LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

CONTRACT DOCUMENT

FOR

CONTRACT NO: **T60/2021**

FOR

CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

(RETURNABLE DOCUMENT)

- The Form Of Offer and Acceptance (C1.1) is on C1-Page 1 of this document
- The Preferencing Schedule is on T2-Pages 34 - 40 of this document

TENDERER	
CONTACT PERSON	
TEL NO.	
FAX NO.	
TENDER AMOUNT	
COMPLETION PERIOD (WEEKS)	

VOLUME 1: RETURNABLE DOCUMENT : CIVIL AND STRUCTURAL WORKS

ISSUED BY:

LANGEBERG MUNICIPAL OFFICES
28 MAIN ROAD
ASHTON,
6715

PART A
INVITATION TO BID

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE LANGEBERG MUNICIPALITY					
Bid Number:	T60/2021	**Closing Date:**	3 December 2021	**Closing Time:**	12:00
Description:	CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK				

THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM MBD7 (FORM OF OFFER AND ACCEPTANCE).

Bid Response Documents may be Deposited in the Bid Box situated at:

MUNICIPAL HEAD OFFICE
28 Main Road
ASHTON
6715

SUPPLIER INFORMATION				
NAME OF BIDDER				
POSTAL ADDRESS				
STREET ADDRESS				
TELEPHONE NUMBER	CODE		NUMBER	
CELLPHONE NUMBER				
FACSIMILE NUMBER	CODE		NUMBER	
E-MAIL ADDRESS				
VAT REGISTRATION NUMBER				
TAX COMPLIANCE STATUS	TCS PIN:		**AND** CSD No:	
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE [TICK APPLICABLE BOX]	☐ Yes ☐ No			

[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES & QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]

1. ARE YOU THE ACCREDITED REPRESENTATIVE **IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?**	☐Yes ☐No [IF YES ENCLOSE PROOF]	**2.** ARE YOU A FOREIGN BASED SUPPLIER FOR **THE GOODS /SERVICES /WORKS OFFERED?**	☐Yes ☐No [IF YES, ANSWER PART B:3]
3. TOTAL NUMBER OF ITEMS OFFERED		**4. TOTAL BID PRICE**	**R**
5. SIGNATURE OF BIDDER	……	**6. DATE**	
7. CAPACITY UNDER WHICH THIS BID IS SIGNED			

BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		**TECHNICAL INFORMATION MAY BE DIRECTED TO:**	
DEPARTMENT	**SCM**	CONTACT PERSON	**MAYNARD JOHNSON**
CONTACT PERSON	**Sabelo Ngcongolo**	TELEPHONE NUMBER	**023 615 8000**
TELEPHONE NUMBER	**023 615 8000**	FACSIMILE NUMBER	**023 615 2428**
FACSIMILE NUMBER	**023 615 2428**	E-MAIL ADDRESS	**mjohnson@langeberg.gov.za**
E-MAIL ADDRESS	**sngcongolo@langeberg.gov.za**		

PART B
TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:

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

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

1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, 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. NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.

SIGNATURE OF BIDDER: ……

CAPACITY UNDER WHICH THIS BID IS SIGNED: ……

LANGEBERG MUNICIPALITY

TENDER NO. T60/2021

CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

GENERAL TENDER INFORMATION

TENDER ADVERTISED	:	29 October 2021
ESTIMATED CIDB CONTRACTOR GRADING	:	6CE or Higher
CLARIFICATION MEETING	:	A compulsory clarification meeting to be held on 11 November 2021 at 10:00.
VENUE FOR CLARIFICATION MEETING	:	Muncipal offices, 52 Church Street, Robertson
CLOSING DATE	:	03 December 2021
CLOSING TIME	:	12:00
CLOSING VENUE	:	**Tender Box** at the Municipal Office, 28 Main Road, Ashton, 6715.
VALIDITY PERIOD OF TENDER	:	120 days
TENDER BOX	:	The Tender Documents (which includes the Form of Offer and Acceptance) completed in all respects, plus any additional supporting documentation required, must be submitted in a sealed envelope with the name and address of the tenderer, the tender No. and title and the closing date indicated on the envelope. The sealed envelope must be inserted into the appropriate official tender box before closing time. The onus remains with the tenderer to ensure that the tender is placed in the correct tender box.

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C6	Drawings

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Part T1: Tendering procedures

T1.1 Tender Notice and Invitation to Tender

T1.2 Tender Data

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INVITATION FOR TENDERS

TENDER NUMBER: T60/2021

DESCRIPTION : CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK
CLOSING DATE : 3 December 2021
CLOSING TIME : 12H00: Bids will be opened in public at 28 Main Road, Ashton.

CIDB : Tenderers must be registered with the CIDB in a **CE** class of construction works and have a grading designation equal to or higher than that determined in accordance with the sum tendered or a value determined in accordance with regulation 25(7A) of the Construction Industry Development Regulations, 2004. It is estimated that tenderers will need a grading designation of **6CE or higher**.

INFORMATION : **Obtain documentation:**
Langeberg Municipality
23 Faure Street
Ashton
6715

Enquiries regarding tender documentation:
Maynard Johnson
023 615 8000
023 615 2428
mjohnson@langeberg.gov.za

Office hours for collection:
08h00 – 16h30 as from 29 October 2021 from Ms A. Mouries, Langeberg Municipal Offices, 23 Faure Street, Ashton**.** A non-refundable fee of R 250 is payable to Langeberg Municipality for collection of documents, alternatively the document can be downloaded from municipal website : www.langeberg.gov.za
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Preferential Procurement Regulations, 2011 (Regulation 9. (1) and 9. (3) make provision for the promotion of local production and content. Local production content applicable to designated sectors of construction.

Only goods, works and services with a stipulated minimum threshold as applicable for local production and content will be considered. The South African Bureau of Standards approved, Technical Specification Number (SATS 1286:2011) will be used to calculate local content.

Only goods, works and services with a stipulated minimum threshold as applicable for local production and content will be considered. The South African Bureau of Standards approved, Technical Specification Number (SATS 1286:2011) will be used to calculate local content.

Industry/sector/subsector	Minimum Threshold for Local Content	% of local content
VALVES PRODUCTS AND ACTUATORS	VALVES	70%
STEEL PRODUCTS AND COMPONENTS FOR CONSTRUCTION	FABRICATED STRUCTURAL STEEL REINFORCING BARS	100% 100%
PUMPS, MEDIUM VOLTAGE (MV) MOTOR AND ASSOCIATED ACCESSORIES	PUMPS	70%
PLASTIC PIPES	POLYVINYL CHLORIDE (PVC) PIPES HIGH DENSITY POLYETHYLENE (HDPE) PIPES POLYPROPYLENE (PP) PIPES GLASS REINFORCED PLASTIC (GRP) PIPES	100% 100% 100% 100%
ELECTRICAL CABLE PRODUCTS	LOW VOLTAGE POWER	90%
CEM I	PURE PORTLAND CEMENT WITH A 95-100% CLINKER	100%

A compulsory clarification meeting will be held on **11 November 2021** at **10:00** in the Municipal Offices, 52 Church Street, Robertson after which the sites will be visited. Bidders that fail to attend the compulsory clarification meeting will be disqualified. A representative may only represent one tenderer at this meeting. The entrance to the meeting will close 10h10 afterwhich no more prospective bidders representatives will be allowed to attend the clarification meeting.

Bids may only be submitted on the bid documentation provided by the municipality and must remain valid for 90 days after bid closing.

The official tender document must be fully completed in black ink and all pages must be returned preferably stapled or bound

Telegraphic, telephonic, telex, facsimile, e-mailed or late tenders will not be accepted. The lowest, only or any bid shall not necessarily be accepted and the Council reserves the right to accept any part of the bid.

TENDERS TO BE DEPOSITED IN: The tender box of Langeberg Municipality, 28 Main Road, Ashton. The tender box is open from Mondays until Fridays from 08:00 until 16:30. This excludes weekends and public holidays.

NOTE: This tender will be evaluated in terms of the Preferential Procurement Regulations, 2017 that was promulgated by the Minister of Finance on 20 January 2017 in Government Gazette No 40553. Please take note of the responsiveness criteria as stipulated in the tender document.

PROCUREMENT PREFERENCE POINT SYSTEM: 80/20

A S A DE KLERK
MUNICIPAL MANAGER

LANGEBERG
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T1.2 Tender Data

The Standard for Uniformity in Construction Procurement was first published in Board Notice 62 of 2004 in Government Gazette No 26427 of 9 June 2004. It was subsequently amended in Board Notice 67 of 2005 in Government Gazette No 27831 of 22 July 2005, Board Notice 99 of 2005 in Government Gazette No 28127 of 14 October 2005, Board Notice 93 of 2006 in Government Gazette No 29138 of 18 August 2006, Board Notice 9 of 2008 in Government Gazette No 30692, of 1 February 2008, Board Notice 11 of 2009 in Government Gazette No 31823 of 30 January 2009, Board Notice 86 of 2010 in Government Gazette No 33239 of 28 May 2010 and Board Notice 136 of 2015 in Government Gazette 38960 of 10 July 2015. (see www.cidb.org.za).

This edition incorporates the amendments made in Board Notice 136 of 2015 in Government Gazette 38960 of 10 July 2015 and the erratum notices issued thereafter.

The following variations, amendments and additions to the Standard Conditions of Tender as set out in the Tender Data below shall apply to this tender:

Clause number	**Tender Data**

F.1 General

F.1.1 **Actions**

Add the following:

The Employer is the LANGEBERG MUNICIPALITY, represented by:

The Municipal Manager

F.1.2 **Tender Documents: GCC**

Add the following:

"The tender documents issued by the Employer comprise:

VOLUME 1&2: The Tender Document (this document), in which is bound:

VOLUME 1 : CIVIL & STRUCTURAL WORKS

The Tender

Part T1: Tendering Procedure
T1.1 Tender notice and invitation to tender
T1.2 Tender data

Part T2: Returnable Documents
T2.1 List of returnable documents
T2.2 Returnable schedules

The Contract

Part C1: Agreement and contract data
C1.1 Form of offer and acceptance
C1.2 Contract data
C1.3 Form of Guarantee
C1.4 Occupational Health and Safety Agreement

Part C2: Pricing Data
C2.1 Pricing Assumptions
C2.2 Bills of Quantities

Part C3: Scope of Work
C3.1 Description of the Works
C3.2 Engineering
C3.3 Procurement
C3.4 Construction
C3.5 Management
C3.6 Annexes

Part C4: Site information
C4 Site information (if applicable)

Part C5: Health and Safety Specifications
C5 Health and Safety Tender Specifications

Part C6: Drawings

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C6 Drawings

VOLUME 2 : MECHANICAL, ELECTRICAL, CONTROL AND INSTRUMENTATION WORKS

Part T2: Returnable Documents
T2.2 Returnable schedules
T2.3 Data Sheets

Part C2: Pricing Data
C2.1 Bill of Quantities

Part C3: Scope of Work
C3.1 Scope of Works

Volume 1&2 is deemed the "Returnable Document" which must be returned to the Employer in terms of submitting a tender offer.

The following documents form part of this contract:

VOLUME 3 : *The General Conditions of Contract for Construction Works (Third Edition) 2015 as published by the South African Institution of Civil Engineering. This publication is available and tenderers must obtain copies at their own cost from the South African Institution of Civil Engineering (SAICE), Private Bag X200, Halfway House 1685, Tel: (011) 805 5947, Fax: (011) 805 5971, e-mail: civilinfo@saice.org.za.*

VOLUME 4 : *The South African Bureau of Standards Standardized Specification for Civil Engineering Construction SANS 1200, prepared by and obtainable from the South African Bureau of Standards, Private Bag X191, Pretoria 0001, Tel: (012) 428 6929, Fax: (012) 428 6928, Web site : www.stansa.co.za.*

Volumes 3 and 4 may also be inspected, by appointment, at the offices of the Employer's Agent during normal office hours.

F.1.4 **Communication and employer's agent**
Add the following:
Attention is drawn to the fact that verbal information, given by the Employer's Agent during site visits / clarification meetings or at any other time prior to the award of the Contract, will not be regarded as binding on the Employer. Only information issued formally by the Employer in writing to tenderers will be regarded as amending the Tender Documents.

F.1.5 **The Employer's right to accept or reject any tender offer**
Add the following:
F.1.5.3 The Employer may reject a tender if, in the opinion of the Employer, the tenderer will be unable to achieve the contract participation goal tendered, in the performance of the contract.

F.1.6.2 **Competitive negotiation procedure**
Add the following to F.1.6.2
A competitive negotiation procedure will **not** be followed.

F.1.6.3 **Proposal procedure using two-stage system**
Add the following to F.1.6.3:
A two-stage system will **not** be followed.

F.2 Tenderer's obligations

F.2.1 **Eligibility**
Add the following:
Only those tenderers who satisfy the following criteria are eligible to submit tenders:

F.2.1.1 **Central Supplier Supplier Database Registration**

Tenderers must be registered on the Central Supllier Supplier Database to be eligible to tender.

F.2.1.2 **Construction Industry Development Board (CIDB) Registration**
Only those tenderers who are registered with the CIDB, prior to the tender closing time and evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered or a value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction industry Development Regulations, for an **CE** class of construction work, are eligible to have their tenders evaluated.

Joint ventures are eligible to submit tenders provided that:

1. every member of the joint venture is registered with the CIDB;
2. the lead partner has a contractor grading designation in the 5**CE or higher** class of construction work;
3. the combined contractor grading designation calculated in accordance with the Construction Industry Development Board Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for an **CE** class of construction work or a value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction Industry Development Regulations.

For alpha-numerics associated with the contractor grading designations - see Annex G included in T1.2.

F2.1.3 **Qualification in terms of Labour Intensive Construction**
The proposed Construction Manager must hold an accredited NQF 5 qualification for labour intensive construction. Proof thereof must be submitted with the tender document.

F2.1.4 **Experience**
The company must provide proof of experience for successful completion of projects of a similar scope and nature. Similar scope and nature means at least 3 road upgrade projects (upgrading gravel roads to paved surfaces with the use of local labour) successfully completed in the past 5 years with a project value equal to or higher that the tendered sum.

F2.1.5 **Bank Rating**
The tender must receive at least a "C" bank rating from an approved financial institution. The Employer will, though his Agent, request the bank codes from the relevant financial institutions.

F.2.7 **Clarification meeting**
Add the following:
The arrangements for a **compulsory** tenderer's clarification meeting are as stated in the Tender Notice and Invitation to Tender.

Tenderers should be represented at the clarification meeting by a person who is suitably qualified and experienced to comprehend the implications of the work involved.

F.2.12 **Alternative tender offers**
Add the following to F.2.12.1
F.2.12.1 If a tenderer wishes to submit an alternative tender offer, the only criterion permitted for such alternative tender offer is that it demonstrably satisfies the Employer's standards and requirements, the details of which may be obtained from the Employer's Agent.

Calculations, drawings and all other pertinent technical information and characteristics as well as modified or proposed Pricing Data must be submitted with the alternative tender offer to enable the Employer to evaluate the efficacy of the alternative and its principal elements, to take a view on the degree to which the alternative complies with the Employer's standards and requirements and to evaluate the acceptability of the pricing proposals. Calculations must be set out in a clear and logical sequence and must clearly reflect all design assumptions. Pricing Data must reflect all assumptions in the development of the pricing proposal.

Acceptance of an alternative tender offer will mean acceptance in principle of the offer. It will be an obligation of the contract for the tenderer, in the event that the alternative is accepted, to accept full responsibility and liability that the alternative offer complies in all respects with the Employer's standards and requirements.

The modified Pricing Data must include an amount equal to 5% of the amount tendered for the alternative offer (after adding contingencies and VAT) to cover the Employer's costs of confirming the acceptability of the detailed design before it is constructed.

F.2.13 **Submitting a tender offer**
Add the following to F.2.13.1
F.2.13.1 Where the tendering entity is a joint venture it is recommended that the standard CIDB Joint Venture Agreement be used.

Add the following to F.2.13.3
F.2.13.3 Parts of each tender offer communicated on paper shall be submitted as an original, plus 0 (nil) copies.

F.2.13.4 *Add the following after the first sentence of F.2.13.4:*
The tender shall be signed by a person duly authorised to do so. Tenders submitted by joint ventures of two or more firms shall be accompanied by the document of formation of the joint

venture, authenticated by a notary public or other official deputed to witness sworn statements, in which is defined precisely the conditions under which the joint venture will function, its period of duration, the persons authorised to represent and obligate it, the participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning.

F.2.13.5 *Add the following to F.2.13.5:*
The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are:
Location of tender box: Tender Box
Physical address: Langeberg Municipality, 28 Main Road, Ashton, 6715.
Identification details: Tender number: T60/2021
Title of tender: CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

Sealed tenders with the Tenderer's name and address and the endorsement "**T60/2021 : CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK**" on the envelope, must be placed in the appropriate official tender box at the abovementioned address. The tender box is open from Mondays until Fridays from 08:00 until 16:30. This excludes weekends and public holidays.

F.2.13.6 *Add the following to F.2.13.6:*
A two-envelope procedure will **not** be followed. (F.3.5)

Add the following sub-clause after F.2.13.9:
F.2.13.10 By signing the offer part of C1.1 Form of Offer and Acceptance the tenderer declares that all information provided in the tender submission is true and correct.

F.2.15 **Closing time**
Add the following to F.2.15.1:
F.2.15.1 The closing time for submission of tender offers is as stated in the Tender Notice and Invitation to Tender.
Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.

F.2.16 **Tender offer validity**
Add the following to F.2.16.1:
F.2.16.1 The tender offer validity period is **120 calendar days.**

F.2.17 **Clarification of tender offer after submission**
Add the following to F.2.17:
A tender will be rejected as non-responsive if the tenderer fails to provide any clarification requested by the employer, within the time for submission stated in the Employer's written request for such clarification. A tender will also be rejected as non-responsive if the tenderer fails, within the time stated in writing by the Employer, to comply with the requirements of F.4.3.

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F.2.18 **Provide other material**
Delete the following word in F.2.18.1:
"Notarized"

Add the following to F.2.18.1:
F.2.18.1 Provide, on written request by the Employer, where the tendered amount inclusive of VAT **exceeds R 10 million**:

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) a certificate signed by the tenderer certifying that the tenderer 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;
iii) particulars of any contracts awarded to the tenderer 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;
iv) a statement indicating whether any portion of the goods or services are expected to be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality or municipal entity is expected to be transferred out of the Republic.

Each party to a Consortium/Joint Venture shall submit separate certificates/statements in the above regard.

F.2.23 **Certificates**

Add the following:
The tenderer is required to submit the following:

F.2.23.1 **Tax Clearance Certificate**
Tenderers shall be registered and in good standing with the South African Revenue Services (SARS) and shall submit documentary evidence in the form of a TCS SARS compliance status pin issued by SARS or proof that he or she has made arrangements with SARS to meet his or her outstanding tax obligations.

Each party to a Consortium/Joint Venture shall submit a separate TCS SARS compliance status pin, or proof that he or she has made the necessary arrangements with SARS.

Tenderers are to note that the Employer will not award a contract to a Tenderer whose tax matters are not in order. Furthermore, the successful Tenderer (Contractor) is required to submit an updated original or certified TCS SARS compliance status pin to the Employer should any current TCS SARS compliance status pin expire during the contract. Failure to do so may lead to the withholding of payment to the Contractor until a valid TCS SARS compliance status pin is received by the Employer.

F.2.23.2 **Bargaining Council Certificates**
Tenderers must be registered with a relevant Bargaining Council (if such be in place) and must submit, with the tender, the applicable Certificate of Compliance (letter of good standing in terms of the relevant Government Gazette).

Each party to a Consortium/Joint Venture shall submit separate certificates in the above regard.

F.2.23.3 **Broad-Based Black Economic Empowerment (B-BBEE) Status Level Certificate(s)**
Tenderers shall submit documentary evidence/proof in the form of an original valid or certified copy B-BBEE Status Level verification certificate in terms of the Construction Sector Charter on Black Economic Empowerment, or an Exempted Micro Enterprise certificate issued by a registered auditor, accounting officer (as contemplated in section 60(4) of the Close Corporation Act, 1984 (Act No. 69 of 1984)) or an accredited verification agency, or certified copies thereof) in terms of the Preferential Procurement Regulations, 2017.

Consortiums/Joint Ventures will qualify for preference points, provided that the entity submits the relevant certificate/scorecard in terms of the Preferential Procurement Regulations, 2017. In the case of unincorporated entities, a verified scorecard in the name of the Consortium/Joint Venture must be submitted with the tender.

F.3 The Employer's undertakings

F.3.2 **Issue Addenda**
Add the following to F.3.2:
Notwithstanding any requests for confirmation of receipt of Addenda issued, the tenderer shall be deemed to have received such addenda if the Employer can show proof of transmission thereof (or a notice in respect thereof) via electronic mail, facsimile or registered post.

F.3.4 **Opening of tender submissions**
Add the following to F.3.4.1:
F.3.4.1 The time and location for opening of the tender offers is:

Time: Tenders will be opened immediately after the closing time for receipt of tenders as stated in the Tender Notice and Invitation to Tender, or as stated in any Addendum extending the closing date.
Location: Langeberg Municipality, 28 Main Road, Ashton, 6715.

F.3.8 **Test for responsiveness**
Add the following to F3.8:
Tenders will be considered non-responsive if:
- the tender is not in compliance with the Scope of Work;
- the tenderer does not comply with the CIDB contractor grading designation as specified in F.2.1.2 above;
- the tenderer has failed to clarify or submit any supporting documentation within the time for submission stated in the Employer's written request.

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F.3.9 **Arithmetical errors, omissions and discrepancies**
Delete the contents of Subclauses F.3.9.2 to F.3.9.4 and replace with the following:

F.3.9.2 Check responsive tender offers for:
(a) the gross misplacement of the decimal point in any unit rate;
(b) omissions made in completing the pricing schedule or bills of quantities; or
(c) arithmetic errors in:
  (i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices or
  (ii) the summation of the prices

F.3.9.3 Correct arithmetic errors in the following manner:
(a) If bill of quantities (or schedule 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 unit rate shall govern and the line item total shall be corrected.
(b) 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.
(c) 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 be corrected.

F.3.9.4 Notify the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with F.3.11 of all errors or omissions that are identified in the tender offer and invite the tenderer to confirm the tender offer as tendered and accept the corrected total of prices.

F.3.9.5 Check responsive tender offers for unbalanced unit rates and request tenderers to consider amending and adjusting any rates declared unbalanced by the Employer in accordance with F.4.3 while retaining the total of the prices derived after any correction made in terms of this condition to tender.

Reject a tender offer if the tenderer does not correct or accept the correction of arithmetical errors and consider rejection of a tender offer if the tenderer refuses to amend/adjust an unreasonable, unbalanced rate in the manner described above.

F.3.11 **Evaluation of tender offers**

F.3.11.1 **General**
Add the following:
The procedure for the evaluation of responsive tenders is **Method 2: Financial Offer and Preference** in accordance with F.3.11.3.

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F.3.11.3 **Method 2: Financial offer and preferences**
The procedure for the evaluation of responsive tenders is **Method 2,** where the total number of tender evaluation points, $T_{EV}= N_{FO} + N_{P1}$ as detailed below.

Where N_{FO} is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7
N_{P1} is the number of tender evaluation points awarded for B-BBEE Status Level Contribution in accordance with F.3.11.8

F.3.11.7 **Scoring Financial Offers**
Add the following:
The financial offer will be scored using **Formula 2 (Option 1)** where the value of W_1 is:
1) 90 points where the financial value inclusive of VAT of all responsive tenders received have a value in excess of R50 000 000; or

For this contract, the financial offers will be scored using **Formula 2 (Option 1)** where the value of W_1 is: **80** tender evaluation points. Up to a maximum of 100 minus W_1 namely **20** tender evaluation points will be awarded for Preference with responsive tenders scoring points in accordance with the **80 Financial /20 Preference** scoring criteria listed below.

80 Financial /20 Preference	
Points	Description
	FINANCIAL OFFER
80	Price
	PREFERENCES
20	B-BBEE Status Level Contribution

F.3.11.8 **Scoring Preferences**

Add the following:

Points for preferences claimed will be determined in accordance with the Preferential Procurement Regulations, 2017. Points will be awarded to tenderers who are eligible for preferences in terms of Schedule 22 : Preferencing Schedule (where preferences are granted in respect of B-BBEE Status Level Contribution) which is included in T2.2 Returnable Schedules.

The terms and conditions of Schedule 22 : Preferencing Schedule shall apply in all respects to the tender evaluation process and any subsequent contract.

Points for Preference

A maximum of 100 minus W_1 tender evaluation points will be awarded for preference to tenderers with responsive tenders, who are eligible for such preference, in accordance with the criteria listed below.

Exempted Micro Enterprise or B-BBEE Status Level of Contributor

The Tenderer shall indicate on Schedule 22 : Preferencing Schedule included in T2.2 Returnable Schedules his or her company/firm/entity's B-BBEE Status Level of Contributor, in accordance with one of the following:

- Exempted Micro Enterprise (>50% black owned)
- Exempted Micro Enterprise (≤50% black owned)
- Verified B-BBEE status level of contributor in terms of the Construction Sector Charter on Black Economic Empowerment (Board Notice 111 of 2007 published in Government Gazette No. 29616 of 9 February 2007)
- Non-compliant contributor[1]

For this Contract the **80 Financial / 20 Preference** shall apply and up to **20** tender evaluation points (N_{P1}) will be awarded for the Status Level of B-BBEE contribution, in accordance with the tables below:

B-BBEE Status Level of Contributor	Number of Points (N_p)
1	20
2	18
3	14
4	12
5	8
6	6
7	4
8	2
Non-compliant contributor[1]	0

[1] A non-compliant contributor is one who does not meet the minimum score for a level 8 contributor, or who is not verified in terms of the Construction Sector Charter

Tenderers shall note the following Conditions of Clause 11 of the Preferential Procurement Regulations 2017:

(8) A tenderer (company/firm/entity) will not be awarded points for B-BBEE status level if it is indicated in the tender documents that such a tenderer intends sub-contracting more than 25% of the value of the contract to any other enterprises / sub-contractors that do not have an equal or higher B-BBEE Status Level than the prime contractor, unless the intended sub-contractors are Exempted Micro Enterprises that have the capability and ability to execute the sub-contract works;

(9) A prime contractor will not be awarded points for B-BBEE status level if he indicates in his tender that he intends sub-contracting more than 25% of the value of the contract to sub-contractors that do not qualify for at least the points that the prime contractor qualifies for,

unless the intended sub-contractors are Exempted Micro Enterprises that have the capability and ability to execute the sub-contract works.

F.3.11.10 **Risk Analysis**

Notwithstanding compliance with regard to CIDB registration or any other requirements of the tender, the employer will perform a risk analysis in respect of the following:

a) reasonableness of the financial offer
b) reasonableness of unit rates and prices
c) the tenderers ability to fulfil its obligations in terms of the tender document, that is, that the tenderer can demonstrate that he/she possesses the necessary professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience, reputation, personnel to perform the contract, etc.

No tenderer will be recommended for an award unless the tenderer has demonstrated that he/she has the resources and skills required.

F3.13 **Acceptance of tender offer**

Add the following to F.3.13.1:

F.3.13.1 Tender offers will only be accepted if:

a) the tenderer is registered and in good standing with the South African Revenue Service (SARS) and has submitted evidence in the form of an **original** valid Tax Clearance Certificate issued by SARS or proof that he or she has made arrangements with SARS to meet his or her outstanding tax obligations;
b) the tenderer or any of its directors 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 pay municipal rates and taxes or service charges and such rates, taxes and charges are in arrears for more than three months;
   iii) failed to perform on any previous contract and has been given a written notice to this effect;
d) the tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the employer or potentially compromise the tender process.

Tender offers will be rejected if they show any additional items not originally included in the tender documents, conditional or incomplete offers, irregularities of any kind in the tender.

The Employer does not bind himself to accept the lowest priced tender, highest points tender or any tender offer. The Employer has the right to accept any part of a tender as he may deem expedient subject to negotiation with the successful tenderer for the whole tender.

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F.3.13.2 **Disputes, objections, complaints and queries**

In terms of Regulations 49 and 50 of the Local Government: Municipal Finance Management Act, 2003 – Municipal Supply Chain Management Regulations (Notice 868 of 2005):

a) Persons aggrieved by decisions or actions taken by the Langeberg Municipality in the implementation of its supply chain management system, may lodge within 14 days of the decision or action, a written objection or complaint or query or dispute against the decision or action.
b) Objections, complaints, queries and disputes must be submitted in writing to the Municipal Manager, Langeberg Municipality, 28 Main Road, Ashton, 6715.

F.3.13.3 **Appeals**

a) In terms of Section 62 of the Systems Act 32 of 2000 a person whose rights are affected by a decision taken by the Langeberg Municipality in the implementation of its supply chain management system, may appeal against that decision by giving written notice of the appeal and reasons to the Municipal Manager within 21 days of the date of the notification of the decision.
b) An appeal must contain the following:
   i) Reasons and/or grounds for the appeal
   ii) The way in which the appellants rights have been affected
   iii) Remedy sought by appellant

F.3.13.4 **Right to approach the courts & rights in terms of Promotion of Administrative Justice Act (Act 3 of 2000) and Promotion of Access to Information (Act 2 of 2000)**

Clauses F.3.13.2 and F.3.13.3 do not influence any affected person's rights to approach the High Court at any time or its rights in terms of the Promotion of Administrative Justice Act and Promotion of Access to Information Act.

a) All legal process and pleadings must be served on the Municipal Manager, Langeberg Municipality, 28 Main Road, Ashton, 6715.
b) All requests in terms of PAJA and PAIA must be submitted in writing to the Municipal Manager, Langeberg Municipality, 28 Main Road, Ashton, 6715.

F.3.17 **Provide copies of the contract**
Add the following:
The number of paper copies of the signed contract to be provided by the Employer is one.

F.4 Additional Conditions of Tender

The additional conditions of tender are:

F.4.1 **Compliance with Occupational Health and Safety Act 1993**
Tenderers are to note the requirements of the Occupational Health and Safety Act No. 85 of 1993 and the Construction Regulations 2010 issued in terms of Section 43 of the Act. The tenderer shall be deemed to have read and fully understood the requirements of the above Act and Regulations and to have allowed for all costs in compliance therewith.

In this regard the Tenderer shall submit with his tender, appended to Schedule 13 : Health and Safety Plan in T2.2 : Returnable Schedules, a detailed Health and Safety Plan in respect of the Works in order to demonstrate the necessary competencies and resources to perform the construction work all in accordance with the Act and Regulations. Such Health and Safety Plan shall cover inter-alia the following details:

(1) Management Structure, Site Supervision and Responsible Persons including a succession plan.
(2) Contractor's induction training programme for employees, sub-contractors and visitors to the Site.
(3) Health and safety precautions and procedures to be adhered to in order to ensure compliance with the Act, Regulations and Safety Specifications.
(4) Regular monitoring procedures to be performed.
(5) Regular liaison, consultation and review meetings with all parties.
(6) Site security, welfare facilities and first aid.
(7) Site rules and fire and emergency procedures.

Tenderers are to note that the Contractor is required to ensure that all sub-contractors or others engaged in the performance of the contract also comply with the above requirements.

The Contractor shall prepare and maintain a Health and Safety File in respect of the project, which shall be available for inspection on Site at all times and handed over to the Employer on Final Completion of the project.

The Contractor is required to submit to the Employer the Occupational Health and Safety Agreement (included in C1.4 of the Contract Document) and a letter of good standing from the Compensation Commissioner, or a licensed compensation insurer, within 14 days after the Commencement Date of the Contract.

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F.4.2 **Claims arising after submission of tender**
No claim for any extras arising out of any doubt or obscurity as to the true intent and meaning of anything shown on the Contract Drawings or contained in the Conditions of Contract, Scope of Work and Pricing Data, will be admitted by the Employer/Employer's Agent after the submission of any tender and the Tenderer shall be deemed to have:

1) inspected the Contract Drawings and read and fully understood the Conditions of Contract.

2) read and fully understood the whole text of the Scope of Work and Pricing Data and thoroughly acquainted himself with the nature of the works proposed and generally of all matters which may influence the Contract.

3) visited the site of the proposed works, carefully examined existing conditions, the means of access to the site, the conditions under which the work is to be done, and acquainted himself with any limitations or restrictions that may be imposed by the Municipal or other Authorities in regard to access and transport of materials, plant and equipment to and from the site and made the necessary provisions for any additional costs involved thereby.

4) requested the Employer or his duly authorised agent to make clear the actual requirements of anything shown on the Contract Drawings or anything contained in the Scope of Work and Pricing Data, the exact meaning or interpretation of which is not clearly intelligible to the Tenderer.

Before submission of any tender, the Tenderer should check the number of pages, and if any are found to be missing or duplicated, or the figures or writing indistinct, or if the Pricing Data contain any obvious errors, the tenderer must apply to the Employer/Employer's Agent at once to have the same rectified, as no liability will be admitted by the Employer/Employer's Agent in respect of errors in any tender due to the foregoing.

5) received any Addenda to the tender documents which have been issued in accordance with the Employer's Supply Chain Management Policy.

F.4.3 **Imbalance in tendered rates**

In the event of tendered rates or lump sums being declared by the Employer to be unacceptable to it because they are either excessively low or high or not in proper balance with other rates or lump sums, the Tenderer may be required to produce evidence and advance arguments in support of the tendered rates or lump sums objected to. If, after submission of such evidence and any further evidence requested, the Employer is still not satisfied with the tendered rates or lump sums objected to, it may request the tenderer to amend these rates and lump sums along the lines indicated by it.

The Tenderer will then have the option to alter and/or amend the rates and lump sums objected to and such other related amounts as are agreed on by the Employer, but this shall be done without altering the tender offer as tendered or, if applicable, the corrected total of prices in accordance with F.3.9.3.

Should the Tenderer fail to amend his Tender in a manner acceptable to the Employer, the Employer may reject the Tender.

F.4.4 **Targeted enterprises and targeted labour**

It is a requirement of the Contract that the work be executed in such a manner as to maximise the use of small enterprises / subcontractors and labour intensive construction methods in order to provide low and semi-skilled work / employment opportunities.

To this end, it is a requirement of the Contract that the Contractor shall engage targeted enterprises and targeted labour, as described in Part C3.3 in the Scope of Work, directly or indirectly in the performance of the contract to the extent that the total monetary value of such engagements (exclusive of VAT), expressed as a percentage of the value of the contract. Failure to achieve the specified minimum CPG_2 in the performance of the contract will result in penalties being applied.

F.4.5 **Invalid tenders**

Tenders shall be considered invalid and shall be endorsed and recorded as such in the tender opening record, by the responsible official who opened the tender, in the following circumstances:

a) if the tender offer is not submitted on the Form of Offer and Acceptance bound into this tender document (form C1.1, Part C1: Agreements and Contract Data);
b) if the tender is not completed in non-erasable ink;
c) if the offer (of the Form of Offer and Acceptance) has not been signed;
d) if the offer (of the Form of Offer and Acceptance) is signed, but the name of the tenderer is not stated or is indecipherable.

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F.4.6 **Negotiations with preferred tenderers**

The Employer may negotiate the final terms of a contract with tenderers identified through a competitive tendering process as preferred tenderers provided that such negotiation:

a) does not allow any preferred tenderer a second or unfair opportunity;
b) is not to the detriment of any other tenderer; and
c) does not lead to a higher price than the tender as submitted.

Minutes of any such negotiations shall be kept for record purposes.

F.4.7 **General supply chain management conditions applicable to tenders**

In terms of its Supply Chain Management Policy the Employer may not consider a tender unless the provider who submitted the tender:

a) has furnished the Employer with that provider's:
   - full name;
   - identification number or company or other registration number; and
   - tax reference number and VAT registration number, if any;
b) has indicated whether:
   - the provider is in the service of the state, or has been in the service of the state in the previous twelve months;
   - the provider is not a natural person, whether any of the directors, managers, principal shareholders or stakeholders is in the service of the state, or has been in the service of the state in the previous twelve months;

- whether a spouse, child or parent of the provider or of a director, manager, share holder or stakeholder referred to above is in the service of the state, or has been in the service of the state in the previous twelve months; or

c) irrespective of the procurement process followed, the Employer is prohibited from making an award to:
- a person who is in the service of the state;
- a juristic entity of which any director, manager, principal shareholder or stakeholder is in the service of the state;
- an advisor or consultant contracted with the Employer, or
- a person, advisor or corporate entity involved with the bid specification committee, or a director of such corporate entity.

In this regard, tenderers shall complete Schedule 1, Part T2.2: Returnable Schedules: Compulsory Enterprise Questionnaire. Failure to complete this Schedule may result in the tender not being considered.

F.4.8 **Combating abuse of the Supply Chain Management Policy**

In terms of the Municipality's Supply Chain Management Policy, the Employer may reject the tender of any tenderer if that tenderer or any of its directors has:

a) failed to pay municipal rates and taxes or municipal service charges and such rates, taxes and charges are in arrears for more than three months:
b) failed, during the last five years, to perform satisfactorily on a previous contract with the Municipality or any other organ of state after written notice was given to that tenderer that performance was unsatisfactory;
c) abused the supply chain management system of the Employer or has committed any improper conduct in relation to this system;
d) been convicted of fraud or corruption during the past five years;
e) willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
f) been listed with the Register of Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004) or has been listed on National Treasury's database as a person or juristic entity prohibited from doing business with the public sector.

In this regard, tenderers shall complete Schedule 15, Part T2.2: Returnable Schedules: Declaration of Tenderer's Past Supply Chain Management Practices (in terms of the Municipal Finance Management Act). Failure to complete this Schedule may result in the tender not being considered.

F.4.9 **UIF payments**

The Tenderer shall submit to the Employer a letter from the Industrial Council indicating his good standing with regard to UIF payments upon being requested to do so.

F.4.12 **Price variations**

The Contract Price shall **not** be subject to any contract price adjustment, the rates and prices tendered in the bills of quantities shall be final and binding throughout the period of the contract. However, price adjustments for variations in the costs of special materials may be applicable where the Employer/Employer's Agent specifies such materials and the relevant information in the Contract Data.

Notwithstanding the above, if, as a result of any extension of time granted, the duration of the contract period exceeds one year, the contract will automatically be subject to contract price adjustment for that period by which the extended contract period exceeds such one year.

Adjustment in rates or prices shall be subject to the provisions of Part C1.2 :Contract Data.

