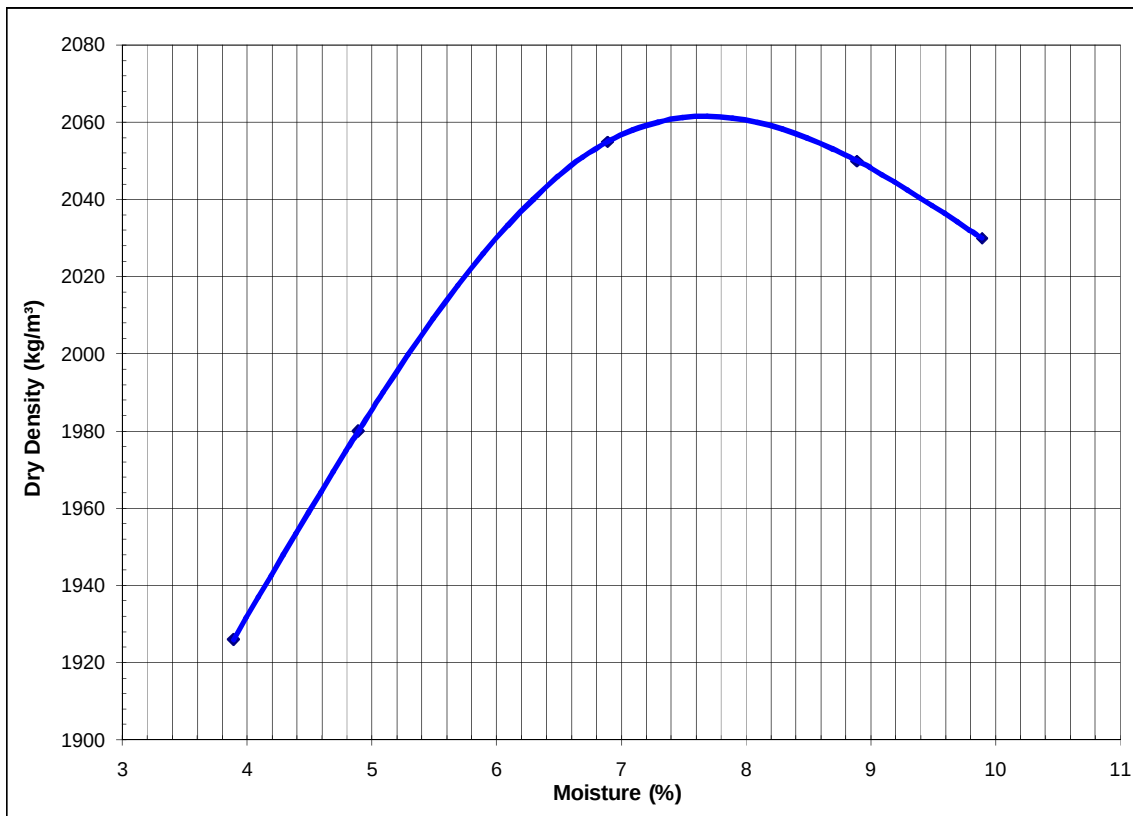
Sample No. : 38654	Field No. : TP 5
Natural/Stabilised : Natural	Depth (m) : 1.0-1.3
Material Description : Ol.Br.Mot.Or.Br.ext. soft rock. GRANITE	Origin : -
	Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **2062**

Optimum Moisture Content (%) **7.7**

Plotted Values:

Moisture (%)	3.9	4.9	6.9	8.9	9.9
Dry Density (kg/m ³)	1926	1980	2055	2050	2030



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Client : GeoZone GeoServices
Project : Diepsloot Pipeline
Attention : Mr G. Davie

Your Ref No. : 15-052
Our Ref No. : 22019
Date Reported : 19.09.2015

Moisture/Density Relationship (TMH1: Method A7)