F.4.13 **Requests for contract documents, or parts thereof, in electronic format**

The Employer shall not formally issue tender documents in electronic format as contemplated in F.2.13.2 and F.2.13.3 and shall only issue tender documents in hardcopy. An electronic version of the issued tender documents may be made available to the tenderer, upon written request in terms of this clause, subject to the following:

(a) Electronic copies of the contract document, or parts thereof, will only be provided to tenderers who have been issued with the tender documents as contemplated in F.1.2 in hardcopy.

(b) The electronic version shall not be regarded as a substitute for the issued tender documents.

(c) The Employer shall not accept tenders submitted in electronic format. Tenderers may not complete and submit a printed copy of the electronic version of the tender document or part thereof. Only those tenders that have been completed on the issued hard copy tender document shall be considered.

(d) The Employer accepts no responsibility or liability arising from any reliance on or use of the electronic version provided in terms of this clause. The Employer further does not guarantee that the electronic version corresponds with the issued tender documents in all respects. Tenderers are alerted to the fact that electronic versions of the tender documents may not reflect any notices or addenda that amend the tender document.

(e) Any non-compliance with these provisions, including effecting any unauthorised alterations to the tender document as contemplated in F.2.11, shall render the tender invalid. The Employer reserves the right to take any action against such tenderer allowed in law including, in circumstances where the tender had already been awarded, the right to cancel the contract.

(f) In requesting the electronic version of the tender document or parts thereof, the tenderer is deemed to have read, understood and accepted all of the above conditions.

F.4.14 Bidders who do not submit B-BBEE Status Level Verification Certificates or are non-compliant contributors to B-BBEE do not qualify for preference points for BBBEE but should not be disqualified from the bidding process. They will score points out of 90 or 80 for price only and zero (0) points out of 10 or 20 for BBBEE.

A trust, consortium or joint venture must submit a consolidated B-BBEE Status

Level Verification Certificate for every separate bid.

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Annex F
(normative)

Standard Conditions of Tender

F.1 General

F.1.1 Actions

F.1.1.1 The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in F.2 and F.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

F.1.1.2 The employer and the tenderer and all their agents and employees involved in the tender process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict, and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

Note: 1) A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.

2) Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.

F.1.1.3 The employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract.

F.1.2 Tender Documents

The documents issued by the employer for the purpose of a tender offer are listed in the tender data.

F.1.3 Interpretation

F.1.3.1 The tender data and additional requirements contained in the tender schedules that are included in the returnable documents are deemed to be part of these conditions of tender.

F.1.3.2 These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

F.1.3.3 For the purposes of these conditions of tender, the following definitions apply:

a) **conflict of interest** means any situation in which:
   i) someone in a position of trust has competing professional or personal interests which make it difficult to fulfill his or her duties impartially;
   ii) an individual or organisation is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or
   iii) incompatibility or contradictory interests exist between an employee and the organisation which employs that employee.

b) **comparative offer** means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;

c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process;

d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels;

e) **organization** means a company, firm, enterprise, association or other legal entity, whether incorporated or not, or a public body;

f) **functionality** means the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

F.1.4 Communication and employer's agent

Each communication between the employer and a tenderer shall be to or from the employer's agent only, and in a form that can be readily read, copied and recorded. Communications shall be in the English language. The employer shall not take any responsibility for non receipt of communications from or by a tenderer. The name and contact details of the employer's agent are stated in the tender data.

F.1.5 Cancellation and Re-Invitation of Tenders

F1.5.1 An organ of state may, prior to the award of the tender, cancel a tender if-

(a) due to changed circumstances, there is no longer a need for the services, works or goods requested; or

(b) funds are no longer available to cover the total envisaged expenditure; or

(c) no acceptable tenders are received; or

(d) there is a material irregularity in the tender process

F1.5.2 The decision to cancel a tender must be published in the cidb website and in the government Tender Bulletin for the media in which the original tender invitation was advertised.

F.1.6 Procurement procedures

F.1.6.1 General

Unless otherwise stated in the tender data, a contract will, subject to F.3.13, be concluded with the tenderer who in terms of F.3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

F.1.6.2 Competitive negotiation procedure

F.1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of F.3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of F.3.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

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F.1.6.2.2 All responsive tenderers, or not less than three responsive tenderers that are highest ranked in terms of the evaluation method and evaluation criteria stated in the tender data, shall be invited in each round to enter into competitive negotiations, based on the principle of equal treatment and keeping confidential the proposed solutions and associated information. Notwithstanding the provisions of F.2.17, the employer may request that tenders be clarified, specified and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

F.1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the employer to make a fresh tender offer, based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

F.1.6.2.4 The contract shall be awarded in accordance with the provisions of F.3.11 and F.3.13 after tenderers have been requested to submit their best and final offer.

F.1.6.3 Proposal procedure using the two stage-system

F.1.6.3.1 Option 1

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these conditions of tender.

F.1.6.3.2 Option 2

F.1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

F.1.6.3.2.2 The employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data, and award the contract in terms of these conditions of tender.

F.2 Tenderer's obligations

F.2.1 Eligibility

F.2.1.1 Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with employer.

F.2.1.2 Notify the employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the employer as the basis in a prior process to invite the tenderer to submit a tender offer and obtain the employer's written approval to do so prior to the closing time for tenders.

F.2.2 Cost of tendering

F2.2.1 Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

F2.2.2 The cost of the tender documents charged by the employer shall be limited to the actual cost incurred by the employer for printing the documents. Employers must attempt to make available the tender documents on its website so as not to incur any costs pertaining to the printing of the tender documents.

F.2.3 Check documents

Check the tender documents on receipt for completeness and notify the employer of any discrepancy or omission.

F.2.4 Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

F.2.5 Reference documents

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

F.2.6 Acknowledge addenda

Acknowledge receipt of addenda to the tender documents, which the employer may issue, and if necessary apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

F.2.7 Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarize themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

F.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least five working days before the closing time stated in the tender data.

F.2.9 Insurance

Be aware that the extent of insurance to be provided by the employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

F.2.10 Pricing the tender offer

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F.2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes (except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable 14 days before the closing time stated in the tender data.

F2.10.2 Show VAT payable by the employer separately as an addition to the tendered total of the prices.

F.2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

F.2.10.4 State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

F.2.11 Alterations to documents

Do not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations.

F.2.12 Alternative tender offers

F.2.12.1 Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

F.2.12.2 Accept that an alternative tender offer may be based only on the criteria stated in the tender data or criteria otherwise acceptable to the employer.

F.2.12.3 An alternative tender offer may only be considered in the event that the main tender offer is the winning tender.

F.2.13 Submitting a tender offer

F.2.13.1 Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works, services or supply identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

F.2.13.2 Return all returnable documents to the employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing legibly in non-erasable ink.

F.2.13.3 Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.

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F.2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.

F.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

F.2.13.6 Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked —financial proposalll and place the remaining returnable documents in an envelope marked —technical proposalll. Each envelope shall state on the outside the employer’s address and identification details stated in the tender data, as well as the tenderer's name and contact address.

F.2.13.7 Seal the original tender offer and copy packages together in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.

F.2.13.8 Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

F.2.13.9 Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.

F.2.14 Information and data to be completed in all respects

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.

F.2.15 Closing time

F.2.15.1 Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

F.2.15.2 Accept that, if the employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

F.2.16 Tender offer validity

F.2.16.1 Hold the tender offer(s) valid for acceptance by the employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

F.2.16.2 If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

F.2.16.3 Accept that a tender submission that has been submitted to the employer may only be withdrawn or substituted by giving the employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted.

F.2.16.4 Where a tender submission is to be substituted, submit a substitute tender in accordance with the requirements of F.2.13 with the packages clearly marked as —SUBSTITUTE‖.

F.2.17 Clarification of tender offer after submission

Provide clarification of a tender offer in response to a request to do so from the employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors by the adjustment of certain rates or item prices (or both). No change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted.

Note: *Sub-clause F.2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.*

F.2.18 Provide other material

F.2.18.1 Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer 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 employer's request, the employer may regard the tender offer as non-responsive.

F.2.18.2 Dispose of samples of materials provided for evaluation by the employer, where required.

F.2.19 Inspections, tests and analysis

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

F.2.20 Submit securities, bonds and policies

If requested, submit for the employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

F.2.21 Check final draft

Check the final draft of the contract provided by the employer within the time available for the employer to issue the contract.

F.2.22 Return of other tender documents

If so instructed by the employer, return all retained tender documents within 28 days after the expiry of the validity period stated in the tender data.

F.2.23 Certificates

Include in the tender submission or provide the employer with any certificates as stated in the tender data.

F.3 The employer's undertakings

F.3.1 Respond to requests from the tenderer

F.3.1.1 Unless otherwise stated in the tender Data, respond to a request for clarification received up to five working days before the tender closing time stated in the Tender Data and notify all tenderers who drew procurement documents.

F.3.1.2 Consider any request to make a material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence:

a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;
b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or
c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

F.3.2 Issue Addenda

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 three 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 drew documents.

F.3.3 Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

F.3.4 Opening of tender submissions

F.3.4.1 Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

F.3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, number of points claimed for its BBBEE status level and time for completion for the main tender offer only.

F.3.4.3 Make available the record outlined in F.3.4.2 to all interested persons upon request.

F.3.5 Two-envelope system

F.3.5.1 Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

F.3.5.2 Evaluate functionality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the functionality evaluation more than the minimum number of points for functionality stated in the tender data, and announce the score obtained for the technical proposals and the total price and any points claimed on BBBEE status level. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for functionality.

F.3.6 Non-disclosure

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.

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F.3.7 Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices.

F.3.8 Test for responsiveness

F.3.8.1 Determine, after opening and before detailed evaluation, whether each tender offer properly received:

a) complies with the requirements of these Conditions of Tender,
b) has been properly and fully completed and signed, and
c) is responsive to the other requirements of the tender documents.

F.3.8.2 A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer*'s* opinion, would:

a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work*,*
b) significantly change the Employer*'s* or the tenderer's risks and responsibilities under the contract, or
c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non-conforming deviation or reservation.

F.3.9 Arithmetical errors, omissions and discrepancies

F.3.9.1 Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with F.3.11 for:

a) the gross misplacement of the decimal point in any unit rate;
b) omissions made in completing the pricing schedule or bills of quantities; or
c) arithmetic errors in:
    i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or
    ii) the summation of the prices.

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F3.9.2 The employer must correct the arithmetical errors in the following manner:

a) Where there is a discrepancy between the amounts in words and amounts in figures, the amount in words shall govern.
b) 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.
c) 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 asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

Consider the rejection of a tender offer if the tenderer does not correct or accept the correction of the arithmetical error in the manner described above.

F.3.10 Clarification of a tender offer

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

F.3.11 Evaluation of tender offers

F.3.11.1 General

Appoint an evaluation panel of not less than three persons. Reduce each responsive tender offer to a comparative offer and evaluate them using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

F.3.11.2 Method 1: Price and Preference

In the case of a price and preference:

1) Score tender evaluation points for price
2) Score points for BBBEE contribution
3) Add the points scored for price and BBBEE.

F.3.11.3 Method 2: Functionality, Price and Preference

In the case of a functionality, price and preference:

1) Score functionality, rejecting all tender offers that fail to achieve the minimum number of points for functionality as stated in the Tender Data.
2) No tender must be regarded as an acceptable tender if it fails to achieve the minimum qualifying score for functionality as indicated in the tender invitation.
3) Tenders that have achieved the minimum qualification score for functionality must be evaluated further in terms of the preference points system prescribed in paragraphs 4 and 4 and 5 below.

The 80/20 preference point system for acquisition of services, works or goods up to Rand value of R 50 million

4) (a)(i) The following formula must be used to calculate the points for price in respect of tenders(including price quotation) with a rand value equal to, or above R 200 000 and up to Rand value of R 50 000 000 (all applicable taxes included):

$$Ps = 80\left(1 - \frac{Pt - P\,min}{P\,min}\right)$$

Where
Ps = Points scored for comparative price of tender or offer under consideration; Pt = Comparative price of tender or offer under consideration; and Pmin = Comparative price of lowest acceptable tender or offer.

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(4)(a)(ii) An employer of state may apply the formula in paragraph (i) for price quotations with a value less than R30 000, if and when appropriate:

(4)(b) Subject to subparagraph(4)(c), points must be awarded to a tender for attaining the B-BBEE status level of contributor in accordance with the table below:

B-BBEE status level of contributor	Number of points
1	20
2	18
3	14
4	12
5	8
6	6
7	4
8	2
Non-compliant contributor	0

(4)(c) A maximum of 20 points may be allocated in accordance with subparagraph (4)(b)

(4)(d) The points scored by tender in respect of B-BBEE contribution contemplated in contemplated in subparagraph (4) (b) must be added to the points scored for price as calculated in accordance with subparagraph (4)(a).

(4)(e) Subject to paragraph 4.3.8 the contract must be awarded to the tender who scores the highest total number of points.

The 90/ 10 preference points system for acquisition of services, works or goods with a Rand value above R 50 million

(5)(a) The following formula must be used to calculate the points for price in respect of tenders with a Rand value above R 50 000 000 (all applicable taxes included):

90/10

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

Where
Ps = Points scored for comparative price of tender or offer under consideration; Pt = Comparative price of tender or offer under consideration; and Pmin = Comparative price of lowest acceptable tender or offer.

(5)(b) Subject to subparagraph(5)(c), points must be awarded to a tender for attaining the B-BBEE status level of contributor in accordance with the table below:

B-BBEE status level of contributor	Number of points
1	10
2	9
3	6
4	5
5	4
6	3
7	2
8	1
Non-compliant contributor	0

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(5)(c) A maximum of 10 points may be allocated in accordance with subparagraph (5)(b).

(5)(d) The points scored by tender in respect of B-BBEE contribution contemplated in contemplated in subparagraph (5) (b) must be added to the points scored for price as calculated in accordance with subparagraph (5)(a).

(5)(e) Subject to paragraph 4.3.8 the contract must be awarded to the tender who scores the highest total number of points.

In terms of Regulation 11 of the Preferential Procurement Regulations 2017, a contract may be awarded to a tenderer that did not score the highest points, only in accordance with section 2(1)(f) of the Preferential Procurement Policy Framework Act (Act no 5 of 2000) and Regulation 11 of the Preferential Procurement Regulations 2017.

F.3.11.6 Decimal places

Score price, preference and functionality, as relevant, to two decimal places.

F.3.11.7 Scoring Price

Score price of remaining responsive tender offers using the following formula:

$N_{FO} = W_1 \times A$

where: N_{FO} is the number of tender evaluation points awarded for price.
W_1 is the maximum possible number of tender evaluation points awarded for price as stated in the Tender Data.
A is a number calculated using the formula and option described in Table F.1 as stated in the Tender Data.

Table F.1: Formulae for calculating the value of A

Formula	Comparison aimed at achieving	Option 1	Option 2
1	Highest price or discount	$A = (1 + (\frac{P - Pm}{Pm}))$	$A = P / Pm$
2	Lowest price or percentage commission / fee	$A = (1 - (\frac{P - Pm}{Pm}))$	$A = Pm / P$
a P_m is the comparative offer of the most favourable comparative offer. P is the comparative offer of the tender offer under consideration.			

F.3.11.8 Scoring preferences

Confirm that tenderers are eligible for the preferences claimed in accordance with the provisions of the tender data and reject all claims for preferences where tenderers are not eligible for such preferences.
Calculate the total number of tender evaluation points for preferences claimed in accordance with the provisions of the tender data.

F.3.11.9 Scoring functionality

Score each of the criteria and subcriteria for quality in accordance with the provisions of the Tender Data.

Calculate the total number of tender evaluation points for quality using the following formula:

$N_Q = W_2 \times S_O / M_S$

where: S_O is the score for quality allocated to the submission under consideration;
M_S is the maximum possible score for quality in respect of a submission; and
W_2 is the maximum possible number of tender evaluation points awarded for the quality as stated in the tender data

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F.3.12 Insurance provided by the employer

If requested by the proposed successful tenderer, submit for the tenderer*'s* information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the employer to provide.

F.3.13 Acceptance of tender offer

Accept the tender offer, if in the opinion of the employer, it does not present any risk and only if the tenderer:

a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,
b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,
c) has the legal capacity to enter into the contract,
d) is not insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his affairs administered by
a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,
e) complies with the legal requirements, if any, stated in the tender data, and
f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

F.3.14 Prepare contract documents

F.3.14.1 If necessary, revise documents that shall form part of the contract and that were issued by the employer as part of the tender documents to take account of:

a) addenda issued during the tender period,
b) inclusion of some of the returnable documents, and
c) other revisions agreed between the employer and the successful tenderer.

F.3.14.2 Complete the schedule of deviations attached to the form of offer and acceptance, if any.

F.3.15 Complete adjudicator's contract

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

F.3.16 Notice to unsuccessful tenderers

F.3.16.1 Notify the successful tenderer of the employer's acceptance of his tender offer by completing and returning one copy of the form of offer and acceptance before the expiry of the validity period stated in the tender data, or agreed additional period.

F.3.16.2 After the successful tenderer has been notified of the employer's acceptance of the tender, notify other tenderers that their tender offers have not been accepted.

F.3.17 Provide copies of the contracts

Provide to the successful tenderer the number of copies stated in the Tender Data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

F.3.18 Provide written reasons for actions taken

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender, but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

F3.19 Transparency in the procurement process

F3.19.1 The cidb prescripts require that tenders must be advertised and be registered on the cidb i.Tender system.

F3.19.2 The employer must adopt a transparency model that incorporates the disclosure and accountability as transparency requirements in the procurement process.
F3.19.3 The transparency model must identify the criteria for selection of projects, project information template and the threshold value of the projects to be disclosed in the public domain at various intervals of delivery of infrastructure projects.

F3.19.4 The client must publish the information on a quarterly basis which contains the following information:

- Procurement planning process
- Procurement method and evaluation process
- Contract type
- Contract status
- Number of firms tendering
- Cost estimate
- Contract title
- Contract firm(s)
- Contract price
- Contract scope of work
- Contract start date and duration
- Contract evaluation reports

F3.19.5 The employer must establish a Consultative Forum which will conduct a random audit in the implementation of the transparency requirements in the procurement process.

F3.19.6 Consultative Forum must be an independent structure from the bid committees.

F3.19.7 The information must be published on the employer's website.

F 3.19.8 Records of such disclosed information must be retained for audit purposes.

Annex G
(normative)

Alpha-numerics associated with the Contractor Grading Designations

Table G1: Contractor grading designations and associated parameters

Contractor Grading Designation	Tender Value Range designation	Maximum value of contract that a contractor is considered capable of performing (R)
1 (class of construction works)	1	500 000
2 (class of construction works)	2	1 000 000
3 (class of construction works)	3	3 000 000
4 (class of construction works)	4	6 000 000
5 (class of construction works)	5	10 000 000
6 (class of construction works)	6	20 000 000
7 (class of construction works)	7	60 000 000
8 (class of construction works)	8	200 000 000
9 (class of construction works)	9	No Limit

Table G2: Classes of construction work (see next page)

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Description	Design ation	Definition	Basic works types	Examples
Civil engineering works	CE	Construction works that are primarily concerned with materials such as steel, concrete, earth and rock and their application in the development, extension, installation, maintenance, removal, renovation, alteration, or dismantling of building and engineering infrastructure	Water, sewerage, roads, railways, harbours and transport, urban development and municipal services	Structures such as a cooling tower, bridge, culvert, dam, grand stand, road, railway, reservoir, runway, swimming pool, silo or tunnel. The results of operations such as dredging, earthworks and geotechnical processes. Township services, water treatment and supply, sewerage works, sanitation, soil conservation works, irrigation works, storm-water and drainage works, coastal works, ports, harbours, airports and pipelines.
Electrical engineering works (Infrastructure)	EP	Construction works that are primarily concerned with development, extension, installation, removal, renovation, alteration or dismantling of engineering infrastructure: a) relating to the generation, transmission and distribution of electricity; or b) which cannot be classified as EB.	Electrical power generation, transmission, control and distribution equipment and systems.	Power generation Street and area lighting Substations and protection systems Township reticulations Transmission Lines Supervisory control and data acquisition systems
Electrical engineering works (buildings)	EB	Construction works that are primarily concerned with the installation, extension, modification or repair of electrical installations in or on any premises used for the transmission of electricity from a point of control to a point of consumption, including any article forming part of such an installation	All electrical equipment forming an integral and permanent part of buildings and/or structures, including any wiring, cable jointing and laying and electrical overhead line construction	Electrical installations in buildings Electrical reticulations within a plot of land (erf) or building site Standby plant and uninterrupted power supply Verification and certification of electrical installations on premises

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Description	Designation	Definition	Basic works types	Examples
General building works	GB	Construction works that: a) are primarily concerned with the development, extension, installation, renewal, renovation, alteration, or dismantling of a permanent shelter for its occupants or contents; or b) cannot be categorised in terms of the definitions provided for civil engineering works, electrical engineering works, mechanical engineering works, or specialist works.	Buildings and ancillary works other than those categorised as being: c) civil engineering works; d) electrical engineering works; e) mechanical engineering works; or f) specialist works.	Buildings for domestic, industrial, institutional or commercial occupancies Car ports Fences other than classified as SS Stores Walls
Mechanical engineering works	ME	Construction works that are primarily concerned with the development, extension, installation, removal, alteration, renewal of engineering infrastructure for gas transmission and distribution, solid waste disposal, heating, ventilation and cooling, chemical works, metallurgical works, manufacturing, food processing and, materials handling	Machine systems including those relating to the environment of building interiors: a) gas transmission and distribution systems b) pipelines c) solid waste disposal d) materials handling, lifting machinery, heating, ventilation and cooling, pumps, e) continuous process systems f) chemical works, metallurgical works, manufacturing, food processing such as that in concentrator machinery and apparatus, oil and gas wells, smelters, cyanide plants, acid plants, metallurgical machinery, equipment and apparatus, and works necessary for the beneficiation of metals, minerals, rocks, petroleum and organic substances or other chemical processes.	Air-conditioning and mechanical ventilation Boiler installations and steam distribution Central heating Centralised hot water generation Cranes and hoists Dust and sawdust extraction Compressed air, gas and vacuum installations Conveyor and materials handling installations Continuous process systems involving chemical works, metallurgical works, oil and gas wells, acid plants, metallurgical machinery, equipment and apparatus, and works necessary for the beneficiation of metals, minerals, rocks, petroleum and organic substances and other chemical processes Kitchen equipment Laundry equipment Lift installations and escalators Refrigeration and cold rooms Waste handling systems (including compactors)

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Description	Designation	Definition	Basic works types	Examples
Specialist works	SB	A subset of construction works identified and defined by the Board that involves specialist capabilities for its execution	The extension, installation, repair, maintenance or renewal, or removal, of asphalt	
	SC		The development, extension, installation, removal, and dismantling, as relevant, associated with building excavations, shaft sinking and lateral earth support	
	SD		The development, extension, installation, repair, renewal, removal, or alteration of corrosion protection systems (cathodic, anodic and electrolytic)	
	SE		Demolition of buildings and engineering infrastructure and blasting	
	SF		The development, extension, installation, renewal, removal, renovation, alteration or dismantling of fire prevention and protection infrastructure (drencher and sprinkler systems and fire installation)	
	SG		The development, extension, installation, renewal, removal, renovation, alteration or dismantling of glazing, curtain walls and shop fronts	
	SH		The development, extension, installation, maintenance, renewal, removal, alteration or dismantling, as relevant, of landscaping, irrigation and horticultural works	
	SI		The development, extension, installation, repair, maintenance, renewal, removal, renovation, alteration or, dismantling of lifts, escalators, travellators and hoisting machinery	
	SJ		The development, installation, removal, or dismantling, as relevant, of piles and other specialized foundations for buildings and structures	
	SK		The installation, renewal, removal, alteration or dismantling, as relevant, road markings and signage	
	SL		The development, extension, installation, renewal, removal, renovation, alteration or dismantling of structural steelwork and scaffolding	
	SM		Timber buildings and structures	
	SN		The extension, installation, repair, maintenance, renewal, removal, renovation or alteration, as relevant, of the waterproofing of basements, roofs and walls using specialist systems.	
	SO		The development, extension, installation, renewal, removal, alteration or dismantling or demolition of water installations and soil and waste water drainage associated with buildings (wet services, plumbing)	
	SQ		The development, extension, installation, repair, removal, alteration, dismantling or demolition of precast concrete or steel fencing	

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Part T2: Returnable Documents

T2.1 List of Returnable Documents

T2.2 Returnable Schedules

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T2.1 List of Returnable Documents

The tenderer must complete the following Returnable Documents in **black ink**:

1. Returnable Schedules required for tender evaluation purposes

1: COMPULSORY ENTERPRISE QUESTIONAIRE .....
2: CLARIFICATION MEETING ATTENDANCE CERTIFICATE .....
3: AUTHORITY OF SIGNATORY .....
4: SCHEDULE OF WORK EXPERIENCE .....
5: SCHEDULE OF CONSTRUCTION EQUIPMENT .....
6: PRELIMINARY PROGRAMME .....
7: SCHEDULE OF ESTIMATED MONTHLY EXPENDITURE .....
8: TAX CLEARANCE CERTIFICATE, TCS SARS COMPLIANCE STATUS PIN, BARGAINING COUNCIL CERTIFICATE AND MINIMUM WAGE DECLARATION .....
9: CONFIRMATION OF CONTRACTOR ENTERPRISE REGISTRATION .....
10: TENDERER"S BANKING DETAILS .....
11: SCHEDULE OF SUBCONTRACTORS .....
12: DETAILS OF CONTRACT MANAGER, CONSTRUCTION MANAGER AND GENERAL FOREMAN'S EXPERIENCE .....
13: HEALTH AND SAFETY PLAN.....
14: PROPOSED AMENDMENTS AND QUALIFICATIONS BY TENDERER .....
15: DECLARATION OF TENDERER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES.....
16. DECLARATION OF "IN THE SERVICE OF THE STATE"… .....
17: DECLARATION FOR MUNICIPAL SERVICES AND PAYMENTS TO SERVICE PROVIDER.....
18: CERTIFICATE OF INDEPENDENT TENDER DETERMINATION .....
19: DECLARATION OF INTEREST MBD4.....
20: DECLARATION FOR PROCUREMENT ABOVE 10 MILLION .....

2. Other documents required for tender evaluation purposes

- Joint Venture Agreement (if applicable) – append to Schedule 3.
- An **original or certified** valid Tax Clearance Certificate issued by the South African Revenue Services –append to Schedule 8.
- Documentary evidence / proof of registration and verification on Langeberg Municipality Supplier Database.- append to Schedule 9.
- Documentary evidence / proof of registration and verification on CIDB Contractor Database.- append to Schedule 9.
- Health and Safety plan – append to Schedule 13.
- **B-BBEE Verification Certificate** – append to Schedule 20.

3. Returnable Schedules that will be incorporated into the Contract

21: RECORD OF ADDENDA TO TENDER DOCUMENT .....

Preferencing Schedule(s)

22: PREFERENCING SCHEDULE – B-BBEE STATUS LEVEL CONTRIBUTION PREFERENCE.....
23: DECLARTION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT .....

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T2.2 Returnable Schedules

Notes to tenderer:

1. Failure to fully complete the relevant returnable documents may render such a tender offer unresponsive.
2. These forms must be completed in black ink. Returnable documents shall be signed by a signatory duly authorised to sign the tender offer. Any alterations made prior to tender closure must be countersigned by an authorised signatory.
3. Tenderers shall note that their signature appended to each returnable form represents a declaration that they vouch for the accuracy and correctness of the information provided.
4. Notwithstanding any check or audit conducted by or on behalf of the Employer, the information provided in the returnable documents is accepted in good faith and as justification for entering into a contract with a tenderer. If subsequently any information is found to be incorrect such discovery shall be taken as willful misrepresentation by that tenderer to induce the contract. In such event the Employer has the discretionary right under contract condition 9.2 to terminate the contract.
5. Should a tenderer wish to offer a different time period of completion than that required by the Employer, it shall be submitted as an alternative tender.
6. If more than one alternative tender is submitted, each one shall be numbered and submitted on a separate copy of form C1.1.1 Form of Offer, completed and signed, and accompanied by the prescribed priced C2.2 Bill of Quantities and supporting documents.

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SCHEDULE 1 : COMPULSORY ENTERPRISE QUESTIONAIRE

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: . . . . . .

Address 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 . . . . . .

Tax reference number . . . . . .

Section 6: Record of service of the state

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

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

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

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

*insert separate page if necessary

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

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

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

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

*insert separate page if necessary

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

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;
ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;
iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;
iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest;
iv) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 2: CLARIFICATION MEETING ATTENDANCE CERTIFICATE

Refer to tender conditions F.2.1 and F.2.7

This is to certify that I/we, (the representative(s)) .....

representing (the tenderer) .....

.....

of (address) .....

.....

.....

telephone number .....

fax number .....

on (date) .....

attended the clarification meeting, have examined the Site of the Works and its surroundings for which I/we am/are submitting this Tender and have, so far as is practicable, familiarized myself/ourselves with all the information, risks, contingencies and other circumstances which may influence of affect my/our Tender.

Attendance of the above person(s) at the Clarification Meeting is confirmed by::

EMPLOYER'S AGENT / REPRESENTATIVE: . (Name). . . . . .

SIGNED BY EMPLOYER'S AGENT / REPRESENTATIVE: . . . . . .

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SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 3 : AUTHORITY OF SIGNATORY

Assurance shall be given at the time of submission of the tender that the tender has been signed by someone properly authorised thereto by resolution of the Directors, Members or Partners. Tenderers shall submit with their tenders the following information:

Single Company, Close Corporation or Partnership
Signatories for companies shall confirm their authority by attaching to this form a copy of the relevant resolution of the board of directors, duly signed and dated.

By resolution of the board of directors taken on (*Date*) .....

Mr/Ms (*Print Name*) .....

has been duly authorized to sign all documents in connection with this tender / contract on behalf of :...

(*Print Company Name*).....

.....

Signed on behalf of Company : .....

In his/her capacity as :.....

Date :.....

Joint Ventures

We, the undersigned, are submitting this tender offer in joint venture and hereby authorize;

Mr/Ms ……..……., authorised signatory of the company, close corporation or partnership ……..……..., 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……..

Note :
A copy of the Joint Venture Agreement showing clearly the **percentage contribution of each partner** to the Joint Venture shall be appended to this schedule.

SIGNED ON BEHALF OF TENDERER: SIGNATURE OF SIGNATORY:. . . . . .

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SCHEDULE 4 : SCHEDULE OF WORK EXPERIENCE

The tenderer shall insert in the spaces provided below a list of similar completed civil engineering contracts awarded to him and those currently being undertaken. This information is deemed to be material to the award of the Contract.

COMPLETED CONTRACTS				
EMPLOYER (NAME, TEL No AND FAX No)	CONSULTING ENGINEER (NAME, TEL No AND FAX No)	NATURE OF WORK	VALUE OF WORK R(m)	DATE COMPLETED

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CURRENT CONTRACTS				
EMPLOYER (NAME, TEL No AND FAX No)	CONSULTING ENGINEER (NAME, TEL No AND FAX No)	NATURE OF WORK	VALUE OF WORK R(m)	ANTICIPATED COMPLETION DATE

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 5 : SCHEDULE OF CONSTRUCTION EQUIPMENT

The tenderer shall state below what construction equipment will be available for this Contract. The tenderer shall differentiate, if applicable, between construction equipment immediately available and construction equipment which will become available by virtue of outstanding orders, and indicate what further construction equipment will be acquired or hired for the work should he be awarded the Contract.

F1: CONSTRUCTION EQUIPMENT IMMEDIATELY AVAILABLE

DESCRIPTION, SIZE, CAPACITY	NUMBER

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F2: CONSTRUCTION EQUIPMENT ON ORDER

(State details of arrangements made, with delivery dates)

DESCRIPTION, SIZE, CAPACITY	NUMBER

F3: CONSTRUCTION EQUIPMENT THAT WILL BE ACQUIRED OR HIRED

(State details of delivery arrangements)

DESCRIPTION, SIZE, CAPACITY	NUMBER

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 6 : PRELIMINARY PROGRAMME

The tenderer shall attach a preliminary programme, reflecting the proposed sequence and tempo of execution of the various activities comprising the work for the Contract, to this page.

This programme shall be in the form of a bar chart (Gantt chart) or similar acceptable time/activity form reflecting the proposed sequence and tempo of the various activities and the quantities that will be carried out every week under each of the elements, comprising the work for this contract. The programme shall also indicate the point where the tenderer intends to commence work operations and the direction in which the work will proceed. The working hours shall be indicated.

The tenderer shall also take into account the additional requirements stated in the Project Specifications when drawing up the programme.

Details of the preliminary programme shall be appended to this Schedule.

Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

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SCHEDULE 7 : SCHEDULE OF ESTIMATED MONTHLY EXPENDITURE

The tenderer shall state his estimated expenditure indicating the values of each monthly claim in terms of Clause 6.10 of the General Conditions of Contract, which he estimates will arise based on his preliminary programme and tendered rates, in the table below. The total of the monthly amounts shall be equal to the tender sum.

MONTH	VALUE
1.	R
2.	R
3.	R
4.	R
5.	R
6.	R
7.	R
8.	R
9.	R
10.	R
11.	R
12.	R
SUB TOTAL	R
CONTINGENCIES (10%)	R
SUB TOTAL	R
VAT (15%)	R
TOTAL (INCLUDING VAT 15%)	R

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SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 8 : TAX CLEARANCE CERTIFICATE, TCS SARS COMPLIANCE STATUS PIN, BARGAINING COUNCIL CERTIFICATE AND MINIMUM WAGE DECLARATION

(A) TAX CLEARANCE CERTIFICATE

A TCS SARS compliance status pin (valid at tender closing date) from the South African Revenue Services (SARS) shall be attached to this Schedule or proof that the tenderer has made arrangements with SARS to meet his or her outstanding tax obligations.

Each party to a Consortium/Joint Venture shall submit a separate Tax Clearance Certificate, or proof that he or she has made the necessary arrangements with SARS.

Failure to submit a TCS SARS compliance status pin will result in the invalidation of the tender/bid.

(B) BARGAINING COUNCIL CERTIFICATE OF COMPLIANCE

Tenderers must be registered with a relevant Bargaining Council (if such be in place) and provide the applicable Certificate of Compliance in terms of the relevant Government Gazette.

Where applicable, a Certificate of Compliance issued by the relevant Bargaining Council shall be attached to this schedule.
Each party to a Consortium/Joint Venture shall attach separate certificates in the above regard.

(C) DECLARATION IN RESPECT OF MINIMUM WAGE

The tenderer, by signing this schedule, declares that not less than the statutory minimum wage shall be paid to employees, as applicable.

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 9 : CONFIRMATION OF CONTRACTOR ENTERPRISE REGISTRATION

A. CENTRAL SUPPLIER DATABASE REGISTRATION

Refer to Tender Data clauses F.2.1 and F.2.23
I/We hereby confirm that I/we are registered and verified on the Langeberg Municipality Supplier Database

COMPANY NAME	REGISTRATION NUMBER

I/We attach a copy of the Company Registration on the Central Supplier Database and acknowledge that the validity of this certificate is dependent upon the validity of the tax clearance certificate attached to Schedule 8. In the case of Joint Venture Partnerships this requirement will apply to each party to the Joint Venture.

B. CIDB CONTRACTOR REGISTRATION

Refer to Tender Data clauses F.2.1.2, F.2.23.3 and F.3.13.1:
I/We hereby confirm my/our registration on the Construction Industry Development Board (CIDB) Contractor Database:

COMPANY NAME	CIDB CONTRACTOR GRADING DESIGNATION	CRS REGISTRATION NUMBER AS APPLICABLE

I/We attach a printed copy of the Active Contractor's Listing off the CIDB website www.cidb.org.za as documentary proof of the Contractor's Registration issued by the Construction Industry Development Board (CIDB) to this schedule.

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.

Failure to affix such documentation as proof of Contractor Enterprise registration as prescribed to this Schedule shall result in this tender not being further considered for the award of the Contract.

Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 10 : TENDERER'S BANKING DETAILS

BANKING DETAILS

The bidder must provide its banking details as follows:

Name of bank : ……

Contact person : ……

Branch Name : ……

Branch Number : ……

Account number : ……

Name of account holder : ……

A letter from the bank must be attached as proof of the tenderer's bank account details. Failure to provide this letter may result in the Tender offer not being considered.

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SCHEDULE 11 : SCHEDULE OF SUBCONTRACTORS

We notify you that it is our intention to employ the following Subcontractors for work in this contract.

Acceptance of this tender shall not be construed as approval of all or any of the listed subcontractors. Should any of the subcontractors not be approved subsequent to acceptance of the tender, this shall in no way invalidate this tender, and the tendered unit rates for the various items of work shall remain final and binding, even in the event of a subcontractor not listed below being approved by the Engineer.

	SUBCONTRACTORS			
Category / type	Subcontractor Name / Address / Contact Person / Phone / Fax / Details Of Organisation / Firm Experience	B-BBEE Status	Items of work (pay items) to be undertaken by the Subcontractor	Estimated Cost of Work (Rand)
			SUBTOTAL (Excluding VAT)	

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	SELECTED SUBCONTRACTORS (To be negotiated after Award)			
Category / type	Subcontractor Name / Address / Contact Person / Phone / Fax / Details Of Organisation / Firm Experience	B-BBEE Status	Items of work (pay items) to be undertaken by the Subcontractor	Estimated Cost of Work (Rand)
			SUBTOTAL (Excluding VAT)	

Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

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SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 12 : DETAILS OF CONTRACT MANAGER, CONSTRUCTION MANAGER GENERAL FOREMAN'S EXPERIENCE

Tenderers shall set out in the Schedule hereunder details of the Site Agent and General Foreman's experience in work of a similar nature to that for which their Tender is submitted.

Failure to complete this Schedule may result in the Tender not being considered.

CONTRACT MANAGER	**NAME**: ……**NQF LEVEL**……			
CONTRACT & CLIENT	**NATURE OF WORK**	**POSITION HELD**	**VALUE OF WORK**	**YEAR COMPLETED**

CONSTRUCTION MANAGER	**NAME**: ……**NQF LEVEL**……			
CONTRACT & CLIENT	**NATURE OF WORK**	**POSITION HELD**	**VALUE OF WORK**	**YEAR COMPLETED**

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GENERAL FOREMAN	**NAME**: ……**NQF LEVEL**……			
CONTRACT & CLIENT	**NATURE OF WORK**	**POSITION HELD**	**VALUE OF WORK**	**YEAR COMPLETED**

Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF THE TENDERER: ……

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SCHEDULE 13: HEALTH AND SAFETY PLAN

Tenderers are to note the requirements of the Occupational Health and Safety Act No. 85 of 1993 and the Construction Regulations 2010 issued in terms of Section 43 of the Act. The tenderer shall be deemed to have read and fully understood the requirements of the above Act and Regulations and to have allowed for all costs in compliance therewith.

In this regard the tenderer shall prepare and attach a Health and Safety Plan in respect of the Works in order to demonstrate the necessary competencies and resources to perform the construction work all in accordance with the Act and Regulations. Such Health and Safety Plan shall cover inter-alia the following details:

(1) Management Structure, Site Supervision and Responsible Persons including a succession plan.
(2) Contractor's induction training programme for employees, sub-contractors and visitors to the Site.
(3) Health and safety precautions and procedures to be adhered to in order to ensure compliance with the Act, Regulations and Safety Specifications.
(4) Regular monitoring procedures to be performed.
(5) Regular liaison, consultation and review meetings with all parties.
(6) Site security, welfare facilities and first aid.
(7) Site rules and fire and emergency procedures.

Tenderers are to note that the Contractor is required to ensure that all sub-contractors or others engaged in the performance of the contract also comply with the above requirements.

The tenderer shall also take into account the additional requirements stated in the Project Specifications when drawing up the Health and Safety Plan for the contract.

Details of the Health and Safety Plan shall be appended to this Schedule.

Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

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SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 14: PROPOSED AMENDMENTS AND QUALIFICATIONS BY THE TENDERER

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 deviations and qualifications in a covering letter attached to his tender and reference such letter in this schedule.

The Tenderer's attention is drawn to clause F.3.8 of the Standard Conditions of Tender referenced in the Tender Data regarding the Employer's handling of material deviations and qualifications.

If no deviations or modifications are desired, the schedule hereunder is to be marked **NIL** and signed by the Tenderer.

No alternative Tender will be considered unless a Tender free of qualifications and strictly on the basis of the Tender Documents is also submitted.

PAGE	CLAUSE / ITEM	PROPOSAL / DESCRIPTION

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: .....

SCHEDULE 15: DECALARATION OF TENDERER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

1.This Municipal Bidding Document must form part of all bids invited.

2.It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.

3.The bid of any bidder may be rejected if that bidder, or any of its directors have:-

a abused the municipality's/municipal entity's supply chain management system or committed any improper conduct in relation to such system;
b been convicted for fraud or corruption during the past five years;
c willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
d been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).

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

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4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality/municipal entity, or to any other municipality/municipal entity, that is in arrears for more than 90 days?	Yes ☐	No ☐
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and the municipality/ municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
4.5.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED

……
(FULL NAME)

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS TRUE AND CORRECT.
I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

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…… ……
SIGNATURE **DATE**

…… ……
POSITION **NAME OF BIDDER**

SCHEDULE 16: DECLARATION OF "IN THE SERVICE OF THE STATE"

the state, or has been in the service of the state in the previous twelve months, the following information must be completed: **(Please indicate if not applicable)**

The name of the person in the employment of the state:

……

The capacity in which that person is in service of the state:

……

Is that person an owner, director, manager, shareholder or connected to the business: Yes or No? **(If yes please specify)**

.....

The relationship to the owner, director, manager, shareholder or stakeholder of the entity:

	Spouse	**Child**	**Parent**
Owner			
Director			
Manager			
Shareholder			

"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.

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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 the Business

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SCHEDULE 17: DECLARATION: CERTIFICATE FOR MUNICIPAL SERVICES AND PAYMENTS TO SERVICE PROVIDERS

PART A: PROPERTY OWNED BY ENTERPRISE OR DIRECTORS
Please complete the following if property is owned by the enterprise, the proprietors, directors or partners in their personal capacity, which must be confirmed by the relevant municipality **(ATTACH COPY OF MUNICIPAL ACCOUNT(S) NOT OLDER THAN 30 DAYS**:

Name of account holder: ……

Account number: ……..

Account number: ……..

FOR MUNICIPAL USE ONLY **I/we hereby certify that the municipal account details of our client as indicated above is correct.** **……..** **Name of municipal official (print name)** **……** **Signature of municipal official**	**Official date stamp of municipality**

PART B: PROPERTY LEASED BY ENTERPRISE OR DIRECTORS
Please attach a sworn affidavit or a copy of your lease agreement if the property is leased by the enterprise or the proprietors or directors in their personal capacity, for which the aforementioned is not responsible for payment of municipal rates and taxes.

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PART C: WHERE PROPERTY IS NOT OWNED OR LEASED BY ENTERPRISE OR DIRECTORS
Please attach a sworn affidavit from the proprietor or director of the enterprise confirming that the enterprise does not own or lease any property and that the aforementioned is not responsible for payment of any municipal rates and taxes.

I,……., the undersigned, certify that the information furnished on this declaration form is correct and that I/we have no undisputed commitments for municipal services towards a municipality or other service provider in respect of which payment is overdue for more than 90 days.

..... **……**

Signature for and on behalf of the bidder **Date**

LANGEBERG MUNICIPALITY

……

SCHEDULE 18 : CERTIFICATE OF INDEPENDENT TENDER DETERMINATION

I, the undersigned, in submitting this tender for Contract No. **T60/2021** in response to the invitation for the tender made by the Langeberg Municipality, 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 Tenderer)

1. I have read and I understand the contents of this Certificate;
2. I understand that this tender will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the tenderer to sign this Certificate, and to submit this tender on behalf of the tenderer;
4. Each person whose signature appears on this tender has been authorized by the tenderer to determine the terms of, and to sign, the tender, on behalf of the tenderer;
5. For the purposes of this Certificate and this tender, I understand that the word "competitor" shall include any individual or organization, other than the tenderer whether or not affiliated with the tenderer, who:
   (a) has been requested to submit a tender in response to this invitation to tender;
   (b) could potentially submit a tender in response to this invitation to tender, based on their qualifications, abilities or experience; and
   (c) provides the same goods and services as the tenderer and/or is in the same line of business as the tenderer;
6. The tenderer has arrived at this tender independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium[1] will not be construed as collusive tendering;
7. In particular, without limiting the generality of paragraph 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 tender;
   (e) the submission of a tender which does not meet the specifications and conditions of the tender; or
   (f) tendering with the intention not to win the tender;
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 invitation to tender relates;

[1]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.

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9. The terms of this tender have not been, and will not be, disclosed by the tenderer, directly or indirectly, to any competitor, prior to the date and time of the official tender 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 tenders and contracts, tenders 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.

SIGNED ON BEHALF OF TENDERER: . . . . . .

....
Position Name of Tenderer

.....
Date

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SCHEDULE 19: DECLARATION OF INTEREST MBD 4

1 Any legal person, including persons employed by the state[1], or persons having a kinship with persons employed by the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid (includes an advertised competitive bid, a limited bid, a proposal or written price quotation). In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons employed by the state, or to persons connected with or related to them, it is required that the bidder or his/her authorised representative declare his/her position in relation to the evaluating/adjudicating authority where-

1. the bidder is employed by the state; and/or the legal person on whose behalf the bidding document is signed, has a relationship with persons/a person who are/is involved in the evaluation and or adjudication of the bid(s), or where it is known that such a relationship exists between the person or persons for or on whose behalf the declarant acts and persons who are involved with the evaluation and or adjudication of the bid.

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

1. Full Name of bidder or his or her representative: …….
2. Identity Number:……...
3. Position occupied in the Company (director, trustee, shareholder[2], member):
   …….
4. Registration number of company, enterprise, close corporation, partnership agreement or trust:
   ……..…….
5. Tax Reference Number: ……
6. VAT Registration Number: ……...

3 The names of all directors / trustees / shareholders / members, their individual identity numbers, tax reference numbers and, if applicable, employee / PERSAL numbers must be indicated in paragraph 13.2 below.

[1]"State" means –

1. (a) 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);
2. (b) any municipality or municipal entity;
3. (c) provincial legislature;
4. (d) national Assembly or the national Council of provinces; or
5. (e) Parliament.

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

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4 Are you or any person connected with the bidder presently employed by the state? YES / NO

1. If so, furnish the following particulars:

Name of person / director / trustee / shareholder/ member: ……..……

Name of state institution at which you or the person connected to the bidder is employed :

……

Position occupied in the state institution: ……

Any other particulars:

……

……

2. If you are presently employed by the state, did you obtain the appropriate authority to undertake remunerative
3. work outside employment in the public sector? YES / NO
4. If yes, did you attach proof of such authority to the bid document? YES / NO
5. (Note: Failure to submit proof of such authority, where applicable, may result in the disqualification of the bid.

6. If no, furnish reasons for non-submission of such proof:
……
……
……

7. Did you or your spouse, or any of the company's directors / trustees / shareholders / members or their spouses conduct business with the state in the previous twelve months? YES / NO
8. If so, furnish particulars:

……..
……..
……..

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9. Do you, or any person connected with the bidder, have any relationship (family, friend, other) with a person employed by the state and who may be involved with the evaluation and or adjudication of this bid? YES / NO
10. If so, furnish particulars.

……..
……..
……

11. Are you, or any person connected with the bidder, aware of any relationship (family, friend, other) between any other bidder and any person employed by the state who may be involved with the evaluation and or adjudication of this bid? YES/NO

11.1 If so, furnish particulars.

……..
……..
……

12. Do you or any of the directors / trustees / shareholders / members of the company have any interest in any other related companies whether or not they are bidding for this contract? **YES/NO**

12.1 If so, furnish particulars:

……
……
……

5 **Full details of directors / trustees / members / shareholders.**

Full Name	**Identity Number**	**Personal Income T Reference Number**	**State Employee Number Persal Number**

6 **DECLARATION**

I, THE UNDERSIGNED (NAME)……
CERTIFY THAT THE INFORMATION FURNISHED IN THE SECTION ABOVE IS CORRECT.

I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

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…….. ……
Signature **Date**

…….. ……
Position **Name of bidder**

SCHEDULE 20: DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (ALL APPLICABLE TAXES INCLUDED) MBD 5

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

1 Are you by law required to prepare annual financial statements for auditing? ……

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 Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days?

……

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

4 If yes, provide particulars.

……
……

CERTIFICATION

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

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

…….. ……..
Signature **Date**

……..... **…….**
Position **Name of Bidder**

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SCHEDULE 21: RECORD OF ADDENDA TO TENDER DOCUMENT (ANNEX K)

We confirm that the following communications / Addenda / Notice(s) to Tenderers received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:

ADDENDUM No	DATE	SUBJECT MATTER OF ADDENDUM / NOTICE

Documentary evidence of Addenda / Notices issued to Tenderers indicating proof of receipt shall accompany this Schedule.

Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

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SCHEDULE 22 :PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2017 MBD 6.1

This preference form must form part of all bids invited. It contains general information and serves as a claim form for preference points for Broad-Based Black Economic Empowerment (B-BBEE) Status Level of Contribution

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017.

---

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2 The value of this bid is estimated to not exceed R50 000 000 (all applicable taxes included) and therefore the 80/20 preference point system shall be applicable;

1.3 Points for this bid shall be awarded for:

(a) Price; and

(b) B-BBEE Status Level of Contributor.

1.4 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	80
B-BBEE STATUS LEVEL OF CONTRIBUTOR	20
Total points for Price and B-BBEE must not exceed	**100**

1.5 Failure on the part of a bidder to submit proof of B-BBEE Status level of contributor together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

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

2. DEFINITIONS

(a) **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;

(b) "**B-BBEE status level of contributor"** means the B-BBEE status of an entity in terms of a code of good practice on black economic empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

(c) **"bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the provision of goods or services, through price quotations, advertised competitive bidding processes or proposals;

(d) **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(e) **"EME"** means an Exempted Micro Enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;

(f) **"functionality"** means the ability of a tenderer to provide goods or services in accordance with specifications as set out in the tender documents.

(g) **"price"** includes all applicable taxes less all unconditional discounts;

(h) **"proof of B-BBEE status level of contributor"** means:

1) B-BBEE Status level certificate issued by an authorized body or person;

2) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice;

3) Any other requirement prescribed in terms of the B-BBEE Act;

(i) **"QSE"** means a qualifying small business enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;

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

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3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

4. POINTS AWARDED FOR PRICE

4.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$Ps = 80\left(1 - \frac{Pt - P\,min}{P\,min}\right) \text{ or } \qquad Ps = 90\left(1 - \frac{Pt - P\,min}{P\,min}\right)$$

Where

Ps = Points scored for price of bid under consideration

Pt = Price of bid under consideration

Pmin = Price of lowest acceptable bid

4.2 FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME-GENERATING PROCUREMENT

4.3 POINTS AWARDED FOR PRICE

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$Ps = 80\left(1 + \frac{Pt - P\,max}{P\,max}\right) \text{ or } \qquad Ps = 90\left(1 + \frac{Pt - P\,max}{Pmax}\right)$$

Where

Ps = Points scored for price of bid under consideration

Pt = Price of bid under consideration

Pmax = Price of highest acceptable bid

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5. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTOR

5.1 In terms of Regulation 6 (2) and 7 (2) of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (90/10 system)	Number of points (80/20 system)
1	10	20
2	9	18
3	6	14
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

6. BID DECLARATION

6.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

7. B-BBEE STATUS LEVEL OF CONTRIBUTOR CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 4.1

7.1 B-BBEE Status Level of Contributor: . = ……(maximum of 10 or 20 points)

(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.

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8. SUB-CONTRACTING

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

(***Tick applicable box***)

YES		NO	

8.1.1 If yes, indicate:

i) What percentage of the contract will be subcontracted.....……%
ii) The name of the sub-contractor……..
iii) The B-BBEE status level of the sub-contractor.....……..
iv) Whether the sub-contractor is an EME or QSE
(Tick applicable box)

YES		NO	

v) Specify, by ticking the appropriate box, if subcontracting with an enterprise in terms of Preferential Procurement Regulations,2017:

Designated Group: An EME or QSE which is at last 51% owned by:	**EME** √	**QSE** √
Black people		
Black people who are youth		
Black 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		

9. **DECLARATION WITH REGARD TO COMPANY/FIRM**

9.1 Name of company/firm:……

9.2 VAT registration number:……

9.3 Company registration number:……

9.4 TYPE OF COMPANY/ FIRM

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

[TICK APPLICABLE BOX]

9.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

……
……
……
……..

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9.6 COMPANY CLASSIFICATION

- ☐ Manufacturer
- ☐ Supplier
- ☐ Professional service provider
- ☐ Other service providers, e.g. transporter, etc.

[*TICK APPLICABLE BOX*]

9.7 MUNICIPAL INFORMATION

Municipality where business is situated: ……..

Registered Account Number: …….

Stand Number:……..

9.8 Total number of years the company/firm has been in business:……

9.9 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 B-BBE status level of contributor indicated in paragraphs 1.4 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we 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 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;

iv) If the B-BBEE status level of contributor has 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.

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

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SCHEDULE 23: DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT MBD 6.2

This Municipal Bidding Document (MBD) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

Before completing this declaration, bidders must study the General Conditions, Definitions, Directives applicable in respect of Local Content as prescribed in the Preferential Procurement Regulations, 2017, the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:2011 (Edition 1) and the Guidance on the Calculation of Local Content together with the Local Content Declaration Templates [Annex C (Local Content Declaration: Summary Schedule), D (Imported Content Declaration: Supporting Schedule to Annex C) and E (Local Content Declaration: Supporting Schedule to Annex C)]."

1.General Conditions

1.1. Preferential Procurement Regulations, 2017 (Regulation 8) make provision for the promotion of local production and content.

1.2. Regulation 8.(2) prescribes that in the case of designated sectors, organs of state must advertise such tenderswith the specific bidding condition that only locally produced or manufactured goods, with a stipulated minimum threshold for local production and content will be considered.

1.3. Where necessary, for tenders referred to in paragraph 1.2 above, a two stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.

1.4. A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that thelocal production and content of the overall value of the contract is reduced to below the stipulated minimumthreshold.

1.5. The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with theSABS approved technical specification number SATS 1286: 2011 as follows:

$$LC = [1 - x / y] * 100$$

Where
x imported content
y bid price excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by South African Reserve Bank (SARB) at 12:00 on the date of advertisement of the bid as indicated in paragraph 4.1 below.

The SABS approved technical specification number SATS 1286:2011 is accessible on http:/www.thedti.gov.za/industrial development/ip.jsp at no cost.

1.6. A bid may be disqualified if this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation;

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2. The stipulated minimum threshold(s) for local production and content (refer to Annex A of SATS 1286:2011) for this bid is/are as follows:

Industry/sector/subsector	Minimum Threshold for Local Content	% of local content
VALVES PRODUCTS AND ACTUATORS	VALVES	70%
STEEL PRODUCTS AND COMPONENTS FOR CONSTRUCTION	FABRICATED STRUCTURAL STEEL REINFORCING BARS	100% 100%
PUMPS, MEDIUM VOLTAGE (MV) MOTOR AND ASSOCIATED ACCESSORIES	PUMPS	70%
PLASTIC PIPES	POLYVINYL CHLORIDE (PVC) PIPES HIGH DENSITY POLYETHYLENE (HDPE) PIPES POLYPROPYLENE (PP) PIPES GLASS REINFORCED PLASTIC (GRP) PIPES	100% 100% 100% 100%
ELECTRICAL CABLE PRODUCTS	LOW VOLTAGE POWER	90%
CEM I	PURE PORTLAND CEMENT WITH A 95-100% CLINKER	100%

3. Does any portion of the goods or services offered have any imported content?
(Tick applicable box)

YES	NO

3.1. If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.5 of the general conditions must be the rate(s) published by SARB for the specific currency at 12:00 on the date of advertisement of the bid.
The relevant rates of exchange information is accessible on www.reservebank.co.za
Indicate the rate(s) of exchange against the appropriate currency in the table below (refer to Annex A of SATS 1286:2011):

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Currency	Rates of exchange
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

NB: Bidders must submit proof of the SARB rate (s) of exchange used.

4. Where, after the award of a bid, challenges are experienced in meeting the stipulated minimum threshold for local content the dti must be informed accordingly in order for the dti to verify and in consultation with the AO/AA provide directives in this regard.

LOCAL CONTENT DECLARATION
(REFER TO ANNEX B OF SATS 1286:2011)

LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY (CLOSE CORPORATION, PARTNERSHIP OR INDIVIDUAL)

IN RESPECT OF BID No. .....

ISSUED BY: (Procurement Authority / Name of Municipality / Municipal Entity):

.....

NB The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.

I, the undersigned, ……..... (full names),

do hereby declare, in my capacity as …… ……..

of .....(name of bidder entity), the following:

a) The facts contained herein are within my own personal knowledge.

b) I have satisfied myself that the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286.

c) (The local content has been calculated using the formula given in clause 3 of SATS 1286, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E which has been

d) consolidated in Declaration C::

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Bid price, excluding VAT (y)	R
Imported content (x), as calculated in terms of SATS 1286:2011	R
Stipulated minimum threshold for local content (paragraph 3 above)	
Local content %, as calculated in terms of SATS 1286:2011	

If the bid is for more than one product, the local content percentages for each product contained in Declaration C shall be used instead of the table above.
The local content percentages for each product has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E.

d) I accept that the Procurement Authority / Municipality /Municipal Entity has the right to request that the local content be verified in terms of the requirements of SATS 1286.

e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286, may result in the Procurement Authority / Municipal / Municipal Entity imposing any or all of the remedies as provided for in Regulation 13 of the Preferential Procurement Regulations, 2011 promulgated under the Policy Framework Act (PPPFA), 2000 (Act No. 5 of 2000).

SIGNATURE: _____ DATE: _____

WITNESS No. 1 _____ DATE: _____

WITNESS No. 2 _____ DATE: _____

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ANNEXURE C	SATS 1286:2011
Local Content Declaration – Summary Schedule	

***(C1)* Tender No.**	T60/2021			
***(C2)* Tender Description**	CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK			
***(C3)* Designated product(s)**				
***(C4)* Tender Authority**	Langeberg Municipality			
***(C5)* Name of Tendering Entity**				
***(C6)* Tender Exchange Rate**	**Currency**		**Rate**	
***(C7)*Specified local content %**				

NOTE: VAT to be excluded from all calculations

		Calculation of local content						Tender summary			
Tender Item No's	*List of Items*	*Tender Price – each*	*Exempted imported value*	*Tender value net of exempted imported content*	*Imported value*	*Local value*	*Local content % (per item)*	*Tender Quantity*	*Total tender value*	*Total exempted imported content*	*Total imported content*
(C8)	*(C9)*	*(C10)*	*(C11)*	*(C12)*	*(C13)*	*(C14)*	*(C15)*	*(C16)*	*(C17)*	*(C18)*	*(C19)*
Civil BOQ											
M&E BOQ											

***(C20)* Total tender value**		
***(C21)* Total Exempt imported content**		
(C22) Total Tender value net of exempt imported content		
***(C23)* Total Imported content**		
***(C24)* Total local content**		
***(C25)* Average local content % of tender**		

SIGNATURE OF TENDERER AS PER LOCAL CONTENT DECLARATION

DATE

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ANNEXURE D	**SATS 1286.2011**
Imported Content Declaration – Supporting Schedule to Annexure C	

(D1)	**Tender No.**	T60/2021				**NOTE: VAT to be excluded from all calculations**
(D2)	**Tender Description**	CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK				
(D3)	**Designated product(s)**	*As specified on T2 page 42				
(D4)	**Tender Authority**	Langeberg Municipality				
(D5)	**Tendering Entity's Name**					
(D6)	**Tender Exchange Rate**	**Currency**		**Rate**		

A. Exempted imported content						**Calculation of imported content**				**Summary**	
Tender item no's	**Description of imported content**	**Local supplier**	**Overseas supplier**	**Foreign currency value as per Commercial Invoice**	**Tender Exchange Rate**	**Local value of imports**	**Freight costs to port of entity**	**All locally incurred landing costs & duties**	**Total landed cost**	**Tender Quantity**	**Exempted imported value**
(D7)	*(D8)*	*(D9)*	*(D10)*	*(D11)*	*(D12)*	*(D13)*	*(D14)*	*(D15)*	*(D16)*	*(D17)*	*(D18)*

(D19) **Total exempt imported value**

This total must correspond with Annex C – C21

B. Imported directly by the Tenderer						**Calculation of imported content**				**Summary**	
Tender item no's	**Description of imported content**	**Unit of measure**	**Overseas supplier**	**Foreign currency value as per Commercial Invoice**	**Tender Exchange Rate**	**Local value of imports**	**Freight costs to port of entity**	**All locally incurred landing costs & duties**	**Total landed cost**	**Tender Quantity**	**Total imported value**
(D20)	*(D21)*	*(D22)*	*(D23)*	*(D24)*	*(D25)*	*(D26)*	*(D27)*	*(D28)*	*(D29)*	*(D30)*	*(D31)*

(D32) **Total imported value by tenderer**

ANNEXURE D - continued **SATS 1286.2011**

Imported Content Declaration – Supporting Schedule to Annexure C

NOTE: VAT to be excluded from all calculations

C. Imported by a 3rd party and supplied to the Tenderer				Calculation of imported content						Summary	
Description of imported content	Unit of measure	Local supplier	Overseas supplier	Foreign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to port of entity	All locally incurred landing costs & duties	Total landed cost	Quantity imported	Total imported value
(D33)	*(D34)*	*(D35)*	*(D36)*	*(D37)*	*(D38)*	*(D39)*	*(D40)*	*(D41)*	*(D426)*	*(D43)*	*(D44)*
										(D45) Total imported value by 3rd party	

D. Other foreign currency payments			Calculation of imported content		Summary of Payments
Type of payment	Local supplier making the payment	Overseas beneficiary	Foreign currency value paid	Tender rate of exchange	Local value of payments
(D46)	*(D47)*	*(D48)*	*(D49)*	*(D50)*	*(D51)*
				(D52) Total of foreign currency payments declared by tenderer and/or 3rd party	
				(D53) Total of imported content and foreign currency payments – (D32), D45) and D52) above	

SIGNATURE OF TENDERER AS PER LOCAL CONTENT DECLARATION

DATE

This total must correspond with Annex C – (C23)

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Annex E

Local Content Declaration – Supporting Schedule to Annex C

(E1)	Tender No.:	T60/2021	Note: VAT to be excluded from all calculations
(E2)	Tender description:	CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK	
(E3)	Designated products:	*As specified on T2 page 42	
(E4	Tender Authority:	Langeberg Municipality	
(E5)	Tendering Entity name:		

Local Products (Goods, Services and Works)	Description of items purchased	Local suppliers	Value
	E6	(E7)	(E8)
	(E9) Total local products (Goods, Services and Works)		R

(E10)	Manpower costs	(Tenderer's manpower cost)	R
(E11)	Factory overheads	(Rental, depreciation & amortisation, utility costs, consumables etc.)	R
(E12)	Administration overheads and mark-up	(Marketing, insurance, financing, interest etc.)	R
		(E13) Total local content	R

This total must correspond with Annex C – C24

Signature of tenderer from Annex B

_____

Date: _____

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PART A: RESPONSIVENESS AND EVALUATION CRITERIA
1. RESPONSIVENESS CRITERIA

No bid will be considered by Langeberg Municipality unless it meets the following responsiveness criteria (for the bid to be considered responsive, the bid must meet the following requirements):

a) Bidders must ensure that they are registered on the database of Langeberg Municipality, if they wish to conduct business with the Langeberg Municipality. If the bidder is not registered on the Langeberg Municipality's supplier database prior to the award of the bid, the registration form can be obtained as follows:
   i. Supply Chain Management Unit, 28 Main Road, Ashton, 6715

b) Langeberg Municipality will reject a bid in terms of the following:
   i) If any municipal rates and taxes or municipal service charges owed by the bidder or any of its directors to this of any other municipality or municipal entity, are in arrears for more than three months.
   ii) The name of the company of any of its director(s) names appear on the list of Tender Defaulters or restricted suppliers as published by National Treasury.

c) The following completed documents must be submitted or provided as part of the bid submission:
   i) Valid tax clearance certificate (MBD 2). A trust, consortium or joint venture must submit individual tax clearance certificates for each company.
   ii) Copy or Certified valid B-BBEE Status Level Verification Certificate. Bidders who do not submit a B-BBEE Status Level Verification Certificate or are non-compliant contributors to B-BBEE do not qualify for preference points for B-BBEE, but will not be disqualified from the bidding process. A trust, consortium or joint venture must submit a consolidated B-BBEE Status Level Verification certificate for every separate bid.
   iii) Copy of a billing account of your local municipality for the company or directors where applicable. Such account must not be older than 30 days.
   iv) Completed and signed declaration of interest form (MBD 4).

d) Bidders must acquaint themselves fully on the General Conditions of contract and special conditions of contract (if applicable).

e) No bids will be accepted unless the bid documentation as issued by the municipality is utilised.

f) No telephonic, faxed or e-mailed or late bids will be accepted.

g) The awarding of this bid is subject to the following:
   i) Relevant technical specifications / scope of works as stated in this bid document;
   ii) Attendance of compulsory site or clarification meetings, if applicable;
   iii) Attaining the minimum points for functionality, if applicable;
   iv) Proper completion of this bid document and signing of declarations;
   v) General conditions of contract that applies for this bid;
   vi) Valid tax clearance certificate on the date of award;
   vii) Any special conditions of contract as stipulated in this bid document.

h) Persons aggrieved by decisions or actions taken in the implementation of this supply chain management system, may lodge within 14 days of the decision or action, a written objection or complaint against the decision or action.

i) **Inducements, rewards, gifts and favours to municipalities, officials and other role players**
   i) No person who is a provider or prospective provider of goods or services, or a recipient or prospective recipient of goods disposed or to be disposed of may either directly or through a representation intermediary promise, offer or grant any inducement or reward to the Langeberg Municipality for or in connection with the award of a contract;

   ii) The accounting officer must promptly report any alleged contravention of subparagraph (1) to the National Treasury for considering whether the offending person, and any representative or intermediary through which such person is alleged to have acted, should be listed in the National Treasury's database of persons prohibited from doing business with the public sector.

j) The bid must be properly received in a sealed envelope. The outside of the envelope must clearly indicate the quotation number and title (refer to invitation to bid for further details regarding submission)

k) The bid must be deposited in the relevant quotation box as indicated in the invitation to bid (MBD1) on or before the closing date and time of the bid. **Telephonic, facsimile, electronic/ emailed and late bids will not be accepted.**

l) Bids shall be declare invalid, and shall be endorsed and recorded as such in the bid opening record by the responsible official to open the bid, in the following instances:
   i. If the bid is not sealed;
   ii. if the bid including the bid price amount, where applicable is not submitted on the official pricing schedule;

iii. if the bid is not completed in non-erasable ink; or
iv. if the name of the bidder is not stated, or is indecipherable

m) A bid will not be invalidated if the amount in words and the amount in figures do not correspond, in which case the amount in words shall be read out at the bid opening and shall be deemed to be the bid amount.

n) The official bid document must be fully completed in indelible ink. Where information requested does not apply to the bidder and the space is left blank, the bidder must provide written clarification.

o) All requested relevant and/ or additional documentation such as compliance certificates, professional registration, artisan qualification, etc., must be attached behind the bid document.

p) Bidders must submit a certified statement signed by the bidder declaring 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 90 days.

q) The bidder must be in good standing to do business with the public sector in terms of Regulation 38 of the Municipal Supply Chain Management Regulations (Government Gazette 27636 of 30 May 2005).

r) If the entity submitting a bid is a joint venture or consortium or partnership, each party to that formation must submit all the above information.

s) The bidder must adhere to the pricing instructions. **All prices must be exclusive of Value Added Tax stated in the bill of quantities. Value Added Tax will be added at the end of the schedule.**

t) The Bidder's details must be provided.

u) The necessary document authorising the representative to sign and submit the bid on the bidder's behalf must be completed and signed.

v) The declaration of interest by the bidder must be completed and signed.

w) The bid must comply with all the minimum technical specifications.

x) The MBD 9 (certificate of bid determination) must be completed and signed.

y) Alternative offers may be submitted by the bidder. The municipality is under no obligation to accept alternative offers.

2. EVALUATION OF BIDS

a) All bids received shall be evaluated in terms of the Municipal Supply Chain Management Regulations, the Preferential Procurement Policy Framework Act no 5 of 2000 and the Preferential Procurement Regulations of 2017
b) The municipality reserves the right to accept all, some, or none of the bids submitted — either wholly or in part — and it is not obligated to accept the lowest bid.
c) In terms of Regulation 11 of the Preferential Procurement Regulations 2017, a contract may be awarded to a tenderer that did not score the highest points, only in accordance with section 2(1)(f) of the Preferential Procurement Policy Framework Act (Act no 5 of 2000) and Regulation 11 of the Preferential Procurement Regulations 2017.

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Part C1: Agreements and Contract Data

C1.1 Form of Offer and Acceptance (Agreement)
C1.2 Contract Data
C1.3 Form of Guarantee
C1.4 Occupational Health and Safety Agreement

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FORM OF OFFER AND ACCEPTANCE

(Contract Agreement)

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

CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PIPEWORK

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 Tendered, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance (hereinafter the "Contract Agreement"), the Tenderer 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 the 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 Contract Agreement and returning one fully completed original copy of this Contract Agreement to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

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For the Tenderer:

Signature: ....

Name: ....

Capacity: .....

Name and address of organization:

(Name and address of organization/ tenderer) . . . . . .

. . . . . .

. . . . . .

Signature and name of witness:

Signature:.....

Name: .....

Date: .....

Acceptance

By signing this part of this Contract Agreement, the Employer identified below accepts the Tenderer'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 Tenderer's offer shall form agreement binding Contract between the Employer and the Tenderer upon the terms and conditions contained in this Contract Agreement and in the Contract that is the subject of this Contract Agreement.

The terms of the Contract are contained in:

Part C1: Contract Agreements and Contract Data
Part C2: Pricing Data
Part C3: Scope of Work
Part C4: Site Information
Part C5: Health and Safety Specification
Part C6: Drawings

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

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

For the Employer:

Signature(s) . . .

Schedule of Deviations

Notes:

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

2. A Tenderer'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 arises 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.

4. Any change or addition to the tender documents arising from the above agreements 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 . . . . . .
. . . . . .
. . . . . .

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By the duly authorized representatives signing this Schedule of Deviations, the Employer and the Tenderer 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 changes to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

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

For the Tenderer:

Signature(s) . . . . . .

Name(s) . . . . . .

Capacity . . . . . .

(Name and address of organization/ tenderer) . . . . . .

Name and signature of witness . . . . . Date . . . . . .

For the Employer:

Signature(s) . . . . . .

Name(s) . . . . . .

Capacity . . . . . .

(Name and address of organization) LANGEBERG MUNICIPALITY. . . . . .

Name and signature of witness . . . . . Date . . . . . .

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CONFIRMATION OF RECEIPT

The Tenderer, (now Contractor), identified in the Offer part of this Agreement hereby confirms receipt from the Employer, identified in the Acceptance part of this Agreement, of one fully completed original copy of this Agreement, including the Schedule of Deviations (if any) today:

the.....(day)

of .....(month)

20.....(year)

at .....(place)

For the Contractor:

.....
Signature

.....
Name

.....
Capacity

Signature and name of witness:

.....
Signature

.....
Name

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C1.2 Contract Data

Part 1: Contract Data provided by the Employer

GENERAL CONDITIONS OF CONTRACT

The following standardized General Conditions of Contract:

General Conditions of Contract for Construction Works (Third Edition) 2015

Prepared by the South African Institution of Civil Employer's Agenting (SAICE) shall apply to and from the General Conditions of Contract for this Contract. Copies of these conditions of contract are obtainable from the South African Institution of Civil Employer's Agenting (SAICE), Private Bag X200, Halfway House 1685, Tel: (011) 805 5947, Fax: (011) 805 5971, e-mail: civilinfo@saice.org.za.

Copies of the General Conditions of Contract are available for inspection and scrutiny at the offices of the Employer.

The General Conditions of Contract make several references to the Contract Data for specific data, which together with these conditions collectively describe the risks, liabilities and obligations of the contracting parties and the procedures for the administration of the Contract. The Contract Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the General Conditions of Contract. Each item of data given below is cross-referenced to the clause in the General Conditions of Contract to which it mainly applies.

The General Conditions of Contract shall be read in conjunction with the variations, amendments and additions set out in the Special Conditions of Contract below.

In the event of any discrepancy and/or ambiguity in the Contract, the following precedence will govern (priority in order from highest to lowest):

1. Contract Data
2. Project Specifications
3. Drawings
4. Bill of Quantities

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1.2.1 SPECIAL CONDITIONS OF CONTRACT

In this regard, the Standard Conditions of Contract – GCC 2015 is amended by the numbered clauses set out below, as follows:

(i) where the Standard Conditions of Contract – GCC 2015 contains no provision with the corresponding clause number, the clause set out herein is inserted into the Contract; and
(ii) where the Standard Conditions of Contract – GCC 2015 contains a provision with the corresponding clause number, it is amended, as set out herein.

Save as amended in terms of this document, the provisions of the Standard Conditions of Contract – GCC 2015 shall remain unchanged.

1.1 Definitions

1.1.1.1 "agreed" means agreed by the Employer and the Contractor; or the Employer's Agent and the Contractor expressly authorised in terms of the Contract, unless specifically stated otherwise.

1.1.1.5 "Commencement Date" means the date that the Contract, made in terms of the Form of Offer and Acceptance, comes into effect by signing the Acceptance part and returning one fully completed original copy of this document, the Contract Agreement.

1.1.1.7 "Contract" means the documentation of the agreement between the parties in terms of the Form of Offer and Acceptance, and such written amendments or additions to the Contract as may be agreed and signed by both parties.

1.1.1.13 "Defects Liability Period" means the period stated in the Contract Data, commencing from the issue of the Certificate of Completion or Certificates of Completion in the event of more than one Certificate of Completion having been issued for different portions of the Works, during which the Contractor has both the right and the obligation to make good defects in the materials, Plant and workmanship covered by the Contract.

1.1.1.16 "Employer's Agents" means the person named as the Employers' Agent in the Contract Data, or any other person appointed from time to time by the Employer, and of whom the Contractors is notified, in writing, to act as the Employers Agent for the purposes of the Contract as substitute for the Employer's Agent so named. In terms of this Contract the term "Employers Agent" will mean to be "Engineer" and vice versa.

1.1.1.14 "Due Completion Date" means the date or dates of the expiry of the time stated in the Contract Data for achieving Practical Completion for the whole or portions of the Works, calculated from the Commencement Date and as adjusted by such extensions of time or acceleration as may be allowed or agreed in terms of Contract.

1.1.1.20 "Form of Offer and Acceptance" means the document defined as the Contract Agreement that formalises the legal process of offer and acceptance and gives rise to the Contract.

1.1.1.35 **"**parties**"** means the Contractor and the Employer.

1.1.1.36 "approved programme" means the latest programme submitted by the Contractor and approved by the Employer's Agent. The latest programme approved by the Employer's Agent supersedes previous approved programmes.

1.2 Interpretations

1.2.1 Any written communication between the parties shall have been duly delivered if:
1.2.1.1 Handed to the addressee or to his duly authorise agent; or
1.2.1.2 Delivered at the address of the addressee as stated in the Contract Data, including an e-mail address; and
1.2.1.3 Any notice or claim required in accordance with this Contract shall be communicated separately from other communications, on a separate cover with specific reference to the clause in terms of which the communication was made
Provided that the Employer, Employer's Agent and Contractor shall be entitled, by written notice to each other, to change their said addresses.

1.2.6 Any act or communication, including but not limited to "accept, agree, appoint, approve, certify, decide, delegate, dispute, elect, grant, inform, instruct, issue, notice, object, order, record, refuse, request, require, state, dispute, call for" and their derivatives indicate an act to be carried out in writing.

1.4 Non Variation Clause

1.4.1 This Contract is the entire contract between the parties regarding the matters addressed in this Contract. No representations, terms, conditions or warranties not contained in this Contract shall be binding on the parties. No agreement or addendum varying, adding to, deleting or terminating this Contract including this clause shall be effective unless reduced to writing and signed by both parties.

2.4 Ambiguity or discrepancy

2.4.2 If compliance with any such instruction shall result in delay to Practical Completion and/or the incurrence of proven additional cost the Contractor shall be entitled to make a claim in accordance with Clause 10.1 as read with Clause 6.3.

2.5 Assignment

2.5.1 Neither the Contractor nor the Employer shall, without the written consent of the other, assign the Contract or any part thereof, or any obligation under the Contract, or cede any right or benefit thereunder. Such assignment or cession shall be null and void without the other parties consent.

3.1 Qualifications of the Employer's Agent

3.1.1 The natural person appointed by the Employer to administer the Contract shall be a registered professional in a built environment profession that is appropriate to the Scope of Work.

3.2 Functions of the Employer's Agent

3.2.1 The function of the Employer's Agent is to administer the Contract in accordance with the provisions of the Contract.

4.1 Extent of obligations and liability

4.1.1 The Contractor shall, save insofar as it is legally or physically impossible, design (to the extent provided in the Contract Data), execute and complete the Works and obligations remedy any defects therein in accordance with the provisions of the Contract.

4.1.2 Where the Contract Data provides that part of the Works shall be designed by the Contractor,

4.1.2.1 the relevant part of the Works shall be fit for such purposes for which it is intended as are specified in the Contract, and

4.1.2.2 the Contractor shall, notwithstanding approval by the Employer's Agent, be liable for any error or deficiency in any drawing or document supplied by him for that part of the Works, and for any loss or damage arising out of such error or deficiency.

4.1.2.3 the Contractor shall submit to the Employer's Agent the "as-built" documents and operation and maintenance manuals in accordance with the Scope of Works and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of issuing a Certificate of Practical Completion in terms of Clause 5.14.1 as read with the relevant Contract data until these documents and manuals have been submitted to the Employer's Agent.

4.1.4 The Contractor indemnifies the Employer against any liability for any breach of the provisions of Clause 4.1.

4.2 Employer's Agent's instructions

4.2.3 Should the Contractor fail to proceed with due diligence with any Employer's Agent's instruction, the Employer's Agent may notify the Contractor to proceed within 7 days from receipt of such notice. Without further notice, on default by the Contractor, the Employer may employ other parties or use its own resources to give effect to such instruction in addition to any other rights that the Employer may have inter alia in terms of Clause 9.2.1.3.6. The Employer may recover such costs from the Contractor resulting from same.

4.3 Legal provisions

4.3.3 The Employer and the Contractor shall enter into an agreement required for the construction of the Works in terms of the provisions of Section 37(2) of the Occupational Health and Safety Act (Act 85 of 1993) and the latest Construction Regulations promulgated thereunder.

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4.12 Contractors Superintendence

4.12.2 The Contractor, or a competent and authorized agent or representative approved in writing by the Employers Agent (which approval may at any time be withdrawn in writing), hereinafter called the Construction Manager, shall be on site at all times when work is being performed, or when the Employers Agent shall, with reason, require his presence. The Construction Manager must be in possession of the following:
a) NQF level 5 for labour intensive construction methods.
b) Completed at least 5 projects by means of labour intensive construction.
c) Minimum ND Civil qualification.

The Contractor shall only employ persons with the minimum number years applicable experience as shown below for the execution of work on this Contract : (Years experience after obtaining qualifications)

Contract Manager	-	minimum 7 years applicable experience
Construction Manager	-	minimum 5 years applicable experience
General Foreman	-	minimum 3 years applicable experience
Surveyor	-	minimum 3 years applicable experience
All other key personnel	-	minimum 3 years applicable experience

5.3 Commencement of the Works

5.3.1 Upon the Employer's Agent's instruction the Contractor shall, save as may be otherwise provided in the Contract or be legally or physically impossible, commence executing the Works. Such instruction shall be subject to the submission by the Contractor, and approval by the Employer, of documentation required before commencement with Works execution, as set out in the Contract Data.

5.3.3 If the Employer's Agent's instruction to commence executing the Works, or to resubmit documentation with reasons after having found to be unacceptable by the Employer, is not received by the Contractor within 7 days from the actual date of the submission of all the documentation referred to in Clause 5.3.1, commencement of the Works shall be taken to be on the expiry of such 7 days. However, deemed commencement of the Works shall not be construed as approval of the documentation submitted.

5.4 Access to Site

5.4.3 If the Contractor suffers delay to Practical Completion and/or incurs proven additional cost from failure of the Employer to give access to or possession in accordance with the terms of this Clause, the Contractor shall be entitled to make a claim in accordance with Clause 10.1, for which purpose the time limits of 28 days provided in Clause 10.1.1.1 shall commence to run only from the time when access to or possession of the Site has actually been given.

5.6 Programme

5.6.1 The Contractor shall deliver to the Employer's Agent as part the documentation required before commencement with Works execution in accordance with Clause 5.3.1, an initial programme and method statement for carrying out the Works in order to meet the Due Completion Date.

5.6.2 The initial programme and all subsequent adjusted programmes shall show and, when relevant, describe in method statements, the entire scope of the Works to be performed including but not limited to:

5.6.2.1 The Commencement Date, commencement of the Works, Due Completion Date(s) or revisions thereof, and the planned date(s) of Practical Completion for the Works as a whole or in respect of different portions of the Works.
5.6.2.8 Health and safety requirements
5.6.2.9 Critical path including the links between all predecessors and successors for activities on the critical path

5.6.3 The Employer's Agent shall, within 7 days after the Contractor has submitted an initial or adjusted programme, approve such programme or rejecting same with reasons and instruct the Contractor to amend such programme. Reasons for rejecting a programme are *inter alia* that it is not in accordance with the Contract or is not reflecting the actual progress. The Employer's Agents failure to approve or reject with reasons the submitted programme,

5.6.3.1 in the event of the submitted programme being an adjusted programme, shall be considered to be the approved programme; and
5.6.3.2 in the event of the submitted programme being an initial programme, shall not be considered to be the approved programme. However, the Contractor shall have the right to suspend the Works in terms of Clause 5.11.1.3 and if the Contractor suffers delay to Practical Completion and/or incurs proven additional cost from such suspension, the Contractor shall be entitled to make a claim in accordance with Clause 10.1.

5.6.4 The programme, method statement and the cash flow forecast shall be subject to updates and review on a monthly basis. The Contractor shall deliver to the Employer's Agent an adjusted programme reflecting actual progress and updated dates in accordance with Clause 5.6.2, even though it may reflects that the planned date(s) of Practical Completion will be later than the corresponding Due Completion Date(s), every month, and in addition;

5.6.4.1 when instructed by the Employer's Agent,
5.6.4.2 when it no longer reflects the actual progress,
5.6.4.3 when a specific event, circumstance, act or omission may delay the execution of the Works, or
5.6.4.4 with each extension of time claim

5.6.5 The submission to and approval by the Employer's Agent of any programme, method statement and/or cash flow forecast or its adjustments, or the delivery of any other relevant particulars, shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

5.7 Progress of the Works

5.7.3 The Employer's Agent may request the Contractor to submit, or the Contractor may submit to the Employer's Agent, a revised programme and cost determined in accordance with Clause 6.4 for accelerating the rate of progress to achieve Practical Completion before the Due Completion Date. If accepted by the Employer, the adjusted Due Completion Date and the conditions for payment of cost shall be agreed in writing and signed by the parties.

5.9 Instructions

5.9.3 The Contractor shall give adequate written notice to the Employer's Agent of any instructions or drawings, which the Contractor may require for the execution of the Works and the Employer's Agent shall deliver such instructions and/or drawings to the Contractor. The notice shall include details of the necessary drawing or instruction, details of by when it should be issued, and details of the nature and amount of the delay likely to be suffered if it is late.

5.11 Suspension of the Works

5.11.1 The Contractor may, after giving fourteen (14) days written notice to the Employer, with a copy to the Employer's Agent, (with specific reference to this Clause) suspend the progress of the Works where the Employer has failed in terms of Clause 6.10.4 to:

5.11.1.1 Deliver a payment certificate, or
5.11.1.2 Make full payment of the amount certified in the payment certificate without prejudice to the Contractor's other rights under this Contract or by law, or
5.11.1.3 Failed to approve an initial programme in terms of Clause 5.6.3.2

5.12 Extension of the time for Practical Completion

5.12.1 If circumstances of any kind whatsoever which occurred be such as fairly entitle the Contractor to an extension of time and will actually delay Practical Completion of the Works beyond the Due Completion Date, the Contractor shall claim in accordance with Clause 10.1 such extension of time as is appropriate. Such extension of time shall take into account any special non-working days and all relevant circumstances, including concurrent delays or savings of time which might apply in respect of such claim and the Due Completion Date will be revised accordingly.

5.12.2.2 No extension of time will be granted in respect of any delays attributed to normal climatic conditions. Normal climatic conditions shall be deemed to include normal rainfall and associated wet conditions and materials, strong winds and extremes of temperature. However, in the event that delays to critical activities exceed the number of working days listed below cumulatively for the construction period, then abnormal climatic conditions shall be deemed to exist, and an extension of time may be claimed in accordance with the provisions of Clause 5.12.

The cumulative days for normal climatic conditions must be indicated on the initial programme as a single bar item/activity and as the immediate predecessor to Practical Completion and on the critical path of the programme. The normal climatic conditions will be recorded on the specific days, as and when they occur. Should the days listed below for normal climatic conditions not be used, the days, will become float in terms of Clause 5.6.2 of the GCC 2015 (3rd Edition). The float shall belong to the project and shall only be taken up on prior approval by the Employers Agent.

The number of days quoted below shall be regarded as a fair estimate of the delays to be anticipated and allowed for under normal climatic conditions where inclement weather prevents or disrupts critical work.

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January	2 days
February	3days
March	4 days
April	4 days
May	4 days
June	5 days
July	5 days
August	4 days
September	4 days
October	3 days
November	2 days
December	2 days

Claims for delays for abnormal climatic conditions shall be accompanied by substantiating facts and evidence, which shall be submitted timeously as each day or half-day delay is experienced.

It shall be further noted that where the critical path is not affected, no extension of time for abnormal climatic conditions or for any other reason will be entertained.

5.12.2.5 Any delay, impediment, or prevention caused by or attributable to the Employer, Employer's Agent, the Employer's personnel or the Employer's other contractor's on the Site.

5.12.4 Instead of granting extension of time, if feasible, the Employer's Agent may request the Contractor to accelerate the rate of progress to achieve Practical Completion without extension of time and agree the cost for payment of such acceleration in accordance with Clause 5.7.3.

5.13 Penalties for delay

5.13.2.1 Refer to 1.2.2 Contract specific data.

5.14 Completion

5.14.1 Save as otherwise provided in the Contract, the Contractor shall be entitled to receive a Certificate of Practical Completion when the Works have reached Practical Completion.

When the Works are about to reach the said stage, the Contractor shall, in writing, request a Certificate of Practical Completion and the Employer's Agent shall, within 14 days after receiving such request, either where the Works;

5.14.1.1 has reached Practical Completion issue a Certificate of Practical Completion to the Contractor and to the Employer or
5.14.1.2 has not reached Practical Completion, issue a written list to the Contractor defining the incomplete work and defects to be rectified to achieve Practical Completion.

Should the Employer's Agent not issue a Certificate of Practical Completion or such a list within the 14 days, Practical Completion shall be considered to have been achieved on the expiry of the 14 days of the written request in terms of Clause 5.14.1.

5.14.2 As soon as the work referred to in the list issued in terms of Clause 5.14.1 has been duly completed and defects that manifested after the list was issued rectified, the Employer's Agent shall deliver to the Contractor and to the Employer a Certificate of Practical Completion together with a further written list setting out the work to be completed to justify the issuing of a Certificate of Completion.

5.14.6 The Employer need not occupy the Works before the Due Completion Date

5.14.7 If, in terms of the Contract Data stated for Clause 1.1.1.14, different times for achieving Practical Completion are specified in respect of different portions of the Works, the provisions for the Works as a whole shall apply with necessary adjustment in respect of such portions.

6.2 Security

6.2.1 The Contractor shall deliver to the Employer, as part of the documentation required before commencement with Works execution in accordance with Clause 5.3.1, at his cost, the type of security for the due performance of the Contract, as selected in the Contract Data.

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6.2.2 If the Contractor fails to provide or maintain the security as selected in the Contract Data within the time period stated in Clause 5.3.2 or if the performance guarantee is not in accordance with the relevant pro forma performance guarantee, the Employer, in his sole discretion, may either

6.2.2.1 Hand over the Site to the Contractor and withhold payment from the Contractor until the amount withheld is equal to ten per cent (10%) of the Contract Price. Such amount shall be reduced to five per cent (5%) of the Contract Price when the Employer's Agent has issued a Certificate of Completion [5.14.4] and to zero per cent (0%) in the Final Payment Certificate [6.10.9] or

6.2.2.2 Terminate this Contract in terms of Clause 5.3.2 as read with Clause 9.2.1.3.2.

6.2.3 If the Contractor is to provide a performance guarantee as security, he shall ensure that it remains valid and enforceable until the Final Approval Certificate is issued. The performance guarantee shall specify an expiry date, and if the Contractor has not become entitled to receive the Final Approval Certificate of the Works by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the performance guarantee until such time that work have been completed and any defects have been remedied.

6.7 Measurement of the Works

6..7.3.1 The Construction Manager identified in terms of Clause 4.12.2 will attend to assist the Employer's Agent in making such measurement, or to make such measurement in the presence of the Employer's Agent. Should the Construction Manager fail to attend, Clause 6.7.4.2 will apply.

6.8 Adjustment in rates and/or prices

6.8.2 The Contract Price shall **not** be subject to any contract price adjustment and the rates and prices tendered in the bill of quantities shall be final and binding throughout the period of the Contract.

Notwithstanding the above, if special materials are specified in the Contract Data then the provisions of Clause 6.8.3 of the General Conditions of Contract shall apply to such special materials.

Furthermore if, as a result of any extension of time granted, the duration of the contract period exceeds one year, the contract will automatically be subject to contract price adjustment for that period by which the extended contract period exceeds such one year.

Where applicable, in terms of the foregoing, the value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule with the following values:

The value of "x" is 0,15.

The values of the coefficients are:
a = 0,20 b = 0,25 c = 0,50 d = 0,05

The base month is the eleventh month after the Commencement Date of the Contract.

In addition, the Contract Price Adjustment Schedule shall be amended as follows:

"L" is the "Labour Index" and shall be the Consumer Price Index (CPI per Province) for the National Province wherein the larger part of the Site is located, as published in the Statistical News Release, P0141 Table A of Statistics South Africa.

"P" is the "Plant Index" and shall be the Producer Price Index for Civil engineering plant as published in the Statistical News Release P0142.1, Table 12 of Statistics South Africa.

"M" is the "Materials Index" and shall be the Producer Price Index for materials for Building and construction – Civil engineering as published in the Statistical News Release P0142.1, Table 11 of Statistics South Africa.

"F" is the "Fuel Index" and shall be the Producer Price Index for Diesel at wholesale level – Coast as published in the Statistical News Release P0142.1, Table 12 of Statistics South Africa.

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6.10 Payment

6.10.1 With regard to all amounts that become due to the Contractor in respect of the matters set out in Clauses 6.10.1.1,6.10.1.2,6.10.1.3,6.10.1.4, and 6.10.1.5 below, the Contractor shall deliver to the Employer's Agent a monthly statement for payment of all amounts he considers to be due to him (in such form and on such date as may be agreed between the Contractor and the Employer's Agent, or failing agreement, as the Employer's Agent may require) and the Employer's Agent shall, by signed payment certificates issued to the Employer and the Contractor, certify the amount he considers to be due to the Contractor or the Employer, taking into account the following:

6.10.1.5 The value up to the percentage limit stated in the Contract Data of Plant and materials referred to in Clause 6.9.1 not yet built into the Permanent Works. No payment will be made for any Plant and/or materials off site, except if expressly agreed otherwise;

Provided that the Contractor has produced documentary evidence of ownership of such Plant and/or materials and has delivered to the Employer an indemnity, approved in writing by the Employer, against any claim to or in respect of such Plant and/or materials by reason of the Contractor's sequestration or liquidation, or of any defect in the Contractor's title to the Plant and/or materials.

6.10.4 The Employer's Agent shall deliver to the Employer and the Contractor the payment certificate referred to in Clause 6.10.1 within 7 days of the receipt by the Employer's Agent of the Contractor's said statement. The Employer's Agent shall not be relieved from its responsibility to issue a payment certificate whether or not the Contractor submits the said statement. Any dissatisfaction in respect of such payment certificate shall be dealt with in terms of Clause 10.2. The Employer or the Contractor, as the case may be, shall pay the amount due to the other within 28 days of receipt by the Employer and the Contractor of the payment certificate signed by the Employer's Agent. Payment shall be subject to the Contractor or the Employer, as the case may be, submitting a tax invoice, if required by law, to the other party for the amount due.

6.10.8 Within 14 days of the date of the Certificate of Completion, the Contractor shall deliver to the Employer's Agent a completion statement showing the value of work done in respect of which a Certificate of Completion has been issued and shall supply such further information as the Employer's Agent may reasonably require. The Contractor shall not be entitled to any payment in respect of any matter which has not been included in such completion statement save as provided for in Clauses 5.14, 7.7 and 7.8 in respect of work executed during the Defects Liability Period and/or Clauses 10.3 to 10.11 in respect of any dispute. The Employer's Agent shall deliver to the Employer and the Contractor the payment certificate in respect of the completion referred to above within 14 days of the receipt by the Employer's Agent of the Contractor's said statement, and the Employer or the Contractor, as the case may be, shall pay the amount due to the other party within 28 days after receipt by the Employer and the Contractor of the payment certificate signed by the Employer's Agent.

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6.10.9 Within 14 days of the date of final approval as stated in the Final Approval Certificate, the Contractor shall deliver to the Employer's Agent a final statement claiming final settlement of all moneys due to him (save in respect of matters in dispute, in terms of Clauses 10.3 to 10.11, and not yet resolved). The Employer's Agent shall within 14 days issue to the Employer and the Contractor a Final Payment Certificate, the amount of which shall be paid to the Contractor or the Employer, as the case may be, within 28 days of the date of such certificate, after which no further payments shall be due to the Contractor (save in respect of matters in dispute, in terms of Clauses 10.3 to 10.11 and not yet resolved).

8.6 Insurances

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:

(a) Insurance of Construction Equipment (including tools, offices and other temporary structures and contents) and other things (except those intended for incorporation into the Works) brought onto the site for a sum sufficient to provide for their replacement.

(b) Insurance in terms of the provisions of the Compensation for Occupational injuries and Diseases Act No. 130 of 1993.

(c) Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger Liability Indemnity.

(d) Where the contract involves manufacturing and/or fabrication of the works or part thereof at premises other than the Site, the Contractor shall satisfy the Employer that all materials and equipment for incorporation in the works are adequately insured during manufacture and/or fabrication. In the event of the Employer having an insurable interest in such works during manufacture or fabrication then such interest shall be noted by endorsement to the Contractor's Policies of Insurance.

9.2 Termination by Employer

9.2.1.3.2 Has failed, in terms of Clause 5.3.2, to submit documentation in time, or to submit acceptable documentation, or to maintain and extend the validity of the performance guarantee until the Certificate of Completion; or

9.2.1.3.6 Is not executing the Works in accordance with the Contract, or is neglecting or failing to carry out his obligations under the Contract, *inter alia* to comply with any instruction under Clause 4.2; or

10.1 Contractor's Claim

10.1.1 The following provisions shall apply to any claim by the Contractor for an extension of time for Practical Completion of the Works in terms of Clause 5.12, or in terms of any Clause that refers to Clause 10.1 for additional payment or compensation:

10.1.1.1 The Contractor shall within 28 days after the commencement of each circumstance, event, act or omission giving rise to such a claim, deliver to the Employer's Agent a written claim, referring to this Clause and setting out:

10.1.1.1.1 The particulars of the circumstance, event, act or omission giving rise to the claim concerned,
10.1.1.1.2 The provisions of the Contract on which he bases the claim
10.1.1.1.3 The length of the extension of time, if any, claimed and the basis of the calculation by incorporating the effects of each circumstance, event, act or omission on the critical path of an Approved Programme, indicating the delay on Practical Completion, and
10.1.1.1.4 The amount of money claimed and the basis of calculation thereof.

10.1.1.2 If, by reason of the nature and circumstances of the claim, the Contractor cannot reasonably comply with all or any of the provisions of Clause 10.1.1.1.1 to 10.1.1.1.4 to deliver a claim within the said period of 28 days, he shall:

10.1.1.2.1 within the said period of 28 days issue a further notice referring to the relevant notice in terms of Clause 10.1.2 and confirming his intention to make the claim and comply with such of the requirements of Clause 10.1.1.1.1 to 10.1.1.1.4 as he reasonably can, and
10.1.1.2.2 As soon as practicable, comply with such of the requirements of Clause 10.1.1.1.1 to 10.1.1.1.4 as have not yet been complied with.

10.1.1.3 If the circumstance, event, act or omission relating to the claim are of an ongoing nature:

10.1.1.3.1 the Contractor shall, within 14 days after the commencement of each circumstance, event, act or omission giving rise to such a claim, deliver to the Employer's Agent a written notice of his intention to submit a claim, referring to this Clause and setting out the particulars of the circumstance, event, act or omission. Provided that the additional payment or compensation or delay that occurred before 14 days prior the date on which the notice in terms of this clause was delivered, shall be deemed to be covered by the rates and/or prices set out in the Pricing Data and the time stated in the Contract Data relating to Clause 5.5.1
10.1.1.3.2 The Contractor shall, in addition to delivering the said further notice within 28 days in terms of Clause 10.1.1.2.1, each month deliver to the Employer's Agent, in writing, updated particulars required in terms of Clause 10.1.1.1.1 to 10.1.1.1.4 and, within 28 days after the end of the circumstance, event, act or omission deliver his final claim.

10.1.2 The Contractor shall issue an early warning notifying to the Employer's Agent as soon as he becomes aware of any circumstance, event, act or omission which could:

10.1.2.1 Increase the Contract Prices,
10.1.2.2 Delay Practical Completion, or
10.1.2.3 Impact on the quality or
10.1.2.4 Impair the performance of the Works in use

10.1.3.6 The Employer, the Employer's Agent and the Contractor shall not in any proceedings in accordance with Clauses 10.3 to 10.11 be entitled to give or lead evidence of or rely on any fact or circumstance not recorded in terms of this Clause.

10.1.4 If, in respect of any claim to which this Clause refers, the Contractor fails to deliver his claim within the 28 day claim period in terms of Clause 10.1.1.1 or does not deliver a further notice within the period of 28 days in terms of Clause

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10.1.1.2.1 or does not deliver his final claim within 28 days after the circumstance, event, act or omission ceased in terms of Clause 10.1.1.3.2, the Due Completion Date shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged all liability in connection with the claim.

Provided that failure by the Contractor to give an early warning notice in terms of Clause 10.1.2 which an experienced Contractor could have given, the claim shall be assessed by the Employer's Agent and the ruling in terms of Clause 10.1.5 shall be taken into account the lack of mitigation measures employed due the lack of such early warning notice.

10.1.5 Unless otherwise provided in the Contract, the Employer's Agent shall within 28 days after the Contractor has delivered his claim in terms of Clause 10.1.1, give effect to Clause 3.1.2 and deliver to the Contractor and the Employer his written and adequately reasoned ruling on the claim referring specifically to this Clause. The amount thereof, if any, allowed by the Employer's Agent shall be included to the credit of the Contractor the next payment certificate. Where the Employer's Agent fails to make a ruling within such 28 days the claim shall be deemed to be refused;

Provided that:

10.1.5.1 The said period of 28 days may be extended if so agreed between the Contractor and the Employer's Agent prior to the expiry of such 28 days, and

10.1.5.2 Any amount that has been established to the satisfaction of the Employer's Agent, before his ruling on the whole claim, shall be included to the credit of the Contractor in the next payment certificate.

10.3.1 Any dispute of whatsoever nature arising out of this Contract concerning any of the rights and/or obligations of any party thereto, either during the currency of the Contract or after the completion thereof, including any dispute as to the validity of the Contract, shall be referred to adjudication in terms of Clause 10.5. The Contractor or the Employer, hereinafter referred to as "the parties", may deliver to the other a written notice, hereinafter referred to as a "Dispute Notice", of any dispute arising out of or in connection with the Contract;

10.10.1 Nothing herein contained shall deprive the Contractor or the Employer of either party's right to institute immediate court proceedings in respect of failure by the Employer or the Contractor, as the case may be, to pay the amount of a payment certificate on its due date, or to pay any amount of retention money on its due date for payment.

10.10.3 The Adjudication Board, arbitrator and the court shall have full power to open up, review and revise any ruling, decision, order, instruction, certificate or valuation of the Employer's Agent. The Arbitrator and the court shall have full power to and to reconsider any decision by the Adjudication Board relevant to the matter in dispute, and neither party shall be limited in such proceedings before such arbitrator or court to the evidence or arguments put before the Employer's Agent for the purpose of obtaining his ruling, or the Adjudication Board for the purpose of obtaining a decision.

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1.2.2 CONTRACT SPECIFIC DATA

The following contract specific data, referring to the General Conditions of Contract for Construction Works, Third Edition, 2015, are applicable to this Contract:

	CL No	
Defects liability period	1.1.1.13	12 calendar months
Time for achieving practical completion	1.1.1.14	10 months – inclusive of the 14 day period refererred to in Clause 5.3.2 and inclusive of non working days referred to in Clause 5.8.1, but exclusive of special non-working days.
Name of Employer	1.1.1.15	Langeberg Municipality
Address, telephone and fax number of Employer	1.2.1.2	**28 Main Road, Asthon, (tel) 023 615 8000, (fax) 023 615 1563**
The Pricing Strategy	1.1.1.26	Re-measurement Contract
Health and Safety Plan	5.3.1	**Within 14 days after Commencement Date**
Initial programme	5.3.1	Within 14 days after Commencement Date
The agreement in terms of the provisions of Section 37(2) of the Occupational Health and Safety Act (no. 85 of 1993) and the Construction Regulations Promulgated there under must be signed	5.3.1	Within 14 days after Commencement Date
Time within which Performance Guarantee (Security) must be provided	5.3.1	Within 14 days after Commencement Date
Time within which Insurance must be provided	5.3.1	Within 14 days after Commencement Date
Letter of Good Standing from the Compensation Commissioner	5.3.1	Within 14 days after Commencement Date
Time to submit documentation before commencement of the Works is	5.3.2	14 days
Non-working days	5.8.1	The special non-working days are: (1) All gazetted public holidays falling outside the year end break. (2) The year end break commencing as published by SAFCEC The following conditions apply: a) No work allowed after 18:00 on weekdays. b) Working times for Saturdays are 08:00 - 14:00. c) No work allowed on Sundays, Public Holidays and year end break as published by SAFCEC. d) Approval for work outside of normal working hours to be obtained from Employer. Penalty for the transgression of above conditions is R 10 000/transgression.
Special non-working hours/days	5.8.1	The SAFCEC published industry shutdown period in December and January. All statutory holidays.
Amount of penalty for delay	5.13.1	R 10 000 per day
The requirements for achieving Practical Completions are	5.14.1	All payment items in the bill of quantities must be incorporated into the Works or as determined by the Employer's Agent.

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Latent defect period beyond the date of final Approval Certificate	5.16.3	10 Years
The Security provided by the Contractor	6.2.1	Performance guarantee of 10% of the Contract Sum plus **Retention of 10% of the value of the Works**
The percentage allowance on the net cost of materials actually used in the completed works is	6.5.1.2.3	5%
Percentage advance on materials not yet built into the Permanent Works is	6.10.1.5	80% of value of materials on site or value of the MOS Guarantee submitted and approved, whichever is the lesser amount. Proof of payment for material must be submitted (before the MOS will be certified) or alternatively a MOS guarantee may be provided (at the Contractors cost).
Limit of retention money	6.10.3	Ten percent (10%) of the contract sum
The value of Plant and materials supplied by the Employer to be included in the insurance sum is	8.6.1.1.2	**Not Required**
The amount to cover professional fees for the repairing damage and loss to be included in the Insurance sum	8.6.1.1.3	15% of the Contract Sum
Limit of indemnity or liability insurance required	8.6.1.3	R 20 000 000-00 for any single claim and the number of claims to be unlimited during the construction defects liability period
Dispute resolution	10.5.1	Ad Hoc Adjudication
The number of Adjudication Board Members to be appointed is	10.5.3	One

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Part 2: Data provided by the Contractor

Clause 1.1.1.9:
The name of the Contractor is ……

Clause 1.2.1.2:
The address of the Contractor is

Physical : Address	……	Postal : Address	……
	……		……
	……		……
	……		……
	……		……
Telephone :	……	Fax:	……
email :	……		

SIGNED ON BEHALF OF TENDERER: . . . . . .

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C1.3 Form of Guarantee

PERFORMANCE GUARANTEE

For use with the General Conditions of Contract for Construction Works, Third Edition, 2015.

GUARANTOR DETAILS AND DEFINITIONS

"Guarantor" means: .....

"Physical address: .....

"Employer" means: Langeberg Municipality.....

"Contractor" means: .....

"Engineer" means: .....

"Works" means: **CONTRACT NO. T60/2021: CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK.**

"Site" means: The site as defined in Clause 1.1.1.29 of the General Conditions of Contract.....

"Contract" means: The Agreement made in terms of the Form of Offer and Acceptance and such amendments or additions to the Contract as may be agreed in writing between the parties.

"Contract Sum" means: The accepted amount inclusive of tax of R .....

Amount in words: .....

"Guaranteed Sum" means: The maximum aggregate amount of R .....

Amount in words: .....

"Expiry Date" means: The date of issue by the Engineer of the Certificate of Completion of the Works.....

CONTRACT DETAILS

Engineer issues: Interim Payment Certificates, Final Payment Certificate and the Certificate of Completion of the Works as defined in the Contract.

PERFORMANCE GUARANTEE

1. The Guarantor's liability shall be limited to the amount of the Guaranteed Sum.

2. 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 Expiry Date or the date of issue by the Engineer of the Certificate of Completion of the Works or the date of 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.

3. The Guarantor hereby acknowledges that:

3.1 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;

3.2 its obligation under this Performance Guarantee is restricted to the payment of money.

4. Subject to the Guarantor's maximum liability referred to in 1, the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 4.1 to 4.3:

4.1 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 4.2;

4.2 A first written demand issued by the Employer to the Guarantor at the Guarantor's physical address with a copy to the Contractor stating that a period of seven (7) days has elapsed since the first written demand in terms of 4.1 and the sum certified has still not been paid;

4.3 A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum certified in 4.

5. Subject to the Guarantor's maximum liability referred to in 1, the Guarantor undertakes to pay to the Employer the Guaranteed Sum or the full outstanding balance upon receipt of a first written demand from the Employer to the Guarantor at the Guarantor's physical address calling up this Performance Guarantee, such demand stating that:

5.1 the Contract has been terminated due to the Contractor's default and that this Performance Guarantee is called up in terms of 5; or

5.2 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 5; and

5.3 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.

6. It is recorded that the aggregate amount of payments required to be made by the Guarantor in terms of 4 and 5 shall not exceed the Guarantor's maximum liability in terms of 1.

7. Where the Guarantor has made payment in terms of 5, the Employer shall upon the date of issue of the Final Payment Certificate submit an expense account to the Guarantor showing how all monies received in terms of this Performance Guarantee have been expended and shall refund to the Guarantor any resulting surplus. All monies refunded to the Guarantor in terms of this Performance Guarantee shall bear interest at the prime overdraft rate of the Employer's bank compounded monthly and calculated from the date payment was made by the Guarantor to the Employer until the date of refund.

8. Payment by the Guarantor in terms of 4 or 5 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.

9. Payment by the Guarantor in terms of 5 will only be made against the return of the original Performance Guarantee by the Employer.

10. 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.

11. The Guarantor chooses the physical address as stated above for the service of all notices for all purposes in connection herewith.

12. This Performance Guarantee is neither negotiable nor transferable and shall expire in terms of 2, where after no claims will be considered by the Guarantor. The original of this Guarantee shall be returned to the Guarantor after it has expired.

13. This Performance Guarantee, with the required demand notices in terms of 4 or 5, shall be regarded as a liquid document for the purposes of obtaining a court order.

14. Where this Performance Guarantee is issued in the Republic of South Africa the Guarantor hereby consents in terms of Section 45 of the Magistrate's Courts Act No 32 of 1944, as amended, to the jurisdiction of the Magistrate's Court of any district having jurisdiction in terms of Section 28 of the said Act, notwithstanding that the amount of t he claim may exceed the jurisdiction of the Magistrate's Court.

Signed at .....

Date .....

Guarantor's signatory (1) .....

Capacity .....

Guarantor's signatory (2) .....

Capacity .....

Witness signatory (1) .....

Witness signatory (2) .....

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ANNEXURE

LIST OF APPROVED FINANCIAL INSTITUTIONS

The following financial institutions are currently (as at 25th January 2015) approved for issue of contract guarantees to the Municipality:

National Banks:
ABSA Bank Ltd.
Development Bank of Southern Africa
FirstRand Bank Ltd.
Gensec Bank Ltd.
Investec Bank Ltd.
Land & Agricultural Bank of SA
Nedbank Ltd.
Standard Bank of SA Ltd.

International Banks (with branches in SA):
Barclays Bank plc.
Citibank n.a.
Commerzbank Aktiengesellschaft
Credit Agricole Corporate and Investment Bank
Deutsche Bank AG
HSBC Bank : Johannesburg
JP Morgan Chase Bank
Societe Generale
Standard Chartered Bank

Insurance companies:
ABSA Insurance
AIG South Africa
Coface s.a.
Compass Insurance Co.
Constantia Insurance Co.
Credit Guarantee Insurance Co.
Guardrisk Insurance Co.
Hollard Insurance Company Ltd.
Home Loan Guarantee Co.
Infiniti Insurance Limited
Lombard Insurance
Mutual & Federal Insurance Co.
New National Assurance Co.
Regent Insurance Co.
Renasa Insurance Company Ltd.
Santam Limited
Zurich Insurance Co.

LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

C1.4 Occupational Health and Safety Agreement

AGREEMENT MADE AND ENTERED INTO BETWEEN THE LANGEBERG MUNICIPALITY (HEREINAFTER CALLED THE "EMPLOYER") AND

……..……..……..……. ,
(Contractor/Mandatary/Company/CC Name)

IN TERMS OF SECTION 37(2) OF THE OCCUPATIONAL HEALTH AND SAFETY ACT, ACT No. 85 OF 1993 AS AMENDED.

I, ……..……..……..……. , representing

……..……..……..……. , as an employer
in its own right, do hereby undertake to ensure, as far as is reasonably practicable, that all work will be performed, and all equipment, machinery or plant used in such a manner as to comply with the provisions of the Occupational Health and Safety Act (OHSA) and the Regulations promulgated thereunder.

I furthermore confirm that I am/we are registered with the Compensation Commissioner and that all registration and assessment monies due to the Compensation Commissioner have been fully paid or that I/We are insured with an approved licensed compensation insurer.

COID ACT Registration Number:

OR Compensation Insurer: ..... Policy No.: .....

I undertake to appoint, where required, suitable competent persons, in writing, in terms of the requirements of OHSA and the Regulations and to charge him/them with the duty of ensuring that the provisions of OHSA and Regulations as well as the Council's Special Conditions of Contract, Way Leave, Lock-Out and Work Permit Procedures are adhered to as far as reasonably practicable.

I further undertake to ensure that any subcontractors employed by me will enter into an occupational health and safety agreement separately, and that such subcontractors comply with the conditions set.

I hereby declare that I have read and understand the appended Occupational Health and Safety Conditions and undertake to comply therewith at all times.

I hereby also undertake to comply with the Occupational Health and Safety Specification and Plan.

Signed at .....on the.....day of.....20….

LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

_____ _____
Witness **Mandatary**

Signed at ..... on the.....day of.....20 ....

_____ _____
Witness for and on behalf of
LANGEBERG MUNICIPALITY

OCCUPATIONAL HEALTH AND SAFETY CONDITIONS

1. The Chief Executive Officer of the Contractor shall assume the responsibility in terms of Section 16(1) of the Occupational Health and Safety Act (as amended). Should the Contractor assign any duty in terms of Section 16(2), a copy of such assignment shall immediately be provided to the representative of the Employer as defined in the Contract.

2. All work performed on the Employer's premises shall be performed under the supervision of the construction supervisor who understand the hazards associated with any work that the Contractor performs on the site in terms of Construction Regulations 2014.

3. The Contractor shall appoint a Competent Person who shall be trained on any occupational health and safety aspect pertaining to them or to the work that is to be performed.

4. The Contractor shall ensure that he familiarises himself with the requirements of the Occupational Health and Safety Act and that he, his employees, and any sub-contractors, comply with them.

5. Discipline in the interests of occupational health and safety shall be strictly enforced.

6. Personal protective equipment shall be issued by the Contractor as required and shall be worn at all times where necessary.

7. Written safe work procedures and appropriate precautionary measures shall be available and enforced, and all employees shall be made conversant with the contents of these practices.

8. No substandard equipment/machinery/articles or substances shall be used on the site.

9. All incidents referred to in terms of Section 24 of the Occupational Health and Safety Act shall be reported by the Contractor to the Department of Labour and the Employer.

10 The Employer hereby obtains an interest in the issue of any formal inquiry conducted in terms of Section 32 of the Occupational Health and Safety Act and into any incident involving a Contractor and/or his employees and/or his sub-contractor/s.

11. No use shall be made of any of the Employer's machinery / plant / equipment / substance / personal protective equipment or any other article without prior arrangement and written approval.

12. No alcohol or any other intoxicating substance shall be allowed on the site. Any person suspected of being under the influence of alcohol or any other intoxicating substance shall not be permitted access to, or allowed to remain on the site.

13. Prior to commencement of any work, verified copies of all documents mentioned in the agreement, must be presented to the Employer.

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Part C2: Pricing Data

C2.1 Pricing Instructions

C2.2 Bill / Schedule of Quantities

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C2.1 Pricing Instructions

1. Measurement and payment shall be in accordance with the relevant provisions of the SANS 1200 as amended in the Scope of Works.

2. The units of measurement described in the Bill of Quantities are metric units. Abbreviations used in the Bill of Quantities are as follows:

%	=	percent
h	=	hour
ha	=	hectare
kg	=	kilogram
kl	=	kilolitre
km	=	kilometre
km-pass	=	kilometre-pass
kPa	=	kilopascal
kW	=	kilowatt
l	=	litre
m	=	metre
mm	=	millimetre
m²	=	square metre
m²-pass	=	square metre-pass
m³	=	cubic metre
m³-km	=	cubic metre-kilometre
MN	=	meganewton
MN.m	=	meganewton-metre
MPa	=	megapascal
No.	=	number
Prov sum	=	Provisional sum
PC sum	=	Prime Cost sum
R/only	=	Rate only
sum	=	lump sum
t	=	ton (1000 kg)
W/day	=	Work day

3. For the purpose of the Bill of Quantities, 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 and/or Project Specifications
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 Bill of Quantities but the quantity of work of which is not measured in any units.

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

5. It will be assumed that prices included in the bills of quantities are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders. (Refer to www.stanza.org.za or www.iso.org for information on standards)

6. The prices and rates in the Bill of Quantities are to be fully inclusive prices for the work described under the several items. Such prices and rates cover all costs and expenses that may be required in and for the execution of the work described in accordance with the provisions of the Scope of Work, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the Contract Data, as well as overhead charges and profit. Reasonable prices shall be inserted as these will be used as a basis for assessment of payment for additional work that may have to be carried out.

7. Where the Scope of Work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered such items.

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8. The short descriptions of the items of payment given in the Bill of Quantities are only for the purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Scope of Work. The description may also contain the relevant specification for the specific item to be priced.

9. The item numbers appearing in the Bill of Quantities refer to the corresponding item numbers in COLTO, if applicable**.**

10. **A price or rate shall be entered against each item in the Bill / Schedule of Quantities.** Should the Tenderer not wish to make any charge in respect of an item, a rate of zero "R0.00" or "Nil" shall be entered. The Tenderer may not group a number of items together and tender one lump sum for such group of items.

    The tendered rates shall be valid irrespective of any change in the quantities during the execution of the works projects under the contract.

    No unauthorized amendment shall be made to the Schedule of Rates / Bill of Quantities or any part of the Pricing Data. If such amendment is made or if the Schedule of Rates / Bill of Quantities is not properly completed, the tender will be rejected.

11. The quantities set out in the Bill of Quantities are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due and not the quantities given in the Bill of Quantities.

12. Reasonable compensation will be received where no pay item appears in the Bill of Quantities in respect of work required in terms of the Contract and which is not covered in any other pay item.

13. Those parts of the contract to be constructed using labour-intensive methods have been marked in the Bills of Quantities with the letters L in a separate column filled in against every item so designated. The works, or parts of the works so designated are to be constructed using labour-intensive methods only. The use of plant to provide such works, other than plant specifically provided for in the scope of work, is a variation to the contract. The items marked with the letters L are not necessarily an exhaustive list of all the activities which must be done by hand, and this clause does not over-ride any of the requirements in the generic labour intensive specification in the Scope of Works.

14 Payment for items which are designated to be constructed labour-intensively (either in this schedule or in the Scope of Works) will not be made unless they are constructed using labour-intensive methods. Any unauthorised use of plant to carry out work which was to be done labour-intensively will not be condoned and any works so constructed will not be certified for payment.

15 Whether or not a PS is referenced in the payment column of the bill of quantities, and there is an amended clause in the project specifications, the price tendered will be deemed to include all relevant amended project specifications.

16 Where the project specifications amends or replaces the standard specifications, the price tendered will be deemed to be based on all the project specifications, whether a PS in referenced in the bill of quantities or not.

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C2.2 Bill of Quantities

CONTENTS

BILLS / SCHEDULES OF QUANTITIES

Section A Preliminary and General

Section B: Pipelines

Section C : Reservoir

Section D : Mechanical & Electrical (From Volume 2)

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ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
1	SABS 1200 A	**GENERAL**				
		as specified in SABS 1200 A and in the project specifications				
	8.3	FIXED CHARGES AND VALUE RELATED ITEMS				
1.1	PSA 8.3.1	Fixed preliminary and general charges	Sum	1		
1.2	PSA 8.3.2	Value related preliminary and general charges	Sum	1		
	PSA 8.3.5	Cost of survey in terms of Land Survey Act:				
1.3		Locate, record, protect and reinstate pegs	Sum	1		
	PSA 8.4	SCHEDULED TIME RELATED ITEMS				
	PSA 8.4.1	Time related preliminary and general charges :				
1.4	PSA 8.4.1.1	The contract period during the normal industry working period (outside public holidays and the industry shutdown period during December and January)	Sum	1		
1.5	PSA 8.4.1.2	Public Holidays	No	8		
1.6	PSA 8.4.1.3	SAFCEC recommended shutdown period during December and January	Sum	1		
	PSA 8.5	SUMS STATED PROVISIONALLY BY ENGINEER				
	PSA 8.5.1	Works executed by the Contractor:				
1.7		(e) The raising or lowering of water pipelines	Prov Sum	1		10,000.00
1.8		(f) Charge required by the Contractor on sub-item (e) above	x100%	10,000		
	PSA8.5.2	Work executed by local sub-contractors:				
		(1) Pump Station Building Works at Reservoir 2				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
1.9		(a) Cost of constructing pump station buildings	ProvSum	1		
1.10		(b) Charge required by Contractor on sub-item (a) above	x100%	400,000		
		(2) Upgrade of Pump Station Building at Reservoir 1				
1.11		(a) Cost of upgrading pump station building	ProvSum	1		
1.12		(b) Charge required by Contractor on sub-item (a) above	x100%	650,000		
		Works executed by Specialist Subcontractor				
		(1) Removal of existing asbestos cement roof of pump station 1				
1.13		(a) Cost of removal of asbestos roof	ProvSum	1		
1.14		(b) Charge required by contractior on sub item (a) above	x100%	100,000		
	PSA 8.6	PRIME COST SUMS				
		(1) Communication allowances:				
1.15		(a) The cost of calls in connection with contract administration and telephone and cellular telephone rental	PCSum	1		6,000.00
1.16		(b) Charge required by Contractor on sub-item (a) above	x100%	6,000		
		(2) Additional testing of materials required by Engineer:				
1.17		(a) Cost of testing	PCSum	1		10,000.00
1.18		(b) Charge required by Contractor on sub-item (a) above	x100%	10,000		
		(4) As built surveys:				
1.19		(a) Cost of as built surveys	PCSum	1		15,000.00
1.20		(b) Charge required by Contractor on sub-item (a) above	x100%	15,000		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
	PSA 8.7	DAYWORK				
	PSA 8.7.1	Dayworks:				
		(a) Vehicles, plant and equipment:				
		(3) Hydraulic excavator with bucket at least 500 mm wide				
1.21		20 Ton (> 115kW @ 1800 rmp)	h	8		
1.22		25 Ton (> 130 kW @ 2000 rmp)	h	8		
1.23		30 Ton (>145 kW @ 1800 rmp)	h	8		
1.24		(4) Loader Backhoe	h	10		
1.25		(5) Dumper (> 10m³ capacity)	h	10		
1.26		(6) Tipper truck, more than 5m³ capacity	h	5		
1.27		(8) Flat bed truck equipped with hydraulic crane of more than 2 t capacity	h	5		
		(9) Water trucks:				
1.28		(i) 12 kℓ capacity	h	20		
		(11) Compressors:				
1.29		(i) Up to 10m³/minute	h	5		
		(12) Concrete mixer:				
1.30		(ii) Over 400 l capacity	h	100		
		(13) Water pump:				
1.31		(i) 200 ℓ/min capacity @10m head	h	20		
1.32		(ii) 600 ℓ/minute capacity @ 10m head	h	20		
		Labour:				
		(a) Labour:				
1.33		(1) Labourer	h	40		
1.34		(2) Semi-skilled labourer	h	10		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
1.35		(3) Skilled labourer	h	10		
1.36		(4) Artisan	h	10		
1.37		(5) Team Leader	h	5		
1.38		(6) Foreman	h	5		
1.39		(7) Surveyor	h	10		
	PSA 8.8	TEMPORARY WORKS				
1.40	PSA 8.8.2	Accommodation of traffic	Sum	1		
	PSA 8.8.4	Location and protection of existing services:				
	PSA 8.8.4.1	Provision of detecting devices for:				
1.41		(a) Water and sewer pipes	Sum	1		
1.42		(b) Electrical and other cables	Sum	1		
	PSA 8.8.4.2	Hand excavation necessary for locating and exposing existing services in all materials:				
1.43		(a) In roadways	m³	50		
1.44		(b) In all other areas	m³	20		
	PSA 8.8.7	Dealing with water:				
1.45		(a) Dealing with subsurface water	Sum	1		
1.46		(b) Dealing with surface water	Sum	1		
	PSA 8.8.8	Temporary fence minimum 1,2 m high				
1.47		(a) 1,2 m high PVC netting or similar	m	1,500		
1.48		(b) 2.1m high Nedsteel or similar	m	500		
	PSA 8.8.9	Dismantle and re-erect temporary high fence				
1.49		(a) 1.2m high PVC netting or similar	m	800		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
1.50		(b) 2.1m high Nedsteel or similar	m	200		
1.51	PSA 8.8.10	Dust control	Sum	1		
1.52	PSA 8.10	Accommodating other Contractors	Sum	1		
1.53	PSA 8.12	Compliance with the Occupational Health and Safety Act (Act No 85 of 1993) and Construction Regulations and specifications included in the Particular Specification	Sum	1		
1.54	PSA 8.13	Compliance with the Environmental Management Plan and requirements included in the Particular Specification	Sum	1		
1.55	PSA 8.17	Photographic Record	Sum	1		
1.56	PSA 8.19	Liaison with residents and the local authority	Sum	1		
1.57	PSA 8.20	Record of test results and related administration	Sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT R
1	GENERAL	
TOTAL CARRIED FORWARD TO SUMMARY OF SCHEDULES		

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
2	SABS 1200 C	**SECTION : SITE CLEARANCE**				
		CLEAR SITE				
	PSC 8.2.1	Clear and grub:				
2.1		Sites for Pump Stations	m²	200		
		Pipeline routes				
2.2		3 m wide	m²	2,805		
	8.2.2	Remove and grub large trees and tree stumps of girth over and up to				
2.3		Over 1,0 m up to and including 2,0 m	No	1		
2.4	PSC 8.2.7	Dismantle and remove pipelines (not encased in concrete), electricity transmission lines, cables, etc.	m	10		
2.5	PSC 8.2.7	Dismantle and remove pipelines encased in concrete	m	10		
	PSC 8.2.8	Demolish and remove structures/buildings				
2.6		(a) Flow meter chamber at reservoir 1	Sum	1		
2.7	8.2.10	Remove topsoil to nominal depth of 150 mm and stockpile	m³	420		
	PSC 8.2.13	Take down and re-erect existing fences				
2.8		(a) At water treatment works	m	10		
2.9		(b) At Reservoir 2 (Beta fence)	m	10		
2.10		(c) At Reservoir 3 (Beta fence)	m	10		
2.11	PSC 8.2.15	Remove and dispose of kerbing	m	50		
2.12	PSC 8.2.17	Rip and clear tarred and paved areas	m²	460		
	PSC 8.2.18	Remove kerbs, stockpile, store, maintain and reinstate				
2.13		BK2 + C1 Channel	m	25		
2.14		BK2	m	30		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
3	SABS 1200 D	**EARTHWORKS**				
	PSD 8.3.3	Restricted Excavation for Pump Station at Reservoir 1				
		Excavate for sub level in all materials, and use for backfill or embankment, or dispose				
3.1		(a) Excavate for restricted foundations in all materials, and use for backfill or embankment, or dispose	m³	290		
		(b) Extra over item 3.1 above for:				
3.2		Intermediate excavation	m³	30		
3.3		Hard rock excavation	m³	5		
3.4	PSD 8.3.3 (c)	(c) Extra over item 8.3.3 (a) for hand excavation	m³	90		
3.5	PSD 8.3.4	Importing of materials from commercial sources and use for fill (clean sand, G7, compacted to 100% Mod AASHTO)	m³	45		
3.6	8.3.5	Extra excavation in all materials to provide working space around structure	m²	90		
3.7	8.3.7	Additional lateral support between pump station excavation and reservoir or existing pump station, if ordered	Sum	1		
	PSD 8.3.8	Existing services:				
	8.3.8.2	Dealing with services that are at risk because of the construction of earthworks:				
3.8		(a) Cables	No	5		
3.9		(c) Temporary protection of existing 200mm and 500mm dia suction pipes at existing pump station	Sum	1		
3.10	8.3.9	Extra over for backfill or fill material against structures	m³	20		
3.11	PSD 8.3.10	Topsoiling	m³	420		
3.12	PSD 8.3.16	Compaction of in situ material to a depth of 300mm	m²	55		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
4	SABS 1200 DB	**EARTHWORKS (PIPE TRENCHES)**				
		as specified in SABS 1200 DB and in the project specifications				
		PIPELINE TRENCHES				
	PSDB 8.3.2	Excavation:				
		Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		(2) Pipes over 125 mm dia up to 400 mm dia for depths:				
4.1		Up to 1,5 m	m	750		
4.2		Over 1,5 m up to 2,5 m	m	190		
	PSDB 8.3.2	(b) Extra over item (a) above for:				
4.3		(1) Intermediate excavation	m³	400		
4.4		(2) Hard rock excavation	m³	100		
		(3) Hand excavation and backfill where directed by the Employer's Agent				
4.5		(a) Soft material	m³	20		
4.6		(4) Backfill stabilized with 5% cement where directed by the Engineer	m³	5		
4.7		(5) Soilcrete backfill where directed by the Engineer	m³	5		
4.8		(6) Mass concrete Class 15 MPa/19mm encasing around pipes where directed by the Engineer	m³	5		
4.9	8.3.2	(c) Excavate and dispose of unsuitable material from trench bottom	m³	15		
	PSDB 8.3.3	Excavation ancillaries:				
	8.3.3.1	Make up deficiency in backfill material:				
4.10		(a) from other necessary excavations on site	m³	20		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
4.11		(c) by importation from commercial or off site sources selected by the Contractor (sand compacted to 100% Mod AASHTO)	m³	50		
4.12	PSDB 8.3.3.3	Compaction in road crossings	m³	50		
	PSDB 8.3.4	Particular items:				
		(a) Shore trench opposite structure or service or in restricted work space				
4.13		Depth up to 1.0m	m	50		
4.14		Over 1.0m up to 2.0m	m	50		
	8.3.5	Existing services that intersect or adjoin a pipe trench:				
		(a) Services that intersect a pipe trench:				
4.15		(1) LT electricity cables	No	5		
4.16		(2) HT electricity cables	No	5		
4.17		(3) Telkom	No	5		
4.18		(4) Watermains	No	5		
4.19		(5) Stormwater	No	5		
4.20		(6) Sewer	No	5		
		(b) Services that adjoin a trench:				
4.21		(1) Foul sewer	m	10		
4.22		(2) HT electrical cables	m	10		
4.23		(3) Watermains	m	100		
	PSDB 8.3.6	Finishing:				
	PSDB 8.3.6.1	Reinstate road surfaces complete with all courses:				
4.24		(a) Paved Roads	m²	50		
4.25		(b) Asphalt Road (Asphalt measured seperately)	m²	125		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
	PSDB 8.3.17	Testing of trench related work				
		Insitu material at trench invert. (Test up to 1,5m below invert)				
4.26		1) DCP test by Contractor	No	20		
4.27		2) DCP test by Independent laboratory	No	6		
		Bedding layer				
4.28		1) DCP test by Contractor	No	20		
4.29		2) DCP test by Independent laboratory	No	6		
4.30		3) Troxler test by independent laboratory	No	6		
4.31		4) Material classification analysis including CBR and grading analysis	No	4		
		Backfill of trenchess				
4.32		1) DCP test by Contractor	No	20		
4.33		2) DCP test by Independent laboratory	No	6		
4.34		3) Troxler test by independent laboratory	No	4		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
5	SABS 1200 G	**CONCRETE (STRUCTURAL)**				
		as specified in SABS 1200 G and in the project specifications				
	8.2	FORMWORK				
	8.2.1	Rough:				
5.1		Vertical plane for walls or foundations	m²	90		
	8.2.2	Smooth:				
		Walls:				
5.2		Internal RC walls	m²	85		
5.3		Underside of slabs with 3m prop height	m²	15		
5.4	8.2.5	Narrow widths up to 25mm x 25mm chamfers	m	50		
	8.2.6	Box out holes/form voids:				
		(a) Small, circular, of diameter up to and including 0,35 m:				
5.5		(1) 0 m to 0,5 m deep	No	2		
	8.3	REINFORCEMENT				
5.6	PSG 8.3.1	Mild steel bars:	t	0.5		
5.7		High tensile steel bars	t	6.5		
	8.4	CONCRETE				
	8.4.2	Blinding layer in 20MPa/40 mm concrete:				
		75 mm minimum thickness:				
5.8		Foundations	m²	50		
	8.4.3	Strength concrete :				
		30MPa/19 mm min structure:				
5.9		Foundations	m³	25		
5.10		Walls	m³	22		
5.11		Suspended slabs	m³	3		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
	PSG 8.4.4	Unformed surface finishes:				
5.12		(b) Steel-floated finish (see PSG 7.2):	m²	50		
	PSG 8.5	JOINTS				
		250mm wide PVC waterstop (abe or similar) with bubble in centre	m	25		
	8.7	GROUTING				
5.14		(a) Under bases (or beds)	m³	5		
	PSG 8.14	Cast in of pipes with or without puddle flanges:				
		(a) Up to 300 mm nominal bore:				
5.15		Through 250mm thick side wall of structure	No	2		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
6	SABS 1200 L	**MEDIUM PRESSURE PIPELINES**				
		PVC-U PIPES				
		as specified in SABS 1200 L and in the project specifications				
	PSL 8.2.1	Supply, lay and bed on bedding for flexible pipes, complete with couplings:				
		PVC-U Class/PN12 (SANS 966 : PART 1:2000 (PVC-U)) using spigot and socket rubber ring joints				
		Supply:				
6.1		75 mm dia	m	10		
6.2		110 mm dia	m	10		
6.3		200 mm dia	m	20		
6.4		250 mm dia	m	35		
6.5		315 mm dia	m	770		
		Lay and bed:				
6.6		25 mm dia	m	10		
6.7		100 mm dia	m	10		
6.8		200 mm dia	m	20		
6.9		250mm dia	m	35		
6.10		315 mm dia	m	770		
		HDPE PE80 Class/PN12 pipes (SANS ISO 4427 : 1996)				
		Supply:				
6.11		250 mm dia	m	100		
		Lay and Bed:				
6.12		250 mm dia	m	100		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
	8.2.2	Extra over item 8.2.1 for the supplying, laying and bedding of Ductile iron (including Plascoat PPA 571 HES coating) specials with a spigot and socket rubber ring joints complete with couplings for PVC-U pipes).				
		Supply:				
		11,25 degree bends				
6.13		315 mm dia	No	3		
		22,5 degree bends				
6.14		315 mm dia	No	3		
		45 degree bends				
6.15		250 mm dia	No	4		
6.16		315 mm dia	No	3		
		90 degree bends				
6.17		75 mm dia	No	1		
6.18		110 mm dia	No	1		
6.19		200 mm dia	No	4		
6.20		315 mm dia	No	2		
		Lay and bed:				
		11,25 degree bends				
6.21		315 mm dia	No	3		
		22,5 degree bends				
6.22		315 mm dia	No	3		
		45 degree bends				
6.23		250 mm dia	No	4		
6.24		315 mm dia	No	3		
		90 degree bends				
6.25		75 mm dia	No	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
6.26		110 mm dia	No	1		
6.27		200 mm dia	No	4		
6.28		315 mm dia	No	2		
	8.2.2	Extra over items 8.2.1 for supplying, laying and bedding of HDPE specials complete with couplings:				
		22.5 degree bends:				
		Supply:				
6.29		250 mm dia	No	1		
		Lay and bed:				
6.30		250mm dia	No	1		
		45 degree bends:				
		Supply:				
6.31		250 mm dia	No	2		
		Lay and bed:				
6.32		250 mm dia	No	2		
		90 degree bends:				
		Supply:				
6.33		250 mm dia	No	2		
		Lay and bed:				
6.34		250 mm dia	No	2		
		Tees:				
		Supply:				
6.35		250 mm dia x 250 mm dia	No	2		
		Lay and Bed:				
6.36		250 mm dia x 250 mm dia	No	2		
		Reducers:				
		Supply:				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
6.37		250 mm x 200 mm dia	No	2		
		Lay and Bed:				
6.38		250 mm x 200 mm	No	2		
		Flanged adaptors (Butt welded with stainless steel backing ring):				
		Supply:				
6.39		250 mm dia	No	4		
		Lay and Bed:				
6.40		250 mm dia	No	4		
		Extra over item 8.2.1 for the supplying, laying and bedding of mild steel flanged and carboguard 891 coated specials with gaskets, bolts and nuts complete to join with PVC-U pipes).				
		Equal tees:				
		Supply:				
6.41		110mm dia	No	1		
6.42		200 mm dia	No	6		
6.43		250 mm dia	No	2		
6.44		315 mm dia	No	1		
		Lay and bed:				
6.45		110 mm dia	No	1		
6.46		200 mm dia	No	6		
6.47		250 mm dia	No	2		
6.48		315 mm dia	No	1		
		Reducing tees:				
		Supply:				
6.49		315 mm dia x 200 mm dia	No	1		
		Lay and bed:				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
6.50		315 mm dia x 200 mm dia	No	1		
		Reducers				
		Supply:				
6.51		110 mm x 75 mm	No	2		
6.52		200 mm x 150 mm	No	2		
6.53		315mm x 200mm	No	4		
		Lay and bed:				
6.54		110 mm x 75 mm	No	2		
6.55		200 mm x 150 mm	No	2		
6.56		315mm x 200mm	No	4		
		Spool pieces up to 500mm long:				
		Supply:				
6.57		200 mm dia	No	2		
		Lay and bed:				
6.58		200 mm dia	No	2		
		Extra over item 8.2.1 for Klamflex Black dedicated flange adaptors, flange drilling to table 1600/3 or similar approved				
		Supply:				
6.59		200 mm dia	No	5		
6.60		250 mm dia	No	6		
6.61		315 mm dia	No	5		
		Lay and bed:				
6.62		200 mm dia	No	5		
6.63		250 mm dia	No	6		
6.64		315 mm dia	No	5		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
		Extra over item 8.2.1 for Klamflex black straight couplings PN12 or similar approved				
		Supply:				
6.65		75 mm dia	No	2		
6.66		110 mm dia	No	1		
6.67		150 mm dia	No	5		
6.68		200 mm dia	No	8		
6.69		250 mm dia	No	2		
6.70		315 mm dia	No	5		
		Lay and bed:				
6.71		75 mm dia	No	2		
6.72		110 mm dia	No	1		
6.73		150 mm dia	No	5		
6.74		200 mm dia	No	8		
6.75		250 mm dia	No	2		
6.76		315 mm dia	No	5		
		End caps: (PVC-U with rubber ring)				
		Supply:				
6.77		200 mm dia	No	2		
6.78		250 mm dia	No	2		
6.79		315 mm dia	No	2		
		Lay and bed:				
6.80		200 mm dia	No	2		
6.81		250 mm dia	No	2		
6.82		315 mm dia	No	2		
	PSL 8.2.3	Extra over items 8.2.1 for supplying, fixing and bedding of gate valves:				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
		Flanged gate valves (PN12)				
		Supply:				
6.83		150 mm dia	No	3		
6.84		200 mm dia	No	2		
6.85		250 mm dia	No	2		
6.86		315 mm dia	No	2		
		Lay and bed:				
6.87		150 mm dia	No	3		
6.88		200 mm dia	No	2		
6.89		250 mm dia	No	2		
6.90		315 mm dia	No	2		
		Extra over items 8.2.1 for supplying, fixing and bedding of air valves complete as shown on drawing 21108-C-205 (Chamber measured elsewhere)				
		Supply:				
6.91		315 mm dia main pipe	No	2		
		Lay and bed:				
6.92		315 mm dia main pipe	No	2		
	PSL 8.2.3	Extra over items 8.2.1 for supplying, fixing and bedding of fire hydrants including double flanged distance piece between hydrant and tee and including flanged stainless steel 304 Denso wrapped tee/reducing tee as per detail drawing W2: (Main pipe diameter scheduled) including stainless steel 316 nuts and bolts with anti-seize compound (Flange drilling to Table 1200/3)				
		Supply:				
6.93		315 mm dia	No	1		
		Lay and bed:				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
6.94		315 mm dia	No	1		
	8.2.5	Supply and place Pipes, Valves, and Specials (Short pipe runs)				
		Connection to Reservoir 2 as shown on detail Dwg 21108-C-210				
6.95		Item 1: 300mm dia AVK float ball valve	No	1		
6.96		Item 2: 300mm dia, 1000mm long puddle pipe flanged all ends	No	1		
6.97		Item 3: 300mm dia 90° bend	No	2		
6.98		Item 4: 300mm dia Klamflex black flange adaptor PN12	No	1		
		Cranking of existing water mains as shown on drawing 21108-C-212, 213, 214 for the following main sizes				
		75mm dia:				
		Supply:				
6.99		Item 1: 75 mm dia Klamflex black straight coupling	No	4		
6.100		Item 2: 75 mm dia spool piece	No	4		
6.101		Item 3: 75 mm dia 45 degree bend	No	8		
6.102		Item 4: 75 mm dia spool piece	No	4		
		Lay and bed:				
6.103		Item 1: 75 mm dia Klamflex black straight coupling	No	4		
6.104		Item 2: 75 mm dia spool piece	No	4		
6.105		Item 3: 75 mm dia 45 degree bend	No	8		
6.106		Item 4: 75 mm dia spool piece	No	4		
		100mm dia:				
		Supply:				
6.107		Item 1: 100 mm dia Klamflex black straight coupling	No	4		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
6.108		Item 2: 100 mm dia spool piece	No	4		
6.109		Item 3: 100 mm dia 45 degree bend	No	8		
6.110		Item 4: 100 mm dia spool piece	No	4		
		Lay and bed:				
6.111		Item 1: 100 mm dia Klamflex black straight coupling	No	4		
6.112		Item 2: 100 mm dia spool piece	No	4		
6.113		Item 3: 100 mm dia 45 degree bend	No	8		
6.114		Item 4: 100 mm dia spool piece	No	4		
		150mm dia:				
		Supply:				
6.115		Item 1: 150mm dia Klamflex black straight coupling	No	4		
6.116		Item 2: 150mm dia spool piece	No	4		
6.117		Item 3: 150mm dia 45 degree bend	No	8		
6.118		Item 4: 150mm dia spool piece	No	4		
		Lay and bed:				
6.119		Item 1: 150 mm dia Klamflex black straight coupling	No	4		
6.120		Item 2: 150mm dia spool piece	No	4		
6.121		Item 3: 150mm dia 45 degree bend	No	8		
6.122		Item 4: 150mm dia spool piece	No	4		
	PSL8.2.11	Anchor blocks / thrust blocks and pedestals:				
		Concrete:				
6.123		Class 25MPa/19mm	m³	5		
	8.2.13	Valve and hydrant chambers, etc.:				
6.124		Valve chamber as per Dwg. No. 21108-C-204	No	9		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
6.125		Hydrant chamber as per dwg no 21108-C-204	No	1		
6.126		Air valve chamber as per drawing 21108-C-205	No	2		
6.127		Bulk water meter chamber complete at Pump Station 1 as per Dwg. No. 21108-C-201 (Fittings measured under mechanical bill)	No	1		
6.128	PSL8.2.17	Marker blocks/pipeline route markers:	No	10		
	PSL 8.2.18	Connection to existing main supply pipe:				
6.129		75 mm dia	No	2		
6.130		110 mm dia	No	2		
6.131		150 mm dia	No	4		
6.132		200mm dia	No	4		
6.133		250 mm dia	No	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
7	SABS 1200 LB	**BEDDING (PIPES)**				
		as specified in SABS 1200 LB and in the project specifications				
	PSLB 8.2.1	Provision of bedding from trench excavations:				
7.1		(a) Selected granular material	m³	5		
7.2		(b) Selected fill material	m³	5		
	PSLB 8.2.2	Supply only of bedding by importation:				
	8.2.2.1	From other necessary excavations:				
7.3		(a) Selected granular material	m³	5		
7.4		(b) Selected fill material	m³	5		
	8.2.2.3	From commercial sources:				
7.5		(a) Selected granular material	m³	355		
7.6		(b) Selected fill material	m³	170		
	PSLB 8.2.7	Provision of stone/geofabric to deal with water:				
7.7		19mm crushed stone	m³	50		
7.8		Geofabric (A2 or equivalent approved)	m²	300		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
8	SABS 1200 LC	**CABLE DUCTS**				
		as specified in SABS 1200 LC and in the project specifications				
	8.2.2	Excavation:				
8.1		(a) Excavate in all materials for trenches, backfill, compact, and dispose of surplus material	m	80		
	PSLC 8.2.5	Supply, lay, bed and prove duct:				
		PVC-U Class 400 kPa complying with SANS 1601 using spigot and socket rubber ring joint pipes				
		Supply:				
8.2		110mm dia	m	10		
8.3		160mm dia	m	10		
		Lay and bed:				
8.4		110mm dia	m	10		
8.5		160mm dia	m	10		
		PVC-U Class 34 heavy duty complying with SANS 791 using spigot and socket rubber ring joints				
		Supply:				
8.6		75mm dia	m	20		
8.7		110mm dia	m	20		
8.8		150mm dia	m	20		
		Lay and bed:				
8.9		75mm dia	m	20		
8.10		110mm dia	No	20		
8.11		150mm dia	No	20		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
9	SABS 1200 MK	**KERBING AND CHANNELLING**				
		as specified in SABS 1200 MK and in the project specifications				
	PSMK 8.2.1	Precast concrete kerbing:				
		Barrier kerb (BK2):				
		Supply:				
9.1		Radius up to 4m	m	10		
9.2		Radius over 4m up to 20m	m	10		
9.3		Radius over 20m and straight sections	m	50		
		Lay and bed:				
9.4		Radius up to 4m	m	10		
9.5		Radius over 4m up to 20m	m	10		
9.6		Radius over 20m and straight sections	m	50		
	8.2.2	Concrete kerbing and channelling combined:				
		Barrier kerb and channel combined (BK2 + C1):				
		Supply:				
9.7		Radius up to 4m	m	10		
9.8		Radius over 4m and up to 15m	m	10		
9.9		Radius over 15m and straight sections	m	50		
		Lay and bed:				
9.10		Radius up to 4m	m	10		
9.11		Radius over 4m and up to 15m	m	10		
9.12		Radius over 15m and straight sections	m	50		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
10	SABS 1200 MH	**ASPHALT BASE AND SURFACING**				
		as specified in SABS 1200 MH and in the project specifications				
	8.5.1	Prime coat:				
10.1		MC-30 Cutback Bitumen	m²	450		
	PSMH 8.5.4	Asphalt surfacing:				
		35mm thick:				
10.2		Continuously graded	m²	450		
TOTAL CARRIED FORWARD TO SUMMARY						

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT R
2	SITE CLEARANCE	
3	EARTHWORKS	
4	EARTHWORKS (PIPE TRENCHES)	
5	CONCRETE (STRUCTURAL)	
6	MEDIUM PRESSURE PIPELINES	
7	BEDDING (PIPES)	
8	CABLE DUCTS	
9	KERBING AND CHANNELLING	
10	ASPHALT BASE AND SURFACING	
TOTAL CARRIED FORWARD TO SUMMARY OF SCHEDULES		

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
11	SABS 1200 C	**SECTION : SITE CLEARANCE**				
		CLEAR SITE				
	PSC 8.2.1	Clear and grub:				
11.1		Site	m²	2,500		
		Pipeline routes				
11.2		3 m wide	m²	100		
	8.2.2	Remove and grub large trees and tree stumps of girth over and up to				
11.3		Over 1,0 m up to and including 2,0 m	No	1		
11.4	PSC 8.2.7	Dismantle and remove pipelines (not encased in concrete), electricity transmission lines, cables, etc.	m	10		
11.5	PSC 8.2.7	Dismantle and remove pipelines encased in concrete	m	10		
11.6	8.2.10	Remove topsoil to nominal depth of 150 mm and stockpile	m³	375		
11.7	PSC8.2.13	Take down and re-erect existing fences	m	50		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
12	SABS 1200 D	**EARTHWORKS**				
		as specified in SABS 1200 D and in the project specifications				
	PSD 8.3	SCHEDULED ITEMS				
	8.3.2	Bulk Excavation:				
	8.3.2(a)	Excavate in all materials and use for fill				
12.1		Excavate for reservoir platform in all materials, and use for backfill or embankment, or dispose	m³	4,450		
12.2		(a) Excavate for restricted foundations chambers in all materials, and use for backfill or embankment, or dispose	m³	50		
		(b) Extra over items 11.1 to 11.2 above for:				
12.3		Intermediate excavation	m³	200		
12.4		Hard rock excavation	m³	2,900		
12.5	PSD 8.3.3 (c)	(c) Extra over item 8.3.3 (a) for hand excavation	m³	20		
12.6	PSD 8.3.4	Importing of materials from commercial sources and use for fill (clean sand, G7, compacted to 100% Mod AASHTO)	m³	20		
12.7	PSD 8.3.10	Topsoiling	m³	375		
	PSD 8.3.11	Grassing or other vegetation cover:				
12.8	PSD 8.3.11.3	Hydroseeding	m²	1,000		
12.9	PSD 8.3.19	Compaction of in-situ material to a depth of 300 mm	m²	650		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
13	SABS 1200 DB	**EARTHWORKS (PIPE TRENCHES)**				
		as specified in SABS 1200 DB and in the project specifications				
		PIPELINE TRENCHES				
	PSDB 8.3.2	Excavation:				
		Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		(2) Pipes over 125 mm dia up to 400 mm dia for depths:				
13.1		Up to 1,5 m	m	10		
13.2		Over 1,5 m up to 2,5 m	m	10		
13.3		Over 2,5 m up to 3,5 m	m	10		
	PSDB 8.3.2	(b) Extra over item (a) above for:				
13.4		(1) Intermediate excavation	m³	5		
13.5		(2) Hard rock excavation	m³	20		
		(3) Hand excavation and backfill where directed by the Employer's Agent				
13.6		(a) Soft material	m³	5		
13.7		(4) Backfill stabilized with 5% cement where directed by the Engineer	m³	5		
13.8		(5) Soilcrete backfill where directed by the Engineer	m³	5		
13.9		(6) Mass concrete Class 15 MPa/19mm encasing around pipes where directed by the Engineer	m³	5		
13.10		(8) Backfill with clean sand compacted to 100% modified AASHTO density	m³	5		
13.11	8.3.2	(c) Excavate and dispose of unsuitable material from trench bottom	m³	5		
	PSDB 8.3.3	Excavation ancillaries:				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
	8.3.3.1	Make up deficiency in backfill material:				
13.12		(a) from other necessary excavations on site	m³	5		
13.13		(c) by importation from commercial or off site sources selected by the Contractor (sand compacted to 100% Mod AASHTO)	m³	5		
	PSDB 8.3.17	Testing of trench related work				
		Insitu material at trench invert. (Test up to 1,5m below invert)				
13.14		1) DCP test by Contractor	No	2		
13.15		2) DCP test by Independent laboratory	No	1		
		Bedding layer				
13.16		1) DCP test by Contractor	No	2		
13.17		2) DCP test by Independent laboratory	No	1		
13.18		3) Troxler test by independent laboratory	No	1		
13.19		4) Material classification analysis including CBR and grading analysis	No	1		
		Backfill of trenchess				
13.20		1) DCP test by Contractor	No	2		
13.21		2) DCP test by Independent laboratory	No	1		
13.22		3) Troxler test by independent laboratory	No	1		
		TRENCHES FOR SUBSURFACE DRAINS				
	PSDB 8.3.2	Excavation:				
		(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		(1) Trenches of width less than 600 mm for depths:				
TOTAL CARRIED FORWARD						

SECTION 1200 DB : EARTHWORKS (PIPE TRENCHES)

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
13.23		(i) Up to 1,0 m	m³	20		
13.24		(ii) Over 1,0 m and up to 2,0 m	m³	20		
	PSDB 8.3.2	(b) Extra over item (a) above for:				
13.25		(2) Hard rock excavation	m³	40		
TOTAL CARRIED FORWARD TO SUMMARY						

SECTION 1200 DM : EARTHWORKS (ROADS, SUBGRADE)

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
14	SABS 1200 DM	**EARTHWORKS (ROADS, SUBGRADE)**				
		as specified in SABS 1200 DM and in the project specifications				
	PSDM 8.3.3	Treatment of roadbed:				
		(a) Roadbed preparation and compaction of material to:				
14.1		(3) Minimum of 100% of modified AASHTO maximum density (sand)	m³	520		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
15	SABS 1200 G	**CONCRETE (STRUCTURAL)**				
	8.1.3	CONCRETE				
	8.4.2	Blinding layer in 20MPa/19mm concrete				
15.1		50mm Minimum thickness	m²	700		
	8.4.3	Strength concrete: Grade - 20MPa/19mm				
15.2		Mass concrete to anchor scour pipe	m³	1.5		
15.3		Mass concrete to anchor outlet pipes	m³	2		
15.4		Additional mass concrete under foundation (on instruction of Engineer only)	m³	20		
	8.4.3	Strength concrete: Grade - 30MPa/19mm				
15.5		Reservoir wall and column foundations	m³	75		
15.6		Reservoir walls	m³	175		
15.7		Reservoir columns	m³	8		
15.8		Roofslab and access opening	m³	130		
15.9		Reservoir floor slabs	m³	125		
	8.1.1	FORM WORK				
	8.2.1	Rough walls below ground:				
15.10		Column foundations straight	m²	17		
15.11		Scour and outlet foundations	m²	13		
	8.2.2	Smooth vertical plane to:				
15.12		Wall foundations curved	m²	75		
15.13		Vertical curved internal and external walls	m²	980		
15.14		Roof slab edge curved and straight	m²	20		
15.15		Opening in roofslab	m²	2		
15.16		Soffit of roof slab (Prop height 5.5m)	m²	620		
15.17		Circular column and conical column top	m²	80		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
	8.1.2	REINFORCEMENT				
	8.3.1	Mild steel bars:				
15.18	8.1.2.2	Diameter 25mm basic price	t	14.5		
	8.1.2.3	Extra-over from item 14.18 for bars of diameter:				
15.19		a) 10mm	t	7.50		
15.20		b) 12mm	t	7.50		
	8.3.1	High tensile steel bars:				
15.21	8.1.2.2	Diameter 25mm basic price	t	60		
	8.1.2.3	Extra-over for item 14.22 for bars of diameter:				
15.22		a) 12mm	t	23		
15.23		b) 16mm	t	23		
15.24		c) 20mm	t	14		
	8.3.2	High tensile welded mesh re-inforcement				
15.25		Type ref 617 in reservoir floor	m²	580		
	PSG 8.4.4	UNFORMED SURFACE FINISHES				
		Wood-floated finish:				
15.26		On outside of wall foundations	m²	55		
		Steel-floated finish:				
15.27		On roof slab	m²	650		
15.28		On reservoir floor	m²	620		
15.29		Top of vertical walls	m²	35		
15.30	PS G 8.4.7	Scour bellmouth	Sum	1		
	PS G 8.5	JOINTS				
		Construction joints: (See PSG 5.5.7)				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
15.31		Supply and install 250mm PVC waterstop with centre bulbs at construction joints in walls	m	270		
		Expansion joints: (See PSG 5.5.7.4)				
15.32		Between floor and wall foundation (curved) see dwg no 21108-S-001	m	90		
15.33		Between floor slabs of reservoir (straight) see dwg no 21108-S-001	m	170		
15.34		Supply and install two (2) layers of malthoid or similar material between roof slab and top of wall	m	90		
	8.8	H.D. BOLTS, MISCELLANEOUS METAL WORK AND OTHER FITTINGS				
15.35		Supply and install cast iron manhole cover and frame (SABS 558 type 9E) complete with lock and locking mechanism as shown on drawing no 21108-S-001	No	1		
15.36		Air vents cast into topslab as shown on Dwg 21108-C-001	No	9		
		SUNDRIES				
15.37	PSG 8.9	Test reservoir for water tightness	Sum	1		
15.38	PSG 8.10	Sterilise reservoir	Sum	1		
15.39	PSG 8.25	Supply 18/16 glass fibre mesh bolted between two flanges at air vents as shown on dwg no 21108-S-001	No	9		
15.40	PSG 8.26	Stone on reservoir roof slab	m^3	50		
15.41	PSG 8.28	Supply and install Polyethylene bond braker under floor	m^2	705		
TOTAL CARRIED FORWARD TO SUMMARY						

STRUCTURAL STEELWORK (SUNDRY ITEMS)

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
16	SABS 1200 HA	**STRUCTURAL STEELWORK (SUNDRY ITEMS)**				
		Supply and install ladders complete				
16.1	PS HA 8.3.3	Internal ladder as shown on Dwg no 21108-S-002	No	1		
16.2	PS HA 8.3.3	External ladder as shown on Dwg no 21108-S-002	No	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
17	SABS 1200 L	**MEDIUM PRESSURE PIPELINES**				
		PVC-U PIPES				
		as specified in SABS 1200 L and in the project specifications				
	PSL 8.2.1	Supply, lay and bed on bedding for flexible pipes, complete with couplings:				
		PVC-U Class/PN12 (SANS 966 : PART 1:2000 (PVC-U)) using spigot and socket rubber ring joints				
		Supply:				
17.1		150mm dia	m	10		
17.2		315mm dia	m	10		
		Lay and bed:				
17.3		150mm dia	m	10		
17.4		315mm dia	m	10		
		Extra over item 8.2.1 for Klamflex Black dedicated flange adaptors, flange drilling to table 1600/3 or similar approved				
		Supply:				
17.5		150 mm dia	No	4		
17.6		250 mm dia	No	2		
17.7		315mm dia	No	4		
		Lay and bed:				
17.8		150 mm dia	No	4		
17.9		250 mm dia	No	2		
17.10		315mm dia	No	4		
	8.2.5	Supply and place Pipes, Valves, and Specials (Short pipe runs)				
		Pipework in Bulk Meter Chamber at reservoir as per detail drawing 19013-C-201				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
17.11		Item 1 : 200 mm dia 620 mm long puddle pipe flanged all ends	No	1		
17.12		Item 2 : 200 mm dia strainer	No	1		
17.13		Item 3 : 200 mm dia 1000 mm long piece flanged both ends	No	1		
17.14		Item 4 : 200 mm dia mechanical watermeter flanged both ends	No	1		
17.15		Item 5 : 200 mm dia non return valve	No	1		
17.16		Item 6 : 200mm dia 250mm long spool piece flanged one end	No	1		
17.17		Item 7 : 200 mm dia Klamflex black straight coupling	No	1		
17.18		Item 8 : 200 mm dia 620 mm long puddle pipe flanged one end	No	1		
17.19		Item 9 : 200 mm flanged gate valve	No	2		
17.20		Item 10 : Y600D ductile iron cover and frame cast into topslab	No	2		
17.21		Item 11 : 300 x 200 mm dia reducer flanged both ends	No	2		
17.22		Item 12 : 300 mm dia Klamflex black flange adaptor	No	2		
		Pipework in scour chamber shown on dwg 21108-C-202:				
17.23		Item 1 : 150 mm flanged gate valve	No	1		
17.24		item 2 : 150 mm dia 22.5 degree bend flanged one end	No	1		
	PSL 8.2.5	Supply, install and test pipes, fittings and valves as listed for 3.0ML reservoir as shown on Dwg no 21108-C-002				
17.25		Item 1: 150 mm dia spool piece welded one end	No	1		
17.26		Item 2: 150 mm dia 90 degree bend welded both ends	No	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
17.27		Item 3: 150 mm dia straight pipe flanged one end and welded on other end	No	1		
17.28		Item 4: 150 mm flange adaptor to suit PVC-U pipe	No	1		
17.29		Item 6: 250 mm dia puddle pipe flanged both ends	No	1		
17.30		Item 7: 250 mm 90 degree bend flanged both ends	No	1		
17.31		Item 8: 250 mm dia straight pipe flanged both ends	No	2		
17.32		Item 9: 250 mm flange adaptor to suit PVC-u pipe	No	2		
17.33		Item 10: 300 mm dia straight pipe welded one end	No	1		
17.34		Item 11: 300 mm dia 90 degree bend welded both ends	No	1		
17.35		Item 12: 300 mm dia straight pipe welded one end and flanged on the other	No	1		
17.36		Item 13: 300 mm dia flange adaptor to suit PVC-u pipe	No	1		
17.37		Item 14: 250 mm dia puddle pipe flanged both ends	No	1		
		Supply:				
17.38		Item 15: 250 mm dia ball float valve	No	1		
		Install:				
17.39		Item 15: 250 mm dia ball float valve	No	1		
	PSL 8.2.11	Anchor blocks / thrust blocks and pedestals:				
		Concrete:				
17.40		Class 25MPa/19mm	m^3	5		
	8.2.13	Valve and hydrant chambers, etc.:				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
17.41		Valve chamber as per Dwg. No. 21108-C-204	No	2		
17.42		Bulk water meter chamber complete as per Dwg. No. 21108-C-201 (Fittings measured above)	No	1		
17.43		Scour and subsoil chamber as per Dwg no 21108-C-21108-C-202 (Fittings measured above)	No	1		
17.44	PSL 8.2.17	Marker blocks/pipeline route markers:	No	2		
	PSL 8.2.18	Connection to existing main supply pipe:				
17.45		200mm dia at Reservoir 3	No	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
18	SABS 1200 LB	**BEDDING (PIPES)**				
		as specified in SABS 1200 LB and in the project specifications				
	PSLB 8.2.1	Provision of bedding from trench excavations:				
18.1		(a) Selected granular material	m³	5		
18.2		(b) Selected fill material	m³	5		
	PSLB 8.2.2	Supply only of bedding by importation:				
	8.2.2.1	From other necessary excavations:				
18.3		(a) Selected granular material	m³	5		
18.4		(b) Selected fill material	m³	5		
	8.2.2.3	From commercial sources:				
18.5		(a) Selected granular material	m³	40		
18.6		(b) Selected fill material	m³	25		
	PSLB 8.2.7	Provision of stone/geofabric to deal with water:				
18.7		19mm crushed stone	m³	10		
18.8		Geofabric (Bidim A2 or equivalent approved)	m²	50		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
19	SABS 1200 LC	**CABLE DUCTS**				
		as specified in SABS 1200 LC and in the project specifications				
	8.2.2	Excavation:				
19.1		(a) Excavate in all materials for trenches, backfill, compact, and dispose of surplus material	m	20		
	PSLC 8.2.5	Supply, lay, bed and prove duct:				
		PVC-U Class 34 heavy duty complying with SANS 791 using spigot and socket rubber ring joints				
		Supply:				
19.2		110mm dia	m	10		
		Lay and bed:				
19.3		110mm dia	m	10		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
20	SABS 1200 LE	**DRAINAGE**				
		as specified in SABS 1200 LE and in the project specifications				
	8.2.1	Supply and lay concrete pipe culverts on class C bedding (spigot and socket / ogee):				
		RC Class 100 D pipes:				
		Supply:				
20.1		300mm dia	m	40		
		Lay and bed:				
20.2		300mm dia	m	40		
	PSLE 8.2.8	Supply and installation of manholes, catchpits and the like:				
		Supply and install manholes:				
		Precast concrete manholes as shown on Detail Dwg No 21108-C-203 for depth:				
20.3		0m - 1,5m	No	1		
20.4		Type 2 Head wall structure complete as shown on Detail Dwg 21108-C-208	No	1		
	PSLE 8.2.14	Pipes in subsurface drains:				
		(a) Normal duty uPVC pipes complete with couplings:				
		Supply:				
20.5		(i) 100 ID perforated	m	90		
		Lay and bed:				
20.6		(ii) 100 ID perforated	m	90		
20.7	PSLE 8.2.15	Geofabric (A2 or similar)	m^2	170		
20.8	PSLE 8.2.16	Crushed stone in subsurface drains	m^3	20		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
20.9	PSLE 8.2.17	Grade 20 MPa/19 mm concrete outlet structure for subsurface drains (including formwork)	m³	5		
20.10	PSLE 8.2.35	Connect subsurface drain to manhole or catchpit	No	2		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
21	SABS 1200 ME	**SUBBASE**				
		as specified in SABS 1200 ME and in the project specifications				
	PSME 8.3.3	Construct the subbase course/shoulders/gravel wearing course with material from commercial sources:				
21.1		Construct the subbase course with material from commercial sources (G5)	m³	100		
	PSME 8.3.11	Treatment of subbase with:				
21.2		(a) Weed killer	m²	520		
21.3		(b) Insecticide	m²	520		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
22	PA 00	FENCING				
		as in the particular specification PA and as shown on drawing 21108-C-209				
		Foundations:				
		Excavate in all materials, dispose of surplus material, supply and cast 25/19 MPa Concrete foundations as per detail drawing.				
22.1		(b) 2.780m long square posts; manufactured from 60 x 60 x 1.6mm pre galvanized tube and pvc coated. RAL 600	No	80		
		- Gate/corner posts				
22.2		-Vehicle	No	2		
		Posts:				
22.3		Supply and install Bekafix tubular posts profiled in "H" shape, 70 x 44mm, with predrilled holes for fixing of the metal security clips, punched holes for positioning and fixing of panels by means of fixing clips. Posts fixed with plastic coated metal clips with stainless steel bolts and shear buts. Green RAL 6005. Including metal fixators. Length 2,2m.	No	80		
		Panels:				
22.4		Supply and install Nylofor Medium Panel 2.500m x 2.030m high. The panels have vertical barbs of 30mm at the one side, the barb must be placed at the top. Panels made of galvinized wires and plastic coated mesh apertures of 100mm x 50mm. (Wire diameter 4,5mm)	No	80		
		Accessories:				
22.5		Bekafixtong	No	2		
		Bar Type Swing Gates:				
		(60mm x 60mm x 3mm square tubing frame with 25mm x 2mm infills spaced at 110mm c/c)				
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
BROUGHT FORWARD						
22.6		Betafence Robusta Medium or similar approved 2 x 2,5m wide x 2,03m high epoxy coated green bar type swing gates, including 2 number gate posts, standard slider lock and including 2 x stays and cox comb.	No	1		
TOTAL CARRIED FORWARD TO SUMMARY						

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT R
11	SITE CLEARANCE	
12	EARTHWORKS	
13	EARTHWORKS (PIPE TRENCHES)	
14	EARTHWORKS (ROADS, SUBGRADE)	
15	CONCRETE (STRUCTURAL)	
16	STRUCTURAL STEELWORK (SUNDRY ITEMS)	
17	MEDIUM PRESSURE PIPELINES	
18	BEDDING (PIPES)	
19	CABLE DUCTS	
20	DRAINAGE	
21	SUBBASE	
22	FENCING	
TOTAL CARRIED FORWARD TO SUMMARY OF SCHEDULES		

ITEM NO	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT R
23		MECHANICAL & ELECTRICAL WORKS				
23.1	PSA8.21	(a) Sum carried over from Schedule of Quantities for Mechanical & Electrical Works. Refer to documentation in Volume 2 (Complete Schedule of Quantites for Mechanical & Electrical works and submit with Tender Document) IMPORTANT NOTE: Tenderers who fail to carry over this Sum amount, or, who carry over the Sum amount incorrectly, may be deemed non-reponsive. (Refer to clause F4.11 in the Tender Data)	Sum	1		
23.2		(b) Charge required by Contractor on sub-item (a) above	%			
TOTAL CARRIED FORWARD TO SUMMARY						

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT R
23	MECHANICAL & ELECTRICAL WORKS	
TOTAL CARRIED FORWARD TO SUMMARY OF SCHEDULES		

CONTRACT NO.: T60.2021

The Construction of 3 ML Reservoir,
Pipelines and Related Pump Work
BILL OF QUANTITIES

SUMMARY OF SCHEDULE OF QUANTITIES

SECTION	DESCRIPTION	AMOUNT R
A	PRELIMINARY AND GENERAL	
B	PIPELINES	
C	RESERVOIR	
D	MECHANICAL & ELECTRICAL (From Volume 2)	
	TOTAL CARRIED FORWARD TO CONTRACT PRICE	

CALCULATION OF CONTRACT PRICE

E : TOTAL OF SCHEDULE(S) A + B + C + D

= R . . . . . .

F : CONTINGENCIES
(The sum provided is under the direct control of the Engineer
and may be partially or totally excluded) (**10%** of TOTAL E above).....R . . . . . .

G : CONTRACT PRICE ADJUSTMENT
(The sum provided is in terms of Subclause 6.8.2 of the General Conditions of Contract) R . . . . .NIL . . . . . .

H : TOTAL (E + F + G) R . . . . . .

I : TOTAL VALUE ADDED TAX (15%) ON H ABOVE R . . . . . .

J : CONTRACT PRICE CARRIED FORWARD TO C1.1 FORM OF OFFER (H+ I) **R . . . . . .**

I/We, the undersigned, do hereby declare that these are the properly priced Bill / Schedules of Quantities forming part of this Contract Document containing Pages in consecutive order upon which my/our Tender for **CONTRACT NO. T60/2021: CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK** has been based.
My/our total Contract Price for this work and above items (Total J) is (in words)

.....

.....

SIGNED ON BEHALF OF TENDERER: .....

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Part C3: Scope of Work

C3.1 Description of the works
C3.2 Engineering
C3.3 Procurement
C3.4 Construction – Works specifications
C3.5 Management
C3.6 Annexes

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C3.1 Description of the Works

CONTENTS

1. EMPLOYER'S OBJECTIVES
2. OVERVIEW OF THE WORKS
3. EXTENT OF THE WORKS
4. CONSTRUCTION TIME PERIOD
5. CONTRACTOR'S CAMP SITE, POWER SUPPLY AND SERVICES
6. CONSTRUCTION IN CONFINED AREAS
7. WATER FOR CONSTRUCTION PURPOSES
8. FEATURES REQUIRING SPECIAL ATTENTION
9. ACCOMMODATION OF TRAFFIC
10. ENVIRONMENTAL REQUIREMENTS
11. LIMITED FUNDS
12. ASSET REGISTER

1 EMPLOYER'S OBJECTIVES

The Employers objective is to execute the upgrading of the existing water infrastructure in Robertson by constructing an additional 3 ML Reservoir, Feeder mains to and from the reservoir and upgrgade the existing pump stations at the Robertson Water Treatment Works and at Reservoir 2. The intent is to upgrade the pump stations to provide for future water demand.

The Upgrading includes the following involves:

- Upgrading of the Pump Station at Reservoir 1 feeding up to Reservoir 2 to a duty of 100 l/s including amendments to the pump station building and VSD's.
- Upgrading of the booster pump station at Reservoir 1 which feeds into town to a duty of 200ℓ/s including VSD's.
- Installation of 525m of 315mm diameter Rising Main from Reservoir 1 to Reservoir 2
- Construction of a new Pump Station building at Reservoir 2 feeding up to Reservoir 3 and refurbishment of the existing pumps
- Construction of potable water reservoir (3 Mℓ Concrete) including bulk earthworks, concrete works, associated pipeworks and extension of the current fencing around reservoir 3.
- Installation of 300m of 315mm diameter gravity water mains from the reservoir to town
- Commissioning of Telemetry and instrumentation for all reservoirs and pump stations in Robertson.

The description of the project contained in the Scope of Work is merely an outline of the Contract Works and shall not limit the work to be carried out by the Contractor under this Contract. Details of some of the major items are given in this section and approximate detailed quantities for each type of work to be carried out in accordance with the Contract Documents are included in the Bill of Quantities.

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2 OVERVIEW OF THE WORKS

2.1 General Description

Work items under this tender shall include any one or more of the following:

i) Establishment on site

ii) Clearing and grubbing

iii) Bulk Earthworks

iv) Accommodation of traffic during construction

v) Installation of Water Mains

vi) Stormwater drainage and associated structures

vii) Rehabiliatation of streets

2.2 Work Areas

The location of the works envisaged for the Project will be shown on the drawings bound into C6 of the Project document.

2.3 Boundaries of the site

The site will be confined to the areas of construction, including the site camp of the contractor.

2.4 Occupation of the site

Access to the site of the works will be given to the Contractor on the Commencement Date.

3. EXTENT OF THE WORKS

The work that is to be carried out under the contract is as provided for in the schedule of quantities. However, if during the course of construction conditions are found to differ from those anticipated, the Engineer reserves the right to modify the scope of the work to suit the prevailing conditions and circumstances. Variations introduced in this manner will be measured and paid for at the rates tendered for appropriate items listed elsewhere in the schedule of quantities or in the absence of such rates, as extra work.

4 CONSTRUCTION TIME PERIOD

The time period specified for completion by the Engineer, as stated in the Contract Data in terms of Clause 1.1.1.14 of the Conditions of Contract, is **as per the approved initial programme** exclusive of all special non-working days and year end break (builder's holidays). The Contractor shall plan and programme his construction sequence for completion within the time period specified.

4.1 Construction work programme

The Contractor shall take note of various factors contained in the specifications, which will have a significant influence on the compilation of the construction work programme. Prominent items are those which might require a lead time for ordering the equipment or which might entail a special manufacturing period.

The Contractor shall take the above into consideration when drawing up his programme and no claims will be entertained in this regard.

5. CONTRACTOR'S CAMP SITE, POWER SUPPLY AND OTHER SERVICES

The choice of all sites for the establishment of camps is subject to the approval of the Engineer.

The Contractor shall, however, make his own arrangements concerning the provision of water, electricity and other services for the campsite and office facilities.

No direct payment will be made for the provision of electrical and other services. The cost thereof shall be deemed to be included in the rates and amounts tendered for the various items of work for which these services are required.

6. CONSTRUCTION IN CONFINED AREAS

It will be necessary for the Contractor to work within confined and restricted areas. The method of construction in these confined areas largely depend on the contractor's constructional plant.

Regardless, measurement and payment will be in accordance with the specified cross-sections and dimensions only, irrespective of the method used for achieving these cross-sections and dimensions. It is deemed that the rates tendered in the Pricing Schedule / Priced Bill / Schedule of Quantities include full compensation for all special equipment and construction methods and for all difficulties encountered when working in confined areas and narrow widths, and at or around obstructions. **No additional payment will be made nor will any claim for payment be considered for work done in such confined areas, despite indications to the contrary in the Standard Specifications.**

7. WATER FOR CONSTRUCTION PURPOSES

The Contractor must make adequate provision in his tender for all negotiations and procurement of water for construction activities and all related costs will be deemed to be included in his tendered rates. Water standpipe to be procured from the Municipality at the Contractors cost. Standard fees for standpipe (consumer deposit applicable) and standard water consumption tariffs are applicable.

8. FEATURES REQUIRING SPECIAL ATTENTION

8.1 Existing Services

Any work requiring the excavation of existing road pavements, sidewalks and verges will require the necessary wayleaves be obtained from the relevant service authorities (including DFA, Neotel, Telkom, Electrical Department / Eskom, Roads & Stormwater Department, Waterworks Department and Drainage & Sewerage Department etc).

Prior to commencing work, the Contractor shall confer with all Authorities and Departments concerned and obtain the necessary wayleaves for both overhead and underground services affected by the Works and shall satisfy himself that he has obtained all the relevant information required to complete the Contract. The Contractor will be liable for obtaining all the necessary wayleaves and work permits from the relevant service authorities prior to the commencement of work within the road reserve.

The Contractor shall carry out the works with the minimum interference to existing services and it shall be clearly understood that obtaining the necessary wayleaves, will be at his own cost. The cost of repairing any damage to services, due to miscalculations or negligence on the part of the Contractor or his failure to carry out the duties set out in this Clause, shall be borne by the Contractor.

8.2 Health and Safety Plan

Prior to commencing work, the Contractor shall submit a Health and Safety Plan, compiled in accordance with the Health and Safety Specifications in the Works Specifications to the Engineer for approval. The Contractor may not commence construction without the Engineer's approval of the Health and Safety Plan.

8.3 Standard of Materials, Workmanship, Testing and Performance

The attention of Tenderers is particularly drawn to the high standard of materials, workmanship, testing and performance applicable to his Contract as a whole and he shall convey this requirement to his proposed Sub-Contractors.

The Contractor will carry out control testing of materials and workmanship as required in terms of the specifications. Where necessary, the Engineer may carry out acceptance control testing. The Employer will not pay claims or grant extension of time for delays to the works resulting from the awaiting of test results. Testing as required by the Engineer will be effected as promptly as possible but it is in the Contractors own interest to submit material samples and other components of workmanship for testing in good time to assist in avoiding or minimising delays.

8.4 Weatherproof Protection for Workers

All staff required to continue working during rain shall be provided with oilskins and rubber knee boots, or other approved protective clothing and footwear.

8.5 Night Work and Work on Public Holidays

Where the Contractor requires staff to work overtime, he shall make the necessary arrangements with the Engineer and obtain written approval from the Engineer. The Contractor shall bear the cost of his overtime work.

The following conditions apply:

e) No work allowed after 18:00 on weekdays.
f) Working times for Saturdays are 08:00 - 14:00.
g) No work allowed on Sundays, Public Holidays and year end break as published by SAFCEC.
h) Approval for work outside of normal working hours to be obtained from Employer.

Penalty for the transgression of above conditions is R10 000 per transgression.

8.6 Other Contractors

The Contractor's attention is drawn to the fact that there will be other contractors working on the Site of the Works. In accordance with Clause 4.8 of the General Conditions of Contract, the Contractor shall note and make due allowance for reasonable access to and for the adjacent operations of these other contractors on the site of the works.

9. ACCOMMODATION OF TRAFFIC

(i) The safety and convenience of the travelling public is to be considered of utmost importance and every effort must be made to ensure that all temporary road signs, cones, flagmen and speed controls are maintained and effective, and that courtesy is extended to the public at all times.

(ii) It is important that the traffic accommodation requirements described in these specifications are adhered to and that all installations meet with the approval of the relevant traffic authority ie the Traffic Manager of Langeberg Municipality and Provincial Department of Roads and Transport.

(iii) Work, including the erection and removal of traffic control facilities, shall be executed between sunrise and sunset on Monday to Saturday, inclusive. Occupation of existing traffic lanes will only be allowed during daylight hours on normal working days, which are defined as Monday to Saturday, inclusive. The existing number of lanes for each traffic movement affected by construction shall not be reduced without the written authorization of the Engineer.

(iv) It should be noted that Sundays are specified as "Special non-working days" in the Contract Data. In terms of Clause 5.8 of the General Conditions of Contract the Engineer's permission has to be obtained for work to be carried out on special non-working days, for which permission shall be applied for at least one (1) week prior to the day.

(v) The travelling public has the right of way on public roads, and the Contractor shall make use of approved methods to control the movement of his equipment and vehicles so as not to constitute a hazard on public roads.

(vi) Failure to maintain road signs, warning signs or flicker lights, etc, in good condition shall constitute ample reason for the Engineer to bring the works to a stop until the road signs, etc, have been repaired to his satisfaction.

(vii) The Contractor may not commence constructional activities before adequate provision has been made to accommodate traffic in accordance with the requirements of these specifications and Chapter 13 of Volume 2 of the South African Road Traffic Signs Manual (SARTSM).

(viii) The Contractor shall submit proposals in connection with all signs and accommodation of traffic to the Engineer for approval.

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The traffic shall be accommodated on the existing surfaced carriageway and shoulders. No bypasses or temporary deviations shall be constructed. Accommodation of traffic will generally be carried out by closing off one lane of traffic at a time and accommodating the traffic on the other lane(s). During non-working days and the period from the 16th December to 6th January, the Contractor will be required to shut down normal construction activities and only emergency work will be allowed. The traffic safety officer will be required to patrol during these non-working periods and ensure that all temporary traffic-control facilities are in place and functional.

10. ENVIRONMENTAL REQUIREMENTS

Personnel and plant shall not enter property beyond the road reserve boundary irrespective of whether or not the boundary is fenced. The Contractor shall take every precaution to avoid damage to vegetation within that area of the road reserve which falls outside the designated work area is indicated on the drawings. Any damage caused is to be repaired at the Contractor's expense.

Storage and stockpiling of materials within the road reserve will not be permitted without the written consent of the Engineer. Excess material from excavations and waste material shall be spoiled off site at suitable locations.

11. LIMITED FUNDS

Limited funds are available for this project and certain portions of the works as detailed in the scope of works may be omitted depending on the tendered rates and tender amounts received. The Employer reserves the right to amend, limit or omit certain portions / parts of the works without thereby invalidating the contract.

The financial year for the Employer closes on 30 June each year. The minimum expenditure to be achieved by the tenderer at 30 June 2022 is R 11 000 000 excluding VAT.

The maximum total expenditure, excluding contract price adjustment and extra work, for any financial year or part thereof during which this contract is being executed, shall be limited to the estimated expenditure (as submitted in Schedule 7 : Schedule of Estimated Monthly Expenditure of T2.2 : Returnable Schedules completed by the tenderer) approved by the Engineer plus ten (10) percent for that specific financial year.

The Contractor shall take cognisance of these additional requirements in the finalisation of his tendered rates and programme of work. No claims will be considered on account of these restrictions.

12. ASSET REGISTER

On practical completion date, a report or certificate should be issued by the Contractor indicating the total costs of the project attributable to each significant component as identified within the lowest asset hierarchy level (4) as specified within the infrastructure catalogue or Annexure A of the Langeberg Municipality's asset management policy as approved in 2014, if not contained in the catalogue.

If construction is still in progress over the year-end period of the Langeberg Municipality, being 30 June of each year, the Municipality should be furnished with a report / certificate at year-end (30 June), which details (a) The cumulative expenditure incurred up to 30 June for the project. (b) any details if the project is taking a significant longer period of time to complete than expected, including reasons for any delays. (c) details where construction or development has been halted either during the current or previous reporting period(s), including reasons for halting the construction or development of the asset/project.

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C3.2 Engineering

Drawings

The drawings listed below are attached in order to give an overview of the project. Additional construction drawings will, in terms of the General Conditions of Contract, be issued to the Contractor by the Engineer/Employer on the commencement date and from time to time as required.

The Works shall be carried out in accordance with the drawings listed in C6 of the tender documents and included in Part C6 : Drawings and form part of the contract documents.

The reduced drawings that form part of the tender documents shall be used for tender purposes only.

The Contractor will be supplied with 3 unreduced paper prints of each of the drawings required for construction. These copies are issued free of charge and the Contractor shall make any additional copies he may require at his own cost.

Only figured dimensions shall be used and drawings shall not be scaled unless otherwise instructed.

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

All information in the possession of the Contractor, which the Engineer requires to complete his record drawings shall be supplied to the Engineer's Representative before a certificate of completion will be issued.

The drawings prepared by the Employer for the permanent Works are listed. The Employer reserves the right to issue amended and/or additional drawings during the contract.

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C3.3 Procurement

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3.3.1. TARGETED CONSTRUCTION PROCUREMENT

3.3.1.1 Objective

The Employer applies and promotes the principles of Targeted Construction Procurement. In terms of Employer's current procurement policy this project provides for the following objectives to be actively pursued:
- the provision of opportunities for Small, Medium and Micro- Business Enterprises (SMMEs).
- the provision of work opportunities for local labour.
- the maximising of job creation by adopting labour-intensive construction methods wherever physically feasible and economically justifiable.

3.3.1.2 Contract requirements

The Targeted Construction Procurement : Participation of Targeted Enterprises and Targeted Labour Standard Specifications is included in Part 3.3.3 of this section C3.3 of the Scope of Works and shall apply as additional Works Specifications to this contract.

For this contract, the Employer has set minimum contract participation goals, calculated as a percentage of the net amount (as defined in clause 3.2.14 below), which are specified in Schedule 20 : Preferencing Schedule in Part T2.2: Returnable Schedules.

3.3.1.3 Labour workforce

On this contract, it is the intention that work is provided during the execution of the works for targeted labour residing in the target area (ward 3 & 6 in Robertson) as defined and which would normally be the local or nearest communities. Labourers of the local or nearest communities required by the contractor shall be targeted, recruited and employed for work to enable the contractor to comply with the minimum contract participation goals for targeted labour set by the employer for the contract.

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3.3.1.4 Labour-intensive construction

Construction work must be undertaken using labour-intensive methods. The Contractor shall employ labourers, artisans and subcontractors for the execution and completion of this work.

Some of the activities, which must be considered as being suitable to be undertaken by labour-intensive methods include the following:

- cleaning and trimming of site
- laying of kerbs
- laying of pipes
- laying of paving
- manhole chambers, inlet structures & headwalls
- traffic accommodation

3.3.2. SUBCONTRACTING

3.3.2.1 General

The Contractor may subcontract portions of the Works included in the Contract. Clause 4.4 of the General Conditions of Contract makes provision for subcontracting.

Subcontract work provides opportunities for small or specialist businesses and can also be used to secure contract participation goal credits for HDI participation or other specific goals, where applicable.

Where participation credits are claimed by the Contractor in respect of subcontractors, suppliers, manufacturers and/or service providers, the Contractor shall ensure that all such are registered and verified on the Western Cape Supplier Database. The Employer shall not accept any claim for participation in respect of subcontractors, etc. unless they are registered and verified.

Notwithstanding the above, contract participation goal credits may not be claimed for work undertaken in respect of provisional sums and prime cost items.

Where monetary allowances for provisional sums or prime costs items have been allowed and the monetary allowance is less than R200 000, the Contractor shall invite three quotations from suitably qualified subcontractors, etc. for the required scope of works. The selection of the Subcontractors, etc. shall be approved by the Engineer.

Where monetary allowances for provisional sums or prime cost items have been allowed and the monetary allowance is greater than R200 000, an open tender process will have to be followed in respect of a subcontractor for this work. In such cases the tender will be issued by the Engineer on behalf of the Contractor.

3.3.2.2 Selected Subcontractors

With reference to subcontractors selected by the Contractor in consultation with the Employer, Clause 4.4.3 (GCC 2015) of the General Conditions of Contract states that this shall be done in accordance with the requirements of "a procedure set out in the Scope of Work."

The procedure for Selected Sub-contractors as referred to in Subclause 4.4.3 (GCC 2015) of the General Conditions of Contract and Contract Data shall be:

All specialist merchants, tradesmen and others executing any work or supplying any goods for which provisional or prime cost sums are provided in the Bill / Schedule of Quantities and who are selected for this purpose by the Contractor as specified hereafter, shall in the execution of such work be subcontractors of the Contractor and are herein referred to as "Selected Subcontractors".

Unless another procedure is specified, Selected Subcontractors are chosen and appointed as follows. The Employer and the Contractor shall compile a list of firms or persons acceptable to both and who will be invited to submit tenders for certain work or goods to be supplied by Selected Subcontractors. Before the closing date of such tenders the Contractor shall furnish the Employer with a sealed list in which is indicated the price increase required by the Contractor regarding the handling and appointment of every tenderer as Selected Subcontractor. No price increase requested by the Contractor in such list may be higher than the percentage or amount the Contractor has tendered in the main Contract against the provisional or prime cost item concerned. The list is then opened with the tenders and on the basis thereof the Employer shall indicate which tender he wishes to accept. The Contractor shall accept the tenderer and appoint him as Selected Subcontractor.

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The Contractor shall incorporate in the subcontract provisions that:

(a) In respect of the work or the goods that are the subject of the subcontract the Selected Subcontractor undertakes to the Contractor mutatis mutandis the obligations and liabilities as are imposed upon the Contractor to the Employer in terms of the Contract, and holds the Contractor harmless from and indemnifies him against the same and in respect of all claims, demands, lawsuits, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities, and,

(b) The Selected Subcontractor holds the Contractor harmless and indemnifies him against:
   (i) Shortcomings in the subcontract works if and where the works were designed by the Selected Subcontractor;
   (ii) defects in the goods if and where the goods were manufactured and/or supplied by the Selected Subcontractor;
   (iii) any negligence by the Selected Subcontractor, his agents, workmen and servants;
   (iv) any misuse by the Selected Subcontractor of any Constructional Plant, Temporary Works or materials provided by the Contractor for the purposes of the Contract;
   (v) any claims as aforesaid.

3.3.2.3 Appointment of targeted enterprise subcontractors

The Contractor is required to appoint domestic subcontractors in order to meet the participation goal for targeted enterprises as indicated in Schedule 21 of T2.2: Returnable Schedules.

The Contractor will be allowed to subcontract any portion of work that he wants to count towards his participation goal and make an award on a domestic subcontract basis, subject to the requirements of Clause 6 of the General Conditions of Contract. The Contractor may procure these subcontractors using his own subcontract selection methodology.

Prior to the appointment of any domestic subcontractor, whose work is to contribute to the participation goal, the Contractor shall submit to the Employer details of the scope of the work subcontracted including the relevant items in the Bill of Quantities, what the subcontract total sum is and what the Contractor's corresponding tender amount is for the same scope of work is including all the relevant Establishment and General sums and any other allowable sums.

In the event that the subcontract total sum is less than 85% of the corresponding Contractor's sum indicated above, or the subcontract total sum is less than 65% of the Employer's internal estimate, the Contractor shall undertake to allow the subcontractor to submit any explanatory information regarding the subcontract to the Employer, and the subcontractor shall agree be interviewed by the Employer or the Employer's Agent to discuss the breakdown of the subcontract sum in order to satisfy the Employer that the subcontractor can complete the work at the amount submitted on a reasonable sustainable commercial basis. If there are concerns about the subcontractor's tender sum the subcontractor shall have the right to withdraw their tender without any sanction of any nature by the Contractor.

If the subcontractor withdraws the Contractor may have to select a different package of work to contribute to his subcontract target or choose and propose to appoint a different subcontractor for the same scope of work, or the Contractor will have to present, for the same subcontractor a re-negotiated subcontract sum that will be acceptable to the Employer. All additional costs that may arise as a result of such a re-negotiation or re-tendering/re-appointment shall be borne by the Contractor.

If a suitable subcontractor cannot be identified for the envisaged scope of works the Contractor shall complete the work at his tendered rates and the associated part of the works shall form part of the works executed by the Contractor and be excluded from counting towards the subcontract participation goal(s).

3.3.3. TARGETED CONSTRUCTION PROCUREMENT SPECIFICATIONS

The following South African National Standard Resource Specifications for the implementation of Targeted Construction Procurement issued and published by Standards South Africa:

South African National Standard SANS 1914-4 : 2002 (Edition 1)
Targeted Construction Procurement : Part 4 : Participation of Targeted Enterprises and Targeted Labour (Local Resources)
shall apply to and form part of this Contract (see Schedule 21 of T2.2 : Returnable Schedules).

Where the South African National Standard SANS 1914-Specification is not bound in this document, it may be obtained from South African Standards (website *www.stansa.co.za)* or inspected, by appointment, at the offices of the Employer's representative during normal working hours.

The South African National Standard Specification makes provision defining targeted enterprises and targeted labour, weightings for different subcategories, for factors and additional requirements to be specified to suit a particular contract. Details of such factors or additional requirements applicable to this contract are contained in this part of the Scope of Work.

Preferences granted in terms of Targeted Enterprises and Targeted Labour (Local Resources) shall be executed in accordance with the conditions specified below and included in **Schedule 21 : Preferencing Schedule where preferences are granted in respect of Targeted Enterprises and Targeted Labour (Local Resources) in Part T2.2, Returnable Schedules.**

VARIATIONS TO THE STANDARDISED SANS 1914-4: 2002 SPECIFICATION

Variations, amendments and additions to the SANS 1914-4: 2002 : Part 4 : Participation of Targeted Enterprises and Targeted Labour (Local Resources) Standardised Specification are as set out below. Should any requirements of the variations conflict with other requirements of the SANS 1914-4: 2002 Specification, the requirements of the variation shall prevail.

The number of each clause and each payment item in this part of the project specifications consists of the prefix TP4 (Targeted Procurement – Part 4) followed by a number corresponding to the number of the relevant clause or item in the SANS Specification. The number of a new clause or item which does not form part of a clause or item in the standard SANS Specification and which is included here, is also prefixed by TP4 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.

TP4-2. DEFINITIONS (CLAUSE 2)

TP4-2.10 Target Area (Clause 2.10):

Add the following:

For this Contract the following Target Areas shall apply:

1. The geographical area located within **Ward 3&6, Robertson, labour should be from Ward 3&6 in Robertson, Langeberg Municipality** - Target Area 1 is **defined as the Local Area for this Contract.**
2. The geographical area, excluding Target Area 1, located within the boundaries of the Langeberg Municipal District.
3. The geographical area, excluding Target Areas 1 and 2, located within the Western Cape Province.

TP4-2.11 Targeted Enterprise (Clause 2.11):

Add the following :

Targeted Enterprises for this Contract shall be a sole trader, partnership or legal entity from the Local Area.

TP4-2.12 Targeted Labour (Clause 2.12):

Add the following :
The following individuals are defined as the target group for this Contract:

All unskilled labour (100%) to be from Target Area. South African citizens, temporarily employed by the contractor and his subcontractors in the performance of the contract, who permanently reside within the boundaries of Target Area (ward 2, Nkqubela) as specified. It is incumbent on individuals to demonstrate their claims to such residency on the basis of identification and association with and recognition by members of the community residing within the aforementioned area. It is incumbent on individuals to provide evidence of qualifying for the target groups.

TP4-2.15 Weightings (Clause 2.15):

Add the following :

In terms of Targeted Labour Goal Credit calculations (Section 3.3 of SANS 1914-4) the Weighting Factor for all contributions shall be taken as 1,0.

Add the following new subclause :

TP4-2.16 (new subclause 2.16):

Wages:
The actual amount paid periodically to targeted labour employed by the main contractor and his subcontractors after all deductions made in terms of the law (e.g. UIF) and exclusive of all company overheads and other benefits such as protective clothing, transport etc.

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TP4-3. REQUIREMENTS (CLAUSE 3)

TP4-3.1 Contract Participation Goal (Clause 3.1):

Add the following to Subclause 3.1.1:

For this Contract the minimum Contract Participation Goals set by the Employer are.

Contract Participation Goal	CPG_{2min}	Minimum set by Employer
Targeted Enterprises SANS 1914-4 Annex A Method 2 Clause A.2.2.1	CPG_{2Emin}	30 %
Targeted Labour SANS 1914-4 Annex A Method 2 Clause A.2.2.2	CPG_{2Lmin}	3 %
Total Contract Participation Goal SANS 1914-4 Annex A Clause A.3	$CPG_{2Emin} + CPG_{2Lmin} = CPG_{2min}$	**33 %**

Tenders that do not meet each of the individual abovementioned minimum Contract Participation Goals (CPG_{2min}) set by the Employer will not be considered (not applicable if minimum percentage specified is 0%).

TP4-3.2 Achieving the Contract Participation Goal (Clause 3.2):

3.2.1 General

(a) Method 1

In the first paragraph numbered (1) replace the words "not less than 50% of the wages and allowances" *with the words* "not less than **30%** of the wages and allowances".

Delete subclauses (1) and (2) and add the following to Subclause 3.2.1:

For this Contract the Contractor may achieve the specified contract participation goal by the engagement and use of targeted enterprises and targeted labour as outlined in SANS 1914-4 and measured **by using Method 2 only**. The engagement and use of targeted enterprises and targeted labour as outlined in SANS 1914-4, will not be measured by using Method 1 - **Method 1 will therefore not be applicable.**

TP4-3.3 Contract Participation Goal Credits (Clause 3.3):

Add the following new subclause after subclause 3.3.3

3.3.4 Further to the requirements of 3.3.3, credit will be denied should the Contractor not employ Targeted Labour in accordance with comply with the following relevant statutory legislation:

- Basic Conditions of Employment Act 75 of 1997
- Labour Relations Act 66 of 1995
- Employment Equity Act 55 of 1998 (Chapters 1 and 2)
- Occupational Health and Safety Act 85 of 1993
- Compensation for Occupational Injuries and Diseases Act 130 of 1993
- Skills Development Act of 1998

The statutory Department of Labour Government Notice No. R204 of 2 March 2001 : Basic Conditions of Employment Act (No. 75 of 1997) : Sectoral Determination 2 : Civil Engineering Sector, South Africa as amended shall apply in respect of any employer or employee associated with the contract.

In particular the Contractor shall pay his Labour workers at least the minimum wage prescribed in the statutory legislation.

The prime or main contractor who does not meet each of the individual minimum contract participation goals set by the Employer faces the possibility of being sanctioned. (See clause TP4-6 below)

Credits towards the contract participation goal for targeted enterprises will only be accorded to subcontractors / suppliers / manufacturers / service providers who undertake work directly for / to the main contractor. No credits will be accorded to targeted enterprises who are engaged by subcontractors / suppliers / manufacturers / service providers working under the main contractor.

Similarly, credits towards the contract participation goal for targeted labour will be granted for targeted labour employed by subcontractors only if they undertake work directly for / to the main contractor in the performance of the contract. However, in the case of subcontractors who are also targeted enterprises, the value of their targeted labour will, at the contractor's choice, count either towards the CPG for labour or the CPG for enterprise, but not both.

TP4-6. SANCTIONS (CLAUSE 6)

Add the following:

In the event that the Contractor fails to substantiate that any failure to achieve the Contract Participation Goal (CPG_{2E} and/or CPG_{2L}) relating to the granting of a preference was due to quantitative underruns, the elimination of items, or any other reason beyond the Contractor's control which may be acceptable to the Employer, the Contractor shall pay to the Employer penalties (P) in an amount determined in accordance with the following formula :

$$P = 0{,}15 \times \frac{(D - Do)}{(100)} \times N_A$$

where D = tendered Contract Participation Goal (CPG_2) percentage.
Do = the Contract Participation Goal (CPG_2) which the Employer's Representative, based on the credits passed, certifies as being achieved upon completion of the Contract.
N_A = Net Amount
P = Rand value of penalty payable

In applying the above formula the employer may give consideration to the following rules:

a) In the event of the CPG for a sub category item not being achieved, credit may be given to reduce the penalty to the extent that other sub category items under the same main category have exceeded their CPG targets provided that at least 50% of the CPG target for the offending sub category item has been achieved.

b) Where, after applying rule a), one or more of the sub category items still warrant a penalty and the CPG target for the relevant main category has also not been achieved, then only the penalty applicable to the main category item will apply.

c) No credit will be given for exceeding the CPG target of any of the three main categories (Subcontractors, Suppliers/Manufacturers and Targeted Labour)

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C3.4 Construction

Works Specifications

CONTENTS

PART A: STANDARD SPECIFICATIONS
PART B: PROJECT SPECIFICATIONS REFERRING TO THE STANDARD SPECIFICATIONS
PART C: HEALTH AND SAFETY REQUIREMENTS

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PART A: STANDARD SPECIFICATIONS

TRADE NAMES OR PROPRIETARY PRODUCTS

Bid specifications may not make any reference to any particular trade mark, name, patent, design, type, specific origin or producer, unless there is no other sufficiently precise or intelligible way of describing the characteristics of the work, in which case such reference must be accompanied by the words “or equivalent”.

TENDERERS MUST NOTE THAT WHEREVER THIS DOCUMENT REFERS TO ANY PARTICULAR TRADE MARK, NAME, PATENT, DESIGN, TYPE, SPECIFIC ORIGIN OR PRODUCER, SUCH REFERENCE SHALL BE DEEMED TO BE ACCOMPANIED BY THE WORDS ‘OR EQUIVALENT”

CERTIFICATION BY RECOGNIZED BODIES

Not applicable to this contract.

AGRéMENT CERTIFICATES

Not applicable to this contract.

3.4.2 APPLICABLE STANDARDISED SPECIFICATIONS

SANS 1200A	1986	General
SANS 1200AB	1986	Engineer’s Office
SANS 1200C	1982	Site Clearance
SANS 1200D	1990	Earthworks
SANS 1200DB	1989	Earthworks (Pipe Trenches)
SANS 1200G	1982	Concrete (structural)
SANS 1200 HA	1990	Structural Steelwork (Small Works)
SANS 1200L	1983	Medium Pressure Pipelines
SANS 1200LB	1983	Bedding (Pipes)
SANS 1200LC	1981	Cable Ducts

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All work carried out, as well as equipment supplied, must fully meet and be in compliance with the requirements of the Occupational Health and Safety Act (Act 85 of 1993) and the Construction Regulations (2014) issued in terms of Section 43 of the Act.

In addition, the latest revisions of the following statutory regulations, laws and obligations as pertaining specifically to any and all electrical work applicable to this specific project are applicable:

- The regulations of the local Supply Authority
- The regulations of the Client, being either Governmental, Municipal, Parastatal or Private
- Local fire regulations
- SANS 10400-A: 2010 – The application of the national building regulations, Part A: General principles and requirements

All references to “SABS” specifications shall be read as “SANS” in light of the recent changes by the South African Bureau of Standards. Where a SANS Standard does not exist or if not applicable, the relevant IEC or BS Standard shall be applicable. All applicable electrical instrumentation must be IP68.

a) The term project specifications appearing in any of the SANS 1200 standardised specifications must be replaced with the terms scope of work.

b) Departures from and/or additions to specifications listed above are in shown in accordance with the numbering system of the standardised or particular specification. Each clause with the prefix PS shall refer to the congruent clause in the appropriate section of the standardised or particular specification. Such clause shall either substitute, or supplement, or amend the clause with the same number. Where there is no such congruent clause in the standardised or particular specification, the PS clause shall be a new clause in the project specification. Any clause that is referred to in the standardised specification will also include the appropriate project specification and shall adhere to the following:

(i) In the event of any discrepancy between the project specifications and a part of the standard specifications, the schedule of quantities, or the drawings, the project specifications shall take precedence.

(ii) The standard specifications, which form part of this contract, may cover items not applicable to this particular contract and should be clarified with the Engineer if discrepancies are obvious.

In certain clauses the standard specifications allow a choice to be specified in the project specifications 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.

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PART B: PROJECT PARTICULAR SPECIFICATIONS

PROJECT SPECIFICATIONS REFERRING TO THE STANDARD SPECIFICATIONS

In certain instances, the Standard Specifications listed in Part A above allow a choice to be specified in the Scope of Work between alternative materials or methods of construction. Allowance is also made for additional requirements to be specified to suit each particular contract. Details of such alternatives of additions are contained in this part of the Scope of Works. In addition, it contains some supplementary specifications required for this particular contract. Subclauses referred to are those in the relevant Standardised Specification.

The number of each clause and each payment item in this part of the project specifications consists of the prefix PS 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 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 PS 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.

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PSA GENERAL (1986)

PSA 1 SCOPE

Replace subclause 1.1 with the following:

"1.1 This specification covers requirements, principles and responsibilities of a general nature which are normally applicable to all civil engineering contracts as well as the requirements for the contractor's establishment on site."

PSA 2 INTERPRETATIONS

PSA 2.3 DEFINITIONS

In the opening phrase between the words "specification" and "the following", insert the words "the definitions given in the conditions of contract and "

(a) General

Add the following definitions:

"General conditions: The general conditions of contract specified for use with this contract and the special conditions of contract as applicable.

Specified: As specified in the standardised specifications, the drawings or the project specifications. Specifications shall have the corresponding meaning."

(c) Measurement and payment

Replace the definitions for fixed charge and time-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 is varied in accordance with the time for completion of the work as adjusted in accordance with the provisions of the contract.

PSA 2.4 ABBREVIATIONS

(a) Abbreviations relating to standard documents

Add the following abbreviation:

"CKS : SABS Co-ordinating Specification."

PSA 3 MATERIALS

PSA 3.1 QUALITY

Add the following:

"All manufactured materials supplied shall be new materials unless the contrary is specified. All materials specified in accordance with SABS specifications shall bear the SABS mark, whether so specified or not. Copies of SABS Certificates of all materials used must be submitted to the Employer's Agent."

Add the following:

"The Contractor must provide the Employer's Agent with at least 48 hours notice prior to control testing being required. Furthermore, the contractor must make provision in his programme for the undertaking, and calculation of results, of such testing. Construction of layer works over areas for which test results are not available will be undertaken at the contractors own risk."

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Add the following subclause(s)

"PSA 3.3 ORDERING OF MATERIALS

The quantities set out in the schedule of quantities have been determined from calculations based on data available at the time and should therefore be considered to be only approximate quantities. The contractor shall therefore, verify the quantities before ordering materials of any kind. No liability or responsibility whatsoever shall be attached to the employer for materials ordered by the contractor except if they have been ordered in accordance with written confirmation issued by the Employer's Agent.

PSA 4 **PLANT**

Replace the heading of PSA 4 with :

"PSA 4 Construction Equipment".

PSA 4.1 SILENCING OF PLANT

Replace the heading of "PSA 4.1 Silencing of plant" with :

"PSA 4.1 Silencing of Construction Equipment".

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 (Act No. 85 of 1993) as amended.

The Contractor shall at all times and at its 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 Construction Equipment 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 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES

Add the following paragraph before the first paragraph:

"The Contractor's construction camp shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. The camp shall always be kept in a neat and tidy condition.

No personnel will be allowed to reside on the site. Only night-watchmen may be on the site after hours."

Add the following to the second paragraph:

"The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 10 workmen, which toilets shall be effectively screened from public view and their use enforced. Such toilets shall be relocated from time to time as the location of the work being executed changes, so as to ensure that easy access to the toilets is maintained.

The contractor shall, where applicable, make all necessary arrangements and pay for the removal of night soil."

"PSA 4.3 SITE SECURITY

The area within the area used by the Contractor for the establishment of his camp site may be subject to a security risk. The Contractor must assess the additional risk and make his own provision for additional protection.

No separate payment will be made for these additional security measures and the cost thereof will be deemed to be included in the rates tendered for Items PSA 8.3 and PSA 8.4. Should the Contractor feel that he needs additional insurance to cover these risks, the cost of such insurance will also be deemed to be included in the tendered rates."

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PSA 5 **CONSTRUCTION**

PSA 5.1 SURVEY

PSA 5.1.2 Preservation and replacement of survey beacons and pegs subject to the Land Survey Act

Delete the words "in the vicinity of boundaries" in the second sentence of Subclause 5.1.2 and replace the words "under the direction of" in the same sentence with "in consultation and liaison with".

Add the following after the second sentence of Subclause 5.1.2 :

"The Contractor and the Employer's Agent shall record on the said list, their concurrence or disagreement (as the case may be) regarding the completeness and accuracy of the details recorded therein."

Replace the third sentence of Subclause 5.1.2 with the following :

"At the completion of the Contract, the Contractor shall expose all pegs that were listed at the commencement of the construction as being in order and the Contractor shall arrange with a registered Land Surveyor for the checking of the positions of all such pegs and the replacement of those that the Land Surveyor's check reveals have become disturbed or damaged. The Contractor shall, as a precedent to the issue of the Certificate of Completion, provide to the Employer's Agent, a certificate from the registered land surveyor, certifying that all the pegs listed at the commencement of construction in accordance with the provisions of this clause, have been checked and that those found to have been disturbed, damaged or destroyed have been replaced in their correct positions, all in accordance with the provisions of the said Act.

The costs of all checking, replacement and certification as aforesaid shall be entirely for the Contractor's account. This, with the provision always that the Contractor shall not be liable for the cost of replacement of pegs which :

(a) cannot reasonably be re-established in their original positions by reason of the finished dimensions of the permanent works, and

(b) the Contractor can prove beyond reasonable doubt to the satisfaction of the Employer's Agent, were disturbed, damaged or destroyed by others beyond his control."

PSA 5.3 PROTECTION OF EXISTING STRUCTURES

Replace :

"Machinery and Occupational Safety Act, 1983, (Act No. 6 of 1983)" *WITH :* "Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended," and insert the following after "(Act No. 27 of 1956)" : "as amended".

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PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES

Replace the heading and the contents of this subclause with the following:

"PSA 5.4 LOCATION AND PROTECTION OF EXISTING SERVICES

PSA 5.4.1 Location of existing services

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services that can reasonably be expected by an experienced and competent Contractor to be present on, under, over or within the Site.

Without in any way limiting its liability in terms of the Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Employer's Agent, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where it intends to work. Neither the Employer nor the Employer's Agent offer any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site and the provision and utilisation of suitable detecting and testing equipment.

Thereafter, the Contractor shall, by the use of appropriate methodologies carefully expose the services at such positions as are agreed to by the Employer's Agent, for the purposes of verifying the exact location and position of the services. Where the exposure of existing services involves excavation to expose underground services, the further requirements of Sub-clauses 4.4 and 5.1.2.2 of SABS 1200D (as amended) shall apply.

The aforesaid procedure shall also be followed in respect of services not shown on the plans but which may reasonably be anticipated by an experienced Contractor to be present or potentially present on the site.

All services, the positions of which have been determined as aforesaid at the critical points, shall henceforth be designated as 'Known Services' and their positions shall be indicated by the Contractor on a separate set of Drawings, a copy of which shall be furnished to the Employer's Agent without delay.

As soon as any service, which has not been identified and located as described above is encountered on, under, over or within the Site, it shall henceforth be deemed to be a Known Service and the aforesaid provisions pertaining to locating, verifying and recording its position on the balance of the Site shall apply. The Contractor shall notify the Employer's Agent immediately any such service is encountered or discovered on the Site.

Whilst it is in possession of the Site, the Contractor shall be liable for all loss of or damage as may occur to :

(a) Known Services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognisance being taken of such deviations in line and level which may reasonably be anticipated ; and

(b) any other services which ought reasonably to have been a Known Service in accordance with the provisions of this clause ;

as well as for consequential damage, whether caused directly by the Contractor's operations or by the lack of proper protection ;

Provided always that the Contractor will not be held liable in respect of damages occurring to services not being Known Services.

No separate payment will be made to the Contractor in respect of its costs of providing, holding available on the Site and utilising the said detecting and testing equipment, nor for any costs incurred in preparing and submitting to the Employer's Agent, the Drawings as aforesaid and these costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor's in respect of exposing services at the positions agreed by the Employer's Agent and as described above will be made under the payment items (if any) as may be provided therefor in the respective sections of the Specifications pertaining to the type of work involved.

PSA 5.4.2 Protection during construction

The contractor shall exercise all the necessary care to prevent damage to known services during construction operations. Major excavating equipment and other plant shall not be operated in dangerously close proximity of these services. Where necessary, excavation in close proximity of these services shall be carefully carried out by means of suitable hand tools, excluding picks wherever their use could cause damage to the services.

Services left exposed shall be suitably protected from damage.

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PSA 5.4.3 Alterations and repairs to existing services

Unless the contrary is clearly specified or ordered, the contractor shall not carry out any alterations to existing services. Where this may be necessary, the contractor shall inform the Employer's Agent, who will either make arrangements for such work to be executed by the owner of the service or instruct the contractor to make such arrangements himself.

Where existing services are damaged by the contractor, he shall immediately inform the Employer's Agent, or when this is not possible, the relevant authority, and shall obtain instructions as to who should carry out repairs. In urgent cases the contractor shall take all necessary steps to minimize damage to and the interruption of the service. No repairs shall be attempted to telecommunication cables or electric power lines and cables.

No liability for damages arising from any delay in having such alterations or repairs effected will be accepted by the employer. The contractor shall provide all reasonable opportunity, access and assistance to persons doing alterations or repairs to existing services."

PSA 5.7 SAFETY

Replace the contents of subclause 5.7 with the following :

"Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations thereunder, the Contractor shall at its own expense (except only where specific provision (if any) is made in the Contract for the reimbursement to the Contractor in respect of particular items):

(a) Provide to its Employees on the Site of the Works, all safety materials, clothing and equipment necessary to ensure full compliance with the provisions of the Occupational Health and Safety Act (Act No 85 of

1993) and Construction Regulations as amended (hereinafter referred to as the Act) at all times, and shall institute appropriate and effective measures to ensure the proper usage of such safety materials, clothing and equipment at all times; and

(b) Provide, install and maintain on all barricades, safety signage and other measures to ensure the safety of workmen and all persons in, on and around the Site, as well as the general public; and

(c) Implement on the Site of the Works, such procedures and systems and keep all records as may be required to ensure compliance with the requirements of the Act at all times; and

(d) Implement all necessary measures as to ensure compliance of the Act by all subcontractors engaged by the Contractor and their employees engaged on the Works; and

(e) Comply fully with all other requirements pertaining to safety as may be specified in the Contract.

The Employer and the Employer's Agent shall be entitled, although not obliged, to make such inspections on the Site, as they shall deem appropriate, for the purpose of verifying the Contractor's compliance with the requirements of the Act. For this purpose, the Contractor shall grant full access to the Site of all parts of the Site and shall co-operate fully in such inspections and shall make available for inspection, all such documents and records as the Employer's and/or Employer's Agent Representative may reasonably require.

Where any such investigations reveal, or where it comes to the Employer's Agent's attention that the Contractor is in any way in breach of the requirements of the Act or is failing to comply with the provisions of this clause, the Employer's Agent shall, in accordance with the provisions of Clause 5.11 of the Conditions of Contract, be entitled to suspend progress on the Works or any part thereof until such time as the Contractor has demonstrated to the satisfaction of the Employer's Agent, that such breach has been rectified.

The Contractor shall have no grounds for a claim against the Employer for extension of time and/or additional costs if the progress on the Works or any part thereof is suspended by the Employer's Agent in terms of this clause and the Contractor shall remain fully liable in respect of the payment of penalties for late completion in accordance with the provisions of Clause 5.13 of the Conditions of Contract should the Contractor fail to complete the Works on or before the specified Due Date for Completion in consequence of the suspension.

Persistent and repeated breach by the Contractor of the requirements of the Act and/or this clause shall constitute grounds for the Employer's Agent to act in terms of Sub-Clause 9.2 of the Conditions of Contract and for the Employer to cancel the Contract in accordance with the further provisions of the said Clause.

Add the following subclause:

"PSA 5.9 SITE MEETINGS

The Contractor or its authorised agent will be required to attend regular site meetings, which shall normally be held twice a month on dates and at times determined by the Employer's Agent, but in any case whenever reasonably required by the Employer's Agent. Unless otherwise indicated in the Contract or instructed by the Employer's Agent, such meetings shall be held at the Contractor's offices on the Site. At such monthly meetings, matters such as general progress on the Works, quality of work, problems, claims, payments, and safety etc, shall be discussed, but not matters concerning the day-to-day running of the Contract."

PSA 6 TOLERANCES

Add the following subclause:

PSA 6.2 DEGREES OF ACCURACY

Add to the subclause:

"Degree of Accuracy 1 shall be applicable to the following parts of the Works unless stated to the contrary elsewhere; weirs, flanges at civil/mechanical interfaces."

"PSA 6.4 GENERAL

No guarantee is given that the full specified tolerances will be available independently of each other, and the contractor is cautioned in regard to the fact that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified or when clearly not applicable, all quantities shall for purpose of measurement and payment be determined from the 'authorised' dimensions. This shall be taken to mean the dimensions as specified or shown on the drawings or, if changed, as finally instructed by the Employer's Agent, without any allowance for the tolerances specified. Save as hereinafter specified to the contrary, all

measurements for determining quantities for purposes of payment will be based on the "authorised" dimensions.

If the work is therefore constructed in compliance with the "authorised" dimensions plus or minus any tolerances allowed, quantities will be based on the "authorised" dimensions regardless of the actual dimensions to which the work has been constructed."

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the Employer's Agent may nevertheless, at his sole discretion, accept the work for payment. In such cases no payment shall be made for quantities of work or material in excess of those calculated for the 'authorised' dimensions, and where the actual dimensions are less than the 'authorised' dimensions minus the tolerance allowed, quantities for payment shall be calculated based on the actual dimensions as constructed."

PSA 7 TESTING

PSA 7.1.1 Checking

Replace the last sentence with the following:

"The contractor shall obtain the services of an independent testing laboratory at his own expense (Refer subclause PS 8.4 of portion 1 of the project specifications) to carry out such checks as are prescribed in the various standardised specifications."

PSA 7.1.2 Standard of finished work not to specification

Insert the words "or checks by an approved laboratory ..." after the words "Where the Employer's Agent's checks ..." in the first line of Subclause 7.1.2.

PSA 7.2 APPROVED LABORATORIES

REPLACE THE CONTENTS OF SUB-CLAUSE 7.2 WITH THE FOLLOWING:

"Unless otherwise specified in the relevant specification or elsewhere in the Project Specification, the following shall be deemed to be approved laboratories in which design work, or testing required in terms of a specification for the purposes of acceptance by the Employer's Agent of the quality of materials used and/or workmanship achieved, may be carried out :

(a) any testing laboratory certified by the South African National Accreditation Systems (SANAS) in respect of the nature and type of testing to be undertaken for the purposes of the Contract;

(b) any testing laboratory owned, managed or operated by the Employer or the Employer's Agent;

(c) any testing laboratory established and operated on the Site by or on behalf of the Employer or the Employer's Agent.

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PSA 8 MEASUREMENT AND PAYMENT

PSA 8.1 MEASUREMENT

PSA 8.1.1 Method of Measurement, All Sections of the Schedule

Delete the words *:* "and South West Africa".

PSA 8.1.2 Preliminary and general items or section

PSA 8.1.2.1 Contents

Delete item (c).

PSA 8.1.2.2 Tendered sums

Replace the contents of this subclause with the following:

"The contractor's tendered sums under items PSA 8.3 and PSA 8.4 shall collectively cover all charges for:

- Risks, costs and obligations in terms of the general conditions of contract and of this standardised specification, except to the extent that provision is made in these project specifications to cover compensation for any of these items of work.
- Head-office and site overheads and supervision.
- Profit and financing costs.
- Expenses of a general nature not specifically related to any item or items of permanent or temporary work.
- Providing facilities on site for the contractor's personnel, including offices, storage facilities, workshops, ablutions, for providing services such as water, electricity, sewerage, sewage and rubbish disposal, for access roads and all other facilities required as well as for the maintenance and removal on completion of the works of these facilities and the cleaning-up of the camp site on completion of the works.
- Providing facilities for the Employer's Agent and his staff as specified in Portion 1: Site facilities required.
- Providing and erecting two new contract name boards as shown on the drawings.
- Providing all the required documentation described in Portion 1 : The Works on a monthly basis.
- Adhering and complying with the client's Procurement requirements including the monthly completion of labour and remuneration records."

PSA 8.2 PAYMENT

PSA 8.2.1 Fixed-charge and value-related items

Replace the contents of this subclause with the following:

"Payment of fixed charges in respect of item 8.3.1 will be made as follows:

Eighty per cent (80%) of the sum tendered will be paid once the facilities have been provided and approved. The remaining twenty per cent (20%) will be paid once the works have been completed, the facilities removed and the camp-site cleared and cleaned.

Payment for the sum tendered under item 8.3.2 will be made in three separate instalments as follows:

(a) The first instalment which is 40% of the sum, will be paid when the contractor has met all his obligations to date under this specification, the general conditions of contract and the special conditions of contract, and where the value of work certified for payment, excluding materials on site and any payments under preliminary and general items is equal to not less than 5% of the total value of the work listed in the schedule of quantities.

(b) The second instalment, which is 40% of the sum, will be made when the amount certified for payment, including retention moneys but excluding the second instalment referred to herein, exceeds 50% of the tender sum.

(c) The final payment, which is 20% of the sum, will be made when the works have been certified as completed and the contractor has fulfilled all his obligations to date under this specification, the general conditions of contract and the special conditions of contract.

Should the value of the measured work finally completed by more or less than the tender sum, then the sum tendered under item 8.3.2 will be adjusted pro rata up or down and this adjustment shall be applied to the third instalment. No adjustment will apply to item 8.3.1 in respect of variations in the value of work done or the time for completion finally authorised."

PSA 8.2.2 Time-related items

Replace the contents of this subclause with the following:

"Three time related items shall be scheduled and shall be full compensation for all time related preliminary and general costs and shall include the following :

- Public holidays
- SAFCEC recommended shut down period during December and January; and
- The contract period during the normal industry working period outside public holidays and outside the industry shutdown period during December and January.

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Subject to the provisions of 8.2.3 and 8.2.4, payment under item 8.4.1 (time-related item) will be made as follows:

PSA 8.2.2.1 The contract period during the normal industry working period payment..... **Unit : Sum**

Payment will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered contract period in Days (excluding public holidays and the SAFCEC recommended industry shutdown period during December and January), provided always that the total of the monthly amounts so paid for the item is not more than in proportion to the progress of the work as a whole.

Should the Employer's Agent grant an extension of the time for completion of the works, the Contractor will be entitled to an increase in the sum tendered for the time-related item, which increase shall be in the same proportion to the original tendered sum as the extension of time is to the original time for completion of the works.

PSA 8.2.2.2 Public Holidays..... **Unit : No of Statutory Public Holidays**

The tendered amount per day will be payable for the number of statutory public holidays included in the contract period which replaces normal working days.

Should an extension of time be granted and a public holiday is within this period, the Contractor will be entitled to additional payment for each additional public holiday which replaces a working day.

PSA 8.2.2.3 Industry recommended shutdown period during December and January ..... **Unit : Sum**

The tendered sum will be payable per the 15 working day industry recommended shutdown period during December and January which falls within the construction period. Should an extension of time be granted which extends the contract period beyond the industry recommended shutdown period during December and January, the Contractor will be entitled to payment as tendered for this item 8.2.2.3.

Payment for such increased amounts determined in accordance with PSA 8.2.2.1 to PSA 8.2.2.2 will be taken to be in full compensation for all additional time-related preliminary and general costs, that result from the circumstances pertaining to the extension of time granted."

PSA 8.3 SCHEDULED FIXED-CHARGE AND VALUE-RELATED ITEMS

Replace the items with the following:

"PSA 8.3.1 Fixed preliminary and general charges ..... **Unit : Sum**

PSA 8.3.2 Value-related preliminary and general charges ..... **Unit : Sum**

The sums tendered shall collectively include full compensation for all fixed and value-related preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.1."

Add the following subclause:

"PSA 8.3.5 Locate, record, protect and reinstate pegs ..... **Unit : Sum**

This item must cover all costs incurred to locate, record and protect pegs during the duration of the contract and the reinstatement of all disturbed pegs on completion of the contract in the manner as prescribed by the Land Survey Act."

PSA 8.4 SCHEDULED TIME-RELATED ITEMS

Replace the items with the following:

"PSA 8.4.1 Time-related preliminary and general charges

PSA 8.4.1.1 The contract period during the normal industry working period payment..... **Unit : Sum**

PSA 8.4.1.2 Public Holidays..... **Unit : No**

PSA 8.4.1.3 Industry recommended shutdown period during December and January ..... **Unit : Sum**

The sums and rate tendered for items PSA 8.4.1.1 to PSA 8.4.1.3 shall include full compensation for all time-related preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.2."

PSA 8.5 **Sums Stated Provisionally by The Employer's Agent**

Replace the contents of Subclause 8.5 with the following :

"PSA 8.5.1 Works Executed by the Contractor

The Contractor will be reimbursed in substitution of the Provisional Sums (if any) allowed in the Schedule of Quantities for work to be executed by the Contractor, in the amounts determined in accordance with the provisions of Clause 6.6 of the Conditions of Contract.

PSA 8.5.2 Works Executed by Subcontractors

(a) Work to be executed by a Subcontractor ..... **Unit : Prov Sum**

(b) Overheads, charges and profit on item (a) above ..... **Unit : % or Sum**

Sub-items (a) and (b) will be provided in the Schedule of Quantities for each different Nominated Subcontract included in the Contract.

The Contractor shall be reimbursed under sub-item (a), in substitution of the respective Provisional Sums (if any) allowed in the Schedule of Quantities, the amounts actually paid or payable by the Contractor to the respective Nominated Subcontractors, in accordance with the provisions of Clause 6.10 of the Conditions of Contract.

The Contractor shall be paid under sub-item (b), either :

(a) where the unit of measurement for sub-item (b) was specified as being a percentage, the respective percentage, as stated by the Contractor in its Tender, of the amount certified by the Employer's Agent for payment under the related sub-item (a), all in accordance with the provisions of Subclause 6.10.1 of the Conditions of Contract, or

(b) where the unit of measurement of sub-item (b) was specified as being a Lump Sum, an amount which is in the same proportion to the amount certified for payment under sub-item (a) and the tendered Lump Sum is to the amount of the Provisional Sum stated under sub-item (a);

The percentage or sum (as applicable) paid under sub-item (b) as aforesaid, shall be deemed to include for full and final compensation to the Contractor for all costs as may be incurred and all charges and profits associated with the engagement, supervision, administration and management of the Nominated Subcontractor and in fulfilling its obligations under the contract as the principal Contractor."

If the Contractor shall have omitted within its Tender to insert a tendered percentage under sub-item (b), or tendered a zero percentage, the Contractor's tendered rate for sub-item (b) shall be deemed to be zero and the Contractor shall not be entitled to any payment under sub-item (b)."

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PSA 8.6 PRIME COST ITEMS

Replace Subclause 8.6 with the following :

"PSA 8.6 PRIME COST SUMS

(a) Description of Item to which Prime Cost Sum Applies .....Unit : PC Sum

(b) Charge required by Contractor on Sub-item (a) above ..... Unit : %

Sub-items (a) and (b) will be provided in the Schedule of Quantities for each different item to which a Prime Cost Sum applies.

The Contractor shall be reimbursed under sub-item(s) (a) in substitution of the respective Prime Cost Sums included in the Contract, the actual price(s) paid or payable by him in respect of the goods, materials or services supplied, but excluding any charges for the Contractor's labour, profit, carriage, establishment or other charges related to such goods, services or materials.

The Contractor shall be paid under sub-item (b), the respective percentage, as stated by the Contractor in its Tender, of the amount certified by the Employer's Agent for payment under the related sub-item (a). The percentages tendered by the Contractor for each respective sub-item (b) included in the Schedule of Quantities shall be deemed to in full and final compensation to the Contractor in respect of any charge by the Contractor for labour, carriage profit, establishment and for any other charges related to the goods, services or materials supplied under the related sub-item (a).

If the Contractor shall have omitted within its Tender to insert a tendered percentage under sub-item (b), or tendered a zero percentage, the Contractor's tendered rate for sub-item (b) shall be deemed to be zero and the Contractor shall not be entitled to any payment under sub-item (b)."

PSA 8.7 DAYWORK

Replace the contents of Subclause 8.7 with the following :

"Measurement and payment shall be in accordance with the provisions of Sub-clause 6.5 of the Conditions of Contract."

Add the following item:

PSA 8.8 TEMPORARY WORKS

PSA 8.8.2 Accommodation of traffic ..... **Unit : sum**

Add the following:

"This amount shall cover all costs in respect of the provision, erection, moving, re-erection and maintenance of all barriers, road signs, lights and flagmen necessary for the protection of the works, for the construction, gravelling and maintenance of detours and entrance roads affected by the work, as well as the breaking up and removal thereof at the contract completion, and for compliance with all necessary traffic rules and regulations, liaising with the road authorities, and all other costs necessary in respect of accommodation of traffic."

Replace item 8.8.4 with the following:

"PSA 8.8.4 Location and protection of existing services

Where particular items are provided in other sections of the schedule the costs of detection, exposure, protection and alterations shall be covered by such particular items. Where no such particular items are provided and where there is reason to expect the presence of such a service or services, the following items will apply:

PSA 8.8.4.1 Provision of detecting devices for :

The tendered rate shall include full compensation to provide a scanner to detect steel pipes and a scanner to detect electrical cables and to mark the position of these services on site.

(a) Water and sewer pipes ..... **Unit : Sum**

(b) Electrical and other cables ..... **Unit : Sum**

(c) Other ..... **Unit : Sum**

PSA 8.8.4.2 Hand excavation necessary for locating and exposing existing services in all materials:

(a) In roadways ..... **Unit : m³**

(b) In all other areas ..... **Unit : m³**

The rates shall cover the cost of excavating by means of hand tools within authorised dimensions, for all precautionary measures necessary to protect the services from damage during excavation and backfilling and for subsequent backfilling and compacting. Compaction of material in all areas except in roadways shall be to 93% of modified AASHTO density.

The rate for hand excavation in roadways shall also include compensation for compacting excavated or selected backfill material to 100% of modified AASHTO density. Reinstating layerworks and surfacing shall be measured and paid for under SABS 1200 DB.

The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water and for removal of surplus excavated material from the site."

Add the following items :

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"PSA 8.8.7 Dealing with water ..... **Unit : Sum**

The sum shall cover the cost for the provision, operation, maintaining and removal of all plant and materials required to deal with surface and subsurface water anywhere on the Site as required in terms of Subclause 5.1.3 of SABS 1200 D and Subclause 5.1.2 of SABS 1200 DB. No additional payment will be made for "Special water hazards".

The sum shall cover the cost of providing the necessary plant or materials, or both, fully erected and operative on the Site, the cost of operating and maintaining pumps, well points, sheeting, close timbering, and other equipment, as applicable, for 24 hours a day, 7 days a week, throughout the period during which the facilities are required, and the cost of removing such goods and restoring the Site to its original condition on completion of that part of the project for which the temporary works were erected.

Equal monthly payments will be made calculated by dividing the sum tendered for the item by the tendered contract period in months. The sum of the equal monthly payments shall not exceed the sum tendered for this item except where an extension of the contract period is approved by the Employer's Agent in which case the monthly payments will be made pro rata to the extension of time only if dealing with water is required."

PSA 8.8.8 Temporary fence minimum ..... **Unit : m**

Various types will be scheduled.

The tendered rate shall include full compensation for the supply and erection of the temporary fence, the maintenance of the fence and the dismantling of the fence.

The contractor shall erect a temporary high visibility barrier fence at the positions as shown on the drawings or as instructed. The tendered rate shall include full compensation for the supply, erection and maintenance of the fence and the removal thereof on completion of the civil contract. It shall at all times be kept in an upright and neat condition.

PSA 8.8.9 Dismantle and re-erect temporary fence ..... **Unit : m**

Various types will be scheduled.

The tendered rate shall include full compensation for the careful dismantling of the temporary high visibility barrier fence, the stacking, loading, transporting, off-loading and re-erection of the fence at a new required position. It will also include for the maintenance of the fence and the removal there-of at the end of the construction activities.

PSA 8.8.10 Dust control ..... **Unit : Sum**

The tendered rate shall include full compensation for the provision of a water truck on site on a continuous basis during the construction of earthworks and layerworks period and the regular wetting of the construction area to prevent any dust disturbance to adjacent areas.

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Add the following items :

PSA 8.10 **Accommodating Other Contractors** ..... **Unit : Sum**

The amount tendered shall cover the cost of accommodating civil, electrical and mechanical contractors on the site of the Works. Payment will be made in equal monthly amounts over the Contract period."

PSA 8.12 COMPLIANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY ACT (ACT NO 85 OF 1993) AND CONSTRUCTION REGULATIONS AND SPECIFICATIONS INCLUDED IN PART C5 ..... **Unit : Sum**

The tendered rate shall include full compensation for compliance with the OHS Act and Construction Regulations and the Health and Safety requirements and specification included in this tender document.

Temporary barriers and fences for deep or trench excavations required in terms of the contract shall not be paid for separately.

Payment under this item will be made as follows :

(a) The first instalment which is 30% of the sum tendered, will be paid once the contractors Health and Safety Plan is approved by the Employer or the Employers Agent and the Contractor has met all his obligations to date under this specification.

(b) The remainder of the sum tendered will be paid in equal monthly amounts calculated by dividing the sum tendered (less 30%) divided by the contract period in months.

No additional payment will be made should an extension of the contract period be granted. Penalties for non-compliance will be deducted from payments due to the contractor.

PSA 8.13 **Compliance with The Environmental Management Plan and Requirements Included in the Particular Specifications**..... **Unit : Sum**

The tendered rate shall include full compensation for compliance with the environmental management requirements and specification included in this tender document.

Payment under this item will be made in equal monthly amounts calculated by dividing the sum tendered divided by the contract period in months.

No additional payment will be made should an extension of the contract period be granted. Penalties for non-compliance will be deducted from payments due to the contractor.

PSA 8.17 **Photographic Record**..... **Unit : Sum**

The Contractor must keep a photographic record of the condition of properties and structures within 30 m of the proposed works. Photographs of every structure must be taken prior to construction and must be of high quality (3) mega pixel or higher to ascertain the condition of the property or structure. Structures will include (but are not limited to) boundary walls, fences, road surfaces, kerbing, stormwater structures and the surrounding area along the route of the pipeline. The preconstruction photographs must be handed to the Employer's Agent prior to any excavation is undertaken.

The structures and properties must again be photographed after construction to ascertain any possible damage to the structures or properties due to construction activities. This photographic record must be supplied to the Employer's Agent at the end of the contract and will form part of the record information to be provided by the Contractor.

The tendered sum shall include full compensation for the investigation and supply of the photographic record in electronic and colour hard copy format (standard photo size). Fifty percent of the sum tendered will be payable upon supply and approval by the Employer's Agent of the pre-construction photo record and the remaining 50% upon supply of the post-construction record.

PSA 8.19 Liaison with residents and the local authority.....**Unit : Sum**

The tendered rate shall include full compensation for all liaisons with the residents of each area and the Municipality regarding valve closures and issuing of public notices.

Residents must be informed of valve closures at least 48 hours prior to closing of valves.

The tendered rate must include :

- the preparation of an information page which must be delivered to each household to be affected, prior to working in the area.
- the delivery of a notice informing residents of a disruption in the water supply (three days prior to the disruption)
- obtaining a "happy letter" from all residents once the work is completed and gardens re-instated.
- direct liaison with residents should a complaint be received including a written account of the complaint and agreement reached with the resident.

No additional payment will be made for additional notices of disruption which must be issued as a result of failed connection attempts."

PSA 8.20 **Record of Test Results and Related Administration**..... **Unit : Sum**

The tendered rate shall include full compensation for all the requirements stipulated in PS 8.4 for the record keeping, updating of test positions, recording the test results in tabular format and providing additional copies with the marked on reference number on a monthly basis.

Upon completion of the contract a separate full set of test results must also be submitted to the Employer's Agent before a Certificate of Practical Completion shall be issued.

Twenty percent of the Time Related P&G amount will be withheld should the required information not be provided in the correct format.

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PSA 8.21 (a) Sum carried over from Mechanical and Electrical Works ..... **Unit : Sum**

The Contractor shall be reimbursed under sub-item (a) for costs duly priced in the Mechanical and Electrical Bill section, payable by the Contractor to the appointed sub-contractor in accordance with the provisions of Clause 6.10 of the Conditions of Contract.

(b) Charge required by Contractor on sub-item (a) above ..... **Unit : %**

The Contractor shall be paid under sub-item (b) the percentage, as stated by the Contractor in its Tender, of the amount certified by the Engineer for payment under the related sub-item (a), all in accordance with the provisions of subclause 6.10.1 of the Conditions of Contract.

The percentage paid under sub-item (b) as aforesaid, shall be deemed to include for full and final compensation to the Contractor for all costs as may be incurred and all charges and profits associated with the engagement, supervision, administration and management of the appointed Subcontractor and in fulfilling its obligations under the contract as the principal Contractor."

If the Contractor shall have omitted within its Tender to insert a tendered percentage under sub-item (b), or tendered a zero percentage, the Contractor's tendered rate for sub-item (b) shall be deemed to be zero and the Contractor shall not be entitled to any payment under sub-item (b)."

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PSC SITE CLEARANCE (1982)

PSC 3 MATERIALS

PSC 3.1 DISPOSAL OF MATERIAL

Add the following:

"The contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance."

PSC 5 CONSTRUCTION

PSC 5.1 AREAS TO BE CLEARED AND GRUBBED

Add the following:

"Pipeline routes shall be cleared to a distance of 1,5 m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations."

PSC 5.2 CUTTING OF TREES

PSC 5.2.3 Preservation of trees

PSC 5.2.3.2 Individual trees

Replace the last sentence with the following:

"An amount of ***R500-00*** will be deducted from moneys due to the Contractor as a penalty for every tree that is damaged or removed unnecessarily."

PSC 5.3 CLEARING

ADD THE FOLLOWING:

"The thickness of the layer that will unavoidably be stripped during clearing of vegetation will be taken as 100 mm. This implies that levels used in earthworks quantity calculations will be 100 mm lower than the original levels."

Add the following:

"The tenderers attention is drawn to the fact that all items described under subclause 5.3 which are not separately listed in the bill of quantities must be included in the price for item PSC 8.2.1."

PSC 5.5 RECLEARING OF VEGETATION

Add the following:

"Where areas have to be re-cleared on the written instructions of the Employer's Agent, such re-clearing shall be carried out at the contractor's own cost and the contractor is advised therefore, not to clear areas at such an early stage that re-clearing may become necessary."

PSC 8 MEASUREMENT AND PAYMENT

PSC 8.1 BASIC PRINCIPLES

Add the following:

"Levels to be used for earthworks quantity calculations will be surveyed once the clearing operation have been completed."

PSC 8.2 SCHEDULED ITEMS

PSC 8.2.1 Clear and Grub

Replace the first line with the following:

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"The area designated by the Employer's Agent to be cleared and grubbed will be measured in m² to the nearest square metre or,"

PSC 8.2.7 Dismantle and remove pipelines, electricity transmission lines, cables, etc.

Replace the contents of this Subclause with :

"The tendered rates shall include full compensation for the detection, disconnection, removal, stockpiling, safeguarding, reinstatement and reconnection of services, including all necessary excavation, bedding, concrete bases and backfilling.

In the event of the contractor damaging any of the services he will replace it at his own cost".

Add the following payment clauses :

PSC 8.2.8 Demolish and remove structures / buildings..... **Unit : Sum**

The contractor shall ascertain the works necessary to remove the structures complete as given in the schedule of quantities and noted on the drawings.

"The rate shall cover the cost of excavating around the structure, demolishing the structure, disposal of excavated material and rubble, and backfilling of the hole with sand in layers of 300 mm including compaction to 100% of MOD AASHTO. There will be distinguished between different structures."

"PSC 8.2.13 Take down and re-erect existing fences ..... Unit : m

The rate shall cover the cost of taking down the fences, coiling wire, sorting, stacking and guarding all material, the cost of loading, transporting and off-loading such material, the cost of re-erecting the fence in its original position, or temporary position, using the dismantled material and the cost of temporary bracing the sections of fence not taken down.

PSC 8.2.15 ***Remove and dispose of kerbing***..... ***Unit : m***

The rate shall cover the cost of the removal, transport and disposal of existing kerbs to a spoil site furnished by the Contractor, including all necessary excavation and backfill compacted to 100% modified AASHTO density.

PSC 8.2.17 Rip and clear tarred and paved areas..... **Unit : m²**

Various items shall be scheduled. The rates shall collectively include full compensation to rip, clear and spoil at a spoil site provided by the contractor of asphalt or block paving.

PSC 8.2.18 Remove kerbs, stockpile, store, maintain and reinstate..... **Unit : m**

The tendered rate shall include full compensation for careful excavation around the kerbs, careful removal, loading, transport of kerbs, off loading, clearing, stacking, storing and maintaining of the kerbs and the reinstatement of kerbs. The rate shall also include full compensation for setting out, kerb mix, planning and finishing of the reinstated kerbs.

Various items shall be measured for various types of kerbs.

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PSD EARTHWORKS (1988) AS AMENDED 1990

PSD 2 INTERPRETATIONS

PSD 2.1 SUPPORTING SPECIFICATIONS

Replace subclause 2.1.2 with the following:

"PSD 2.1.2 Any of the other SABS 1200 specifications may form part of the contract documents."

PSD 2.3 DEFINITIONS

Replace the definition "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 "Specified density" with the following:

"Specified density: The specified dry density expressed as a percentage of modified AASHTO dry density."

Replace the definition "Stockpile" with the following:

"Stockpile (Verb): The process of selecting and, as maybe necessary, loading, transporting and off-loading material in a designated area for later use and a specific purpose."

Add the following definitions:

"Fill: An embankment or terrace constructed from material obtained from excavations or borrow. In roads it includes the earthworks up to below the selected sub-grade level.

Fill (material): Material used for the construction of an embankment or terrace.

Roadbed: The in-situ material on which a fill is to be constructed.

Placing : Placing shall mean spreading of backfilling material, watering, mixing, compacting, final grading, complying with the required tolerances and providing for testing, all in accordance with the requirements of the specification."

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PSD 3 MATERIALS

PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES

PSD 3.1.1 Method of classifying

Add the following:

"Classification of material other than 'soft excavation' shall be agreed upon before excavation may be commenced. The contractor shall immediately inform the Employer's Agent if and when the nature of the material being excavated changes to the extent that a new classification for further excavation is warranted. Failure on the part of the contractor to advise the Employer's Agent thereof in good time shall entitle the Employer's Agent to classify, at his discretion, such excavation as may have been executed in material of a different nature."

PSD 3.2.3 Material suitable for backfill or fill against structures

Replace the contents of this sub-clause 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; and

(b) The material shall not contain large clay lumps that do not break up under the action of the compaction equipment; and

(c) The liquid limit of the material shall not exceed 40, neither shall the PI exceed 18.

(d) The minimum modified AASHTO density shall be 95%."

PSD 3.3 SELECTION

PSD 3.3.1 General

Replace the second paragraph with the following :

"The Contractor shall deal selectively with materials from all excavations to ensure that no acceptable backfill or bedding material is contaminated by material unfit for use. No additional payment shall be made in this regard and all costs related to the above selection process shall be included in the applicable payment items. Should useful material be contaminated to such an extent that it is regarded as unfit for use the Contractor shall at his own cost dispose of this material and replace it with material of an equivalent standard to the acceptable in-situ material."

Add the following subclause:

PSD 3.3.3 Selection in borrow pits

The approval of a borrow area for a certain purpose does not necessarily mean that all material within the area is suitable for the specified purpose. What it does mean, is that the borrow area contains some suitable material. The onus is on the contractor to ensure that only material that is indeed suitable is removed and used for the specified purpose."

Where the contractor is required to select material from excavations for a specific purpose, the above provisions relating to borrow areas shall apply *mutatus mutandis* to excavations.

The contractor shall not waste or contaminate material that has been elected for a specific purpose.

PSD 4 PLANT

PSD 4.4 DETECTORS

Replace the contents of Subclause 4.4 with the following :

"The Contractor shall, for the purposes of detecting and locating underground services in accordance with the provisions of Subclause 5.4 of SABS 1200 A and Subclause 5.1.2 of SABS 1200 D, at its own cost, provide and use detecting equipment which is suitable for the detection of underground cables and pipes."

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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."

PSD 5.1.1.2 Safeguarding of Excavations

REPLACE "Machinery and Occupational Safety Act" WITH "Occupational Health and Safety Act, 1993 (Act 85 of 1993)."

Add the following to paragraph (B)(1) :

"Payment for supporting the sides of excavations and trenches shall be deemed to be included in the rates tendered for excavations. No separate payment will be made in this regard and it will be the Contractor's responsibility to ensure the safety and stability of all excavations.

Where trenches have to be widened to accommodate manholes, junction boxes, etc., the cost of supporting the vertical sides of such additional excavations will be deemed to be included in the rates tendered for excavation."

Add the following to paragraph (B)(2) :

"The slope of the sides of an excavation of trench may never be steeper than 60° to the horizontal and all costs incurred to slope the sides of an excavation or trench and the reinstatement thereof will, irrespective of the angle of the slope, be deemed to be included in the rates quoted for excavation."

PSD 5.1.1.3 Explosives

Replace the contents of this subclause with the following :

"The contractor will generally be permitted to use explosives for breaking up hard material during excavations, for demolishing existing structures and for such other purposes where they may normally be required, subject to the following conditions :

(a) The Employer's Agent shall be authorised to prohibit the use of explosives in cases where, in his opinion the risk of injury to person to persons or damage to property or adjoining structures is too high. Such action by the Employer's Agent shall not entitle the contractor to any additional payment for having to resort to other less economical methods of construction.

(b) The Employer's Agent's prior approval shall be obtained in writing in respect of each and every blasting operation carried out. Such approval may be withheld in the event of the contractor not acting responsibly and carefully in his use of explosives.

(c) The requirements of the Explosives Act, Act 6 of 1956, and the requirements of the Inspector of Explosives shall be complied with.

(d) Before any blasting is undertaken the contractor shall satisfy the Employer's Agent that he has established whether or not the insurers concerned require pre- and post-blasting inspections of buildings and structures within a certain radius of the proposed blasting to be carried out.

Should such inspections be required, the contractor shall, together with the Employer's Agent and the insurer, examine and measure any buildings, houses or structures in the vicinity of the proposed blasting and establish and record, together with the owner, lessee or occupier thereof, the extent of any cracking or damage that may exist before the commencement of blasting operations. It shall be the responsibility of the contractor to make good at his own expense any further damage to such houses, buildings or structures that is a result of the blasting.

(e) Where there is a reasonable possibility of damage to power and telephone lines or any other property, the contractor shall suitably adapt his method of blasting and the size of charges and shall use adequate protective measures, such as cover-blasting, to limit the risk of damage as far as possible.

(f) All accidents, injury to persons and damage to property shall be reported in detail and in writing to the Employer's Agent as soon as is practicable.

(g) The Employer's Agent shall be given 24 hours notice by the contractor before each blasting operation is carried out."

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PSD 5 CONSTRUCTION

PSD 5.1 **Precautions**

PSD 5.1.2 Existing services

PSD 5.1.2.2 Detection, location and exposure

Replace the contents of subsubclause 5.1.2.2 with the following:

"Where no services are shown on the drawings, but the presence of such a service could be assumed within reason, the Contractor must in co-operation with the relevant authorities locate such a service before commencing construction. After locating such a service, it would be regarded as a noted service, and the Contractor will be responsible for any costs arising from damages to the service due to the construction activities of the contractor."

"The exposure by the Contractor of underground services, as required in terms of Subclause 5.4 of SABS 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 : 98% Mod AASHTO density ; and

(b) In all other areas : 93% 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 SABS 1200DB.

Payment in respect of the exposing of the services by means of hand excavation as described above, will be made in accordance with Subclause PSD 8.3.8.1.

Payment in respect of the reinstatement of layerworks in roadways will be made in accordance with Subclause 8.3.6.1 of SABS 1200DB (as amended).

PSD 5.1.2.3 Protection of cables

REPLACE SUBSUBCLAUSE 5.1.2.3 WITH THE FOLLOWING:

"5.1.2.3 Protection during Construction

Further to the requirements of Subclause 5.4.2 of SABS 1200A (as amended), major excavating equipment and other Equipment 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 SABS 1200A (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 minimise the occurrence of any further damage occurring."

PSD 5.1.3 Stormwater and groundwater

Add the following:

"The contractor shall at the earliest practicable opportunity install the permanent drainage specified or shown on the drawings and shall at his own cost provide such further temporary drainage as may be necessary for the protection of the works, except where other specific items regarding drainage are provided."

PSD 5.2 METHODS AND PROCEDURES

PSD 5.2.2 Excavation

PSD 5.2.2.1 Excavation for general earthworks and for structures

Add the following to paragraph (b):

"Where the nature of the material precludes the above procedure, additional excavations shall be made to provide working space for the erection of form work. In general payment will be made for a working width of 600mm, but the contractor may excavate a greater working width at no additional cost to the employer. Excavation for structures shall be measured to vertical planes 0,6m outside the concrete perimeter.

Immediately before any permanent construction is commenced, all loose material shall be removed or thoroughly compacted."

Replace paragraph (e) with the following :

"Where excavations have been carried out below the authorized levels, the contractor shall backfill such excavations to the correct level with approved gravel compacted to 95% of modified AASHTO density or to the density of the surrounding material.

Where excavations for structures in hard material have been carried out, the Employer's Agent may however require the over-excavation to the backfilled with a weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the contractor shall retrim in 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 any

additional concrete which 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 5.2.2.2 Borrow pits

Add the following:

"A commercial source shall, for the purposes of this specification, mean a source of material provided by the contractor, not the employer.

Where it is specified that material shall be obtained from commercial sources, the contractor shall be responsible and include in his prices for borrow to fill from commercial sources, for finding a source of suitable material, for making all arrangements for procuring the material with the owner of the source, for the payment of any royalties, charges or damages and, for transporting the material to the site regardless of the distance involved. No payment will be made for the removal of overburden or stockpiling at the commercial source and no extra over payment for excavating in intermediate, hard or boulder material shall apply."

"PSD 5.2.2.3 Disposal

Add the following:

"The contractor shall provide the necessary spoil sites and shall make the necessary arrangements with the owner of the site where the material is disposed of and shall include in his rates for all charges in this regard and for transporting the material regardless of the distance involved."

Add the following subclause:

"PSD 5.2.2.4 Selection and stockpiling

The approval or designation of a particular borrow area for a particular purpose will not imply that all the material is suitable for the purpose or should be used for that purpose. The contractor shall select suitable material from that source, discard unsuitable material and reserve material for other purposes as necessary. When required and as ordered by the Employer's Agent, material shall be stockpiled for later use when the excavation thereof is unavoidable in order to excavate the material required at the time.

PSD 5.2.3 Placing and Compaction

PSD 5.2.3.1 Embankments

Omit "98% in the case of non-cohesive soil" and substitute "100% in the case of non-cohesive soil".

PSD 5.2.4.3 Grass or other vegetation

Add the following subclause:

"Hydroseeding

The following materials shall be used in hydroseeding :

(a) Fertiliser

The type of fertiliser to be used shall be 2:3:2 (22 + 2N) and superphosphate.

(b) Grass seed

The following seed mixture at an application rate of not less than 45 kg of seed mixture per hectare, shall be used :

10 kg	Cynodon dactylon
10 kg	Festuca rubra
6 kg	Lolium multiflorum
6 kg	Agrostis tenius
3 kg	Trifolium subterranean
4 kg	Dactylis glomerata
6 kg	Serredella
45 kg	per hectare

Cellulose pulp shall be added to the hydroseeding mix at a rate of 25 kg of pulp per kilolitre of water used, except where otherwise instructed in respect of flat slopes.

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Hydroseeding shall be carried out with an approved hydroseeding machine at a rate of application of not less than 45 kg of seed mixture per hectare, unless otherwise specified in the project specifications.

The work shall be executed in May, which falls in the 12-month maintenance period.

Straw stabilisation

One bale of hay per 20 m² shall be rotivated or harrowed into the sand. Harrowing or rotivation shall be done in an east-west direction, i.e. across the direction of the prevailing winds."

PSD 5.2.5 Transport for Earthworks

PSD 5.2.5.2 Overhaul

Replace the contents of this subclause with the following:

"No overhaul will be paid under sections 1200 D, 1200 DM, 1200 DK or 1200 DB or any other sections. All transport costs irrespective of distance, source and material must be included in the relevant payment clauses."

PSD 7 TESTING

PSD 7.2 TAKING AND TESTING OF SAMPLES

Replace the contents of this subclause with the following:

"The contractor shall 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 specification and shall submit the results of these tests to the Employer's Agent in a form approved by him. The Employer's Agent may likewise carry out such tests.

Testing by the Employer's Agent will not relieve the contractor of his obligations to provide materials and workmanship in accordance with the specifications.

The requirements of the density for a particular lot shall be deemed to be satisfied if at least 75% of the dry-density tests show values equal to or above the specified density and no single value is more than five percentage points below the specified value."

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PSD 8 MEASUREMENT AND PAYMENT

PSD 8.1 BASIC PRINCIPLES

Add the following paragraph :

"PSD 8.1.4 Where backfilling is part of the activities described under a payment clause, the word backfilling includes the supply of the approved backfilling (regardless of the source and distance), as well as the placing of the material as described under subclause PSD 2.3."

PSD 8.1.5 Watering or harrowing of material and allowing it to dry out to obtain optimum moisture content before backfilling and compaction of fill material (whether obtained from site or commercial sources) will not be paid for separately and shall be deemed to be included in the tendered rates for Bulk Excavation or Restricted Excavation.

PSD 8.2 COMPUTATION OF QUANTITIES

PSD 8.2.1(a)(2) Add "or residential houses", after "…. rail embankment".

PSD 8.3 SCHEDULED ITEMS

PSD 8.3.2 Bulk Excavation :

Add the words "temporary stockpiling, harrowing or drying the material" after the words "…….. basic selection,loading ……." in the second sentence of paragraph (a).

Add the following :

"PSD 8.3.2(c) Excavate in all materials, temporary stockpile and maintain ..... **Unit : m³**

The rate shall cover the cost of complying with all precautions required in terms of SABS 1200 subclause 5.1 in addition to the cost of excavation, basic selection, loading, transportation within freehaul distance, off-loading, temporary stockpiling, spreading or backfilling, watering, harrowing and drying the material, compacting, final grading complying with the requirements for tolerances, and maintaining of the stockpile, all in accordance with the requirements of the specifications."

PSD 8.3.2.2 Cut to spoil ..... **Unit : m³**

The unit measurement shall be the cubic metre of material measured in-situ before excavation or measured in accordance with the provisions of 8.2.2 by taking a percentage of the loose volume in trucks. Where material from an excavation is used in fill, as well as taken to spoil the provisions of 8.2.1 shall be strictly adhered to for purposes of measurement.

The tendered rates shall include full compensation for excavating as if in soft excavation, loading, transporting for the free-haul distance and for off-loading, spreading and trimming the spoil material at sites provided by theemployer.

PSD 8.3.2.3 Extra over sub-items 8.3.2.1 and 8.3.2.2 for excavating in :

(a) Intermediate excavation ..... **Unit : m³**
(b) Hard rock excavation ..... **Unit : m³**
(c) Boulder excavation class A ..... **Unit : m³**
(d) Boulder excavation class B ..... **Unit : m³**

The tendered rates shall include full compensation for the additional cost of excavating and processing material in the classes specified (see drawing D-1)."

PSD 8.3.3 Restricted excavation

Add the words "harrowing or drying the material" after the words "….. material separate (where relevant)" in the fourth sentence of paragraph (a).

Add the following sub-sub-item :

" (c) Extra over item 8.3.3 (a) for hand excavation ..... Unit : m³

This item shall apply to hand excavation ordered by the Employer's Agent or where the Employer's Agent considers that, owing to circumstances, excavation by mechanical excavators is not practicable. It shall not apply to hand excavation for the purpose of trimming or finishing excavation made by mechanical means.

The tendered rate shall include full compensation for the additional cost of excavating by means of hand tools."

PSD 8.3.4 Importing of Materials

Amend subclause '(a)' as follows:

Delete the words "Extra over for" from the heading. Delete the words "additional to 8.3.2 and 8.3.3" and replace with "of the work and items described in payment items 8.3.2 or 8.3.3 and including the cost of".

The rate shall also include the waterings, shaping and compaction of important material.

PSD 8.3.6 Overhaul

Add the following :

"No overhaul shall apply to material from commercial sources or to material disposed of to sites provided by the contractor or by other means employed by the contractor."

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PSD 8.3.8 Existing services (see 5.1.2.2)

PSD 8.3.8.1 Location

REPLACE ITEM 8.3.8.1 WITH THE FOLLOWING :

"8.3.8.1 Hand Excavation for Locating and Exposing Existing Services :

(a) In roadways ..... **Unit : m³**

(b) In all other areas ..... **Unit : m³**

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised or actual dimensions of the excavation, whichever is the lesser.

The tendered rates shall cover the cost of excavating in all materials by means of hand tools within authorised dimensions and at locations approved by the Employer's Agent in accordance with the requirements of Subclause PSA 5.4.1, for all precautionary measures necessary to protect the services from damage during excavation and backfilling, and for subsequent backfilling and compacting. Compaction of material in all areas except in roadways shall be to 90% of the modified AASHTO density.

The tendered rate for hand excavation in roadways shall include compensation for compacting excavated or selected backfill material to 93% of modified AASHTO density. Reinstating layerworks and surfacing shall be measured and paid for in terms of SABS 1200DB.

The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water, for removing surplus excavated material from the Site, for transporting all material within the free-haul distance, and for supplying adequate supervision during both excavation and backfilling operations. Overhaul, if applicable, will be measured and paid for in terms of SABS 1200DB."

ADD THE FOLLOWING ITEMS IN SUBCLAUSE 8.3:

PSD 8.3.10 Topsoiling ..... **Unit : m³**

Change the unit to "m³" and replace the contents of this item with the following :

"The unit of measurement shall be the cubic metre and the quantity shall be calculated from the authorized dimensions.

The tendered rate shall include for loading the topsoil from stockpiles, transporting it for the free-haul distance, off-loading, spreading, shaping and lightly compacting."

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PSD 8.3.11 Grassing or other vegetation cover

Replace the contents with the following :

"PSD 8.3.11.1 *Planting of grass cuttings* ..... **Unit : m²**

Only special type of grass with a short root system is to be used.

PSD 8.3.11.2 *Planting of grass sods* **Unit : m²**

Only special type of grass with a short root system is to be used.

PSD 8.3.11.3 *Hydroseeding* **Unit : m²**

The tendered rate shall include full compensation of the seed mixture, for furnishing cellulose pulp and mixing it with seed and water and applying the mixture, watering, weeding, rehydroseeding bare patches, and for any other work except mowing, which may be necessary for establishing an acceptable cover and maintaining the grass for a period of three months after an acceptable cover has been established.

PSD 8.3.16 Compaction of in situ material to a depth of 300mm ..... **Unit : m²**

The tendered rate shall include full compensation for scarifying (if necessary), watering, shaping and compacting the in situ material to 95% Mod AASHTO density to a depth of 300mm.

PSDB EARTHWORKS (PIPE TRENCHES) (1989(b))

PSDB 3 MATERIALS

PSDB 3.5 BACKFILL MATERIALS

Add the following paragraphs:

"(c) Cement stabilised backfilling

Backfilling shall be stabilised with 5% cement where directed by the Employer's Agent. Aggregate shall consist of approved soil or gravel containing stones not bigger than 38 mm and with a plasticity index not exceeding 10.

The soil or gravel shall be mixed with 5% cement and shall be compacted in layers of 100 mm thick to 90% of modified AASHTO density.

(d) Soilcrete backfilling

Aggregate for soilcrete shall be mixed with 5% cement and shall consist of approved soil or gravel containing stones not bigger than 38 mm and with a plasticity index not exceeding 10.

The soil or gravel shall be mixed in a concrete mixer with the cement and enough water to such a consistency that the mixture can be placed with vibrators to fill all voids between the pipe and the sides of the trench. Shuttering shall be used where necessary."

PSDB 3.7 SELECTION

Replace the words "if he so wishes" in the first line of the second paragraph with the words "at his own cost".

PSDB 4 PLANT

PSDB 4.1 EXCAVATION EQUIPMENT

Add the following paragraph :

"All excavations in excess of the specified depth and width, must be backfilled with approved backfilling material. No additional payment regarding this will be made, it will be assumed that payment is included in the tendered rates for the applicable items.

Compaction of sand must be to 100% of modified AASHTO maximum density."

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PSDB 5 CONSTRUCTION

PSDB 5.1 PRECAUTIONS

PSDB 5.1.3 Accommodation of traffic and access to properties

Replace the semicolon and the word "and" at the end of subclause 5.1.3(a) with a full stop and replace item (b) with the following :

"(b) Where necessary to achieve compliance by the Contractor with his obligations in terms of subclause PS 8.1 of Portion 1 Specifications to provide and maintain pedestrian and vehicular access to properties affected by the works, the Contractor shall construct and maintain to the satisfaction of the Employer's Agent, such temporary access roads around, and/or steel or timber bridges over excavations in roads, pavements, entrances or accesses to properties.

Temporary pedestrian access bridges shall be at least 1,2 m wide and temporary access bridges for vehicles shall be at least 3,6 m wide. All temporary access bridges shall be fitted with handrails as well as protective mesh fencing on both sides.

On completion of the work, the Contractor shall dismantle and remove all such temporary constructions and reinstate these areas to their former condition.

Except only where the Employer's Agent has included in the Schedule of Quantities, particular payment items specifically therefore, the Contractor will not be paid directly for the construction and maintenance of temporary

access roads and/or the provision and maintenance of bridges as aforementioned, and the costs thereof shall be deemed included in the Contractor's tendered rates for excavation."

Add the following :

"PSDB 5.1.5 REMOVAL OF EXISTING PIPELINES

Where existing pipes have to be removed, they shall be carefully opened up by machine excavation to 300 mm above the pipes after which the whole pipe shall be fully exposed by means of hand excavation. The excavation width shall comply with Subclause 8.2.3.

The pipes shall be removed from the trench in a manner approved by the Employer's Agent, and brought to the surface for inspection by the Employer's Agent.

Pipes that are declared suitable for re-use and pipes declared unfit for re-use shall be dealt with in accordance with the respective manner described in the specifications, or on the drawings or the Employer's Agent's instructions, as relevant."

PSDB 5.2 MINIMUM BASE WIDTHS

Add the following above the table.

"No allowance shall be made for the extra thickness of the collars or couplings."

Add the following after paragraph (b) :

"The above is not applicable to trenches for subsurface drains.

Trenches for subsurface drains shall be excavated to the dimensions and gradients shown on the drawings or directed by the Employer's Agent."

PSDB 5.4 EXCAVATION

Add the following :

"All excavation for pipes must be done according to the trench excavation method, and not to the fill method. No additional payment extra over to that listed under item 8.3.3 will be made for pipes, culverts or any other structure that falls within the road or fill layers. Except where otherwise specified, trenches shall be of such a depth that the minimum cover over the pipes shall be 700 mm except at road-crossings where the minimum cover shall be 1 000 mm."

PSDB 5.6 BACKFILLING

PSDB 5.6.3 Disposal of soft Excavation Material

Replace the contents of the subclause with the following:

"Excavated material from the trench that has become surplus because of bulking, displacement by the pipe, and importation, shall be disposed of outside the site boundaries at a spoil site provided by the contractor. No additional payment will be made and all costs related to the disposal of this surplus or unsuitable material will be deemed to be included in the tendered rates for the applicable items."

PSDB 5.7 COMPACTION

PSDB 5.7.1 Areas not Subject to Traffic Loads

Replace "90%" with "95%".

Add the following sentence:-

"All non-cohesive material shall be compacted to 100% MOD AASHTO density."

PSDB 5.7.2 Areas Subject to Traffic Loads:

Replace "93%" with "95%".

Delete "98%" and substitute "100%".

Add the following :

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"All pipe trenches that fall within the road reserves shall be regarded as areas subject to traffic loads."

"PSDB 5.11 REMOVAL OF EXISTING PIPES

PSDB 5.11.1 Where shown on the drawings or where so instructed by the Employer's Agent, the Contractor shall excavate, expose and remove from the ground, existing water pipelines.

PSDB 5.11.2 If so instructed by the Employer's Agent, the Contractor shall, before commencing with the excavation of the pipeline, expose the pipeline to be removed by means of careful hand excavation at positions agreed with the Employer's Agent, in accordance with the requirements of Subclause PSA 5.4.1 of Portion 1 of the Project Specifications. Measurement and payment for locating the exact positions of the pipelines where required by the Employer's Agent, shall be made in accordance with and under Item PSD 8.3.8.1.

PSDB 5.11.3 Thereafter, the existing pipelines to be removed shall be carefully opened up by machine excavation to a depth of not more than 300 mm above the pipes after which the whole pipeline shall be fully exposed by means of careful hand excavation. The excavation width shall comply with Subclause 5.2.

PSDB 5.11.4 The pipes and all specials encountered (e.g. bends, valves, valve box covers and the like) shall be removed from the trench in a manner as to avoid causing damage and as approved by the Employer's Agent, cleaned sufficiently as to allow inspection of the pipes and specials by the Employer's Agent and stacked in such a manner as will facilitate the inspection of each pipe and special by the Employer's Agent.

PSDB 5.11.5 Pipes and specials that are declared by the Employer's Agent as suitable for re-use shall be transported to the Employer's storeyard; where it shall be off-loaded and neatly stacked to the satisfaction of the Employer's Agent and in accordance to the manufacturer's instructions. The Contractor shall be responsible for obtaining a written receipt of all pipes so delivered to the Employer's storeyard.

PSDB 5.11.6 Pipes and specials which are declared by the Employer's Agent as unsuitable for re-use shall be transported to a spoil site and covered with spoil material to a depth of not less than 300 mm.

PSDB 5.11.7 After removal of the pipelines, the trenches shall be backfilled using the excavated material and compacted to 90% Mod AASHTO density. The provisions of Subclauses 5.6. and 5.7 shall apply."

PSDB 8 MEASUREMENT AND PAYMENT

PSDB 8.1 BASIC PRINCIPLES

PSDB 8.1.1 Replace the last section of subclause 8.1.1 ".... surplus material along the route of the pipeline within 0,5 km of the source", with ".... surplus material within the freehaul distance of the site boundaries."

PSDB 8.1.2 Add the following:

"In the road prism the ground surface from which depth will be measured will always (irrespective of operation sequenced) be the road bed level at centre-line."

PSDB 8.2 COMPUTATION OF QUANTITIES

PSDB 8.2.3 Add the following to subclause 8.2.3.

"Where two or more pipes/ducts are to be placed in one trench, the specified base width shall be calculated as follows:

The trench width for the deeper service shall be calculated according to above specifications. The effective trench width for the shallower service shall then be the difference between its specified base width and the overlap with the trench width of the deeper service.

The trench width for subsurface drains shall be as shown on the drawings."

PSDB 8.3 SCHEDULED ITEMS

PSDB 8.3.2 Excavation

(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material.

Replace "of 1, 0 m" in the first sentence of 8.3.2 (a) with "as scheduled in the schedule of quantities."

Replace the words "measured to the bottom of the bedding layer" with "measured from the final road layer or surface to the pipe invert level".

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Replace the phrase "within freehaul distances"
with:

"at a spoil site provided by the contractor or municipal dumpsite unless scheduled otherwise"

Add the following after the last sentence and before paragraph (b).

"The tendered rate for excavation of trenches for electrical cables to be supplied and installed by the Electrical Contractor shall include full compensation for liaising with the Electrical Contractor, maintaining the trenches to allow the installation of the cables, supply and installation of warning tape and backfilling once the Electrical Contractor completed the installation of cables."

Add the following after the third paragraph :

"The rate shall also cover the cost of the additional compactive effort required as specified in 5.7.2 (as amended) and the additional selection of materials as specified in 5.6.2 to comply with the requirements for areas subject to road traffic loads. No additional payment will therefor be made under item 8.3.3.3."

(b) Extra-over item (a) above for; and (c) excavate and dispose of unsuitable material from trench bottom

Replace the phrase "within freehaul distances"
with:

"at a spoil site provided by the contractor or municipal dumpsite unless scheduled otherwise"

PSDB 8.3.2 (b) Extra over item (a) for :

Add the following at the end of the existing sub-item 2 :

"No payments will be made under sub-items (1) and (2) in respect of any materials measured and paid for under sub-item 3 below."

And add the following new sub-items in 8.3.2(b) :

"(3) Hand excavation and backfill where ordered by the Employer's Agent :

(a) Soft material ..... **Unit : m³**
(b) Intermediate material..... **Unit : m³**

The unit of measurement shall be the cubic metre of material, measured in place according to the authorised dimensions, or the lesser dimension excavated, which was excavated by hand on the specific prior written instructions of the Employer's Agents; provided always that the Employer's Agent's said instruction shall have stated that measurement and payment for such hand excavation will be in accordance with this item.

The tendered rate shall include full compensation for the additional cost, effort and time resulting from excavating in the respective materials using hand methods only.

The Employer's Agent shall not be obliged to authorise payment under this item in respect of any hand excavation carried out (whether ordered in writing or otherwise), which hand excavation was in any case necessary to achieve compliance by the Contractor of his obligations under the Contract to :

(i) utilise construction appropriate to the nature of the specific parts of the Work and /or

(ii) protect existing structures and/or services; and/or

(iii) comply with all prevailing legislation and regulations.

(4) Backfill stabilised with 5% cement where directed by the Employer's Agent..... **Unit : m³**

The unit of measurement shall be the cubic metre of backfill material, measured in place after compaction according to the authorised dimensions, which was stabilised on the Employer's Agent's instructions in accordance with Sub-clause PSDB 3.5(c).

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing, backfilling and compacting the stabilised material to 90% of modified AASHTO density.

(5) Soilcrete backfill where directed by the Employer's Agent..... **Unit : m³**

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The unit of measurement shall be the cubic metre of soilcrete placed on the Employer's Agent's instruction in accordance with Sub-clause PSDB 3.5(b), measured in place according to the authorised dimensions.

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing and placing the soilcrete as well as for the cost of shuttering if required.

(6) Mass concrete Class 15 MPa/19mm in encasing around pipes under structures where directed by the Employer's Agent..... **Unit : m³**

The unit will be the cubic metre as measured in Item 8.3.2 for the applicable material.

The rate will make full provision for the excavation, backfilling, vibrating and compacting as applicable.

The tendered rates for subitem (6) shall include full compensation for supplying the cement and for selecting, mixing and placing the soilcrete or mass concrete, as well as for the cost of shuttering if required.

(7) Excavation is marshy areas irrespective of depth ..... **Unit : m³**

The unit will be the cubic metre as measured in Item 8.3.2 for the applicable material.

The rate will make full provision for the excavation, backfilling, vibrating and compacting as applicable.

The tendered rate for subitem (7) shall include full compensation for all additional costs as a result of excavating in marshy areas, for pumping and draining if required and for vibrating and compacting to the specified density.

(8) Backfill with clean sand compacted to 100% modified AASHTO density ..... **Unit : m³**

The unit will be the cubic metre as measured in Item 8.3.2 for the applicable material.

The rate will make full provision for the excavation, backfilling, vibrating and compacting as applicable.

The tendered rate for subitem (8) shall include full compensation for all additional cost to dispose of excess excavated material at a spoil site provided by the Contractor and to import clean sand from commercial sources to backfill and to compact the clean sand backfill to 100% Mod AAHSTO.

Add the following sub-items in 8.3.2 after sub-item 8.3.2) (c) :

"(d) Excavate in all materials for stormwater inlet and outlet structures and for manholes, catchpits, valve chambers and the like, irrespective of depth and backfill around structures..... **Unit : m³**

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised dimensions, and excluding the volume of material excavated and paid for under sub-item (a).

The tendered rate shall include for the costs of excavating in all materials, backfilling, compacting, trimming and tidying of the final surface around the structure, disposing of surplus and unsuitable materials within the freehaul distance and where applicable, selecting and keeping separate, excavated material suitable for use as backfill.

(e) Excavate open drains in all materials ..... **Unit : m³**

The tendered rates shall include full compensation for excavating in all materials within the dimensions specified or authorised by the Employer's Agent and to the specified lines and profiles, for the disposal of surplus and unsuitable excavated material where applicable, and in the case of item (d), for backfilling with suitable approved material compacted to 93% of modified AASHTO density around the structures.

(f) Extra-over sub-items (d) and (e) for excavating in :

(1) Intermediate material..... Unit : m³

(2) Hard rock material ..... Unit : m³

Measurement and payment shall be in accordance with the provisions of 8.3.2(b) of SABS 1200D (as amended)."

PSDB 8.3.3 Excavation ancillaries

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PSDB 8.3.3.1 Add the following to the last paragraph :

"The freehaul distance is unlimited and no additional payment will be made for the transport of the material.

PSDB 8.3.3.3 Compaction in road reserves

Replace