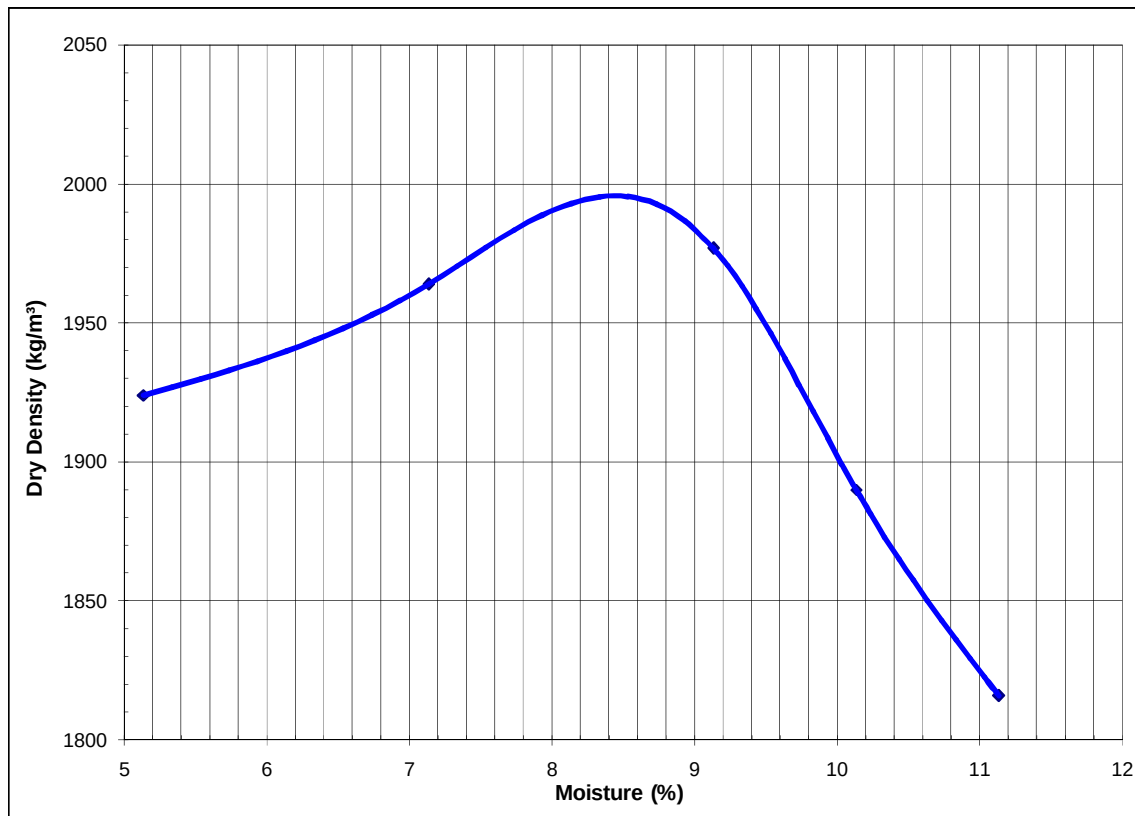
Sample No. : 38655 Field No. : TP 8
 Natural/Stabilised : Natural Depth (m) :
 Material Description : Lt.Br.Mot.Or.Br.silty fine to med. SAND with gravel. Origin : -
 Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) 1995

Optimum Moisture Content (%) 8.5

Plotted Values:

Moisture (%)	5.1	7.1	9.1	10.1	11.1
Dry Density (kg/m ³)	1924	1964	1977	1890	1816



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Email: info.dbn@alsglobal.com
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Reference №: ALSD 6789

Date: 23 September 2015

CERTIFICATE OF ANALYSIS

Report On: 4 (Four) Samples I.D.: Sand
Date & Time Received: 18/09/15 – 08:00 Taken By: Yourselves
Date & Time Analysis Started: 21/09/15 – 10:00 From: PV Naidoo
Date & Time Analysis Finished: 22/09/15 – 14:55 Ref №: Diepsloot Pipeline
MARKED: **AS BELOW.**

Analysis on an as received basis:

The analysis was conducted on a 1:10 slurry and the following results are based on the leachate:

	1. TP 3 0.5 – 1.1	2. TP 4 0.5 – 1.0	3. TP 5 1.0 – 1.3	4. TP 8 1.2
pH, @ 25°C [pH Meter]	6.8	7.0	6.7	6.8
Electrical Conductivity, @ 25 °C, mS/m [Conductivity Meter]	9.8	7.8	2.6	2.0

Technical Signatory: Chemistry _____
Mr P. Ramdeen

Microbiology _____
Ms N. Kassim

Management Signatory: _____
Mr P. Ramdeen

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3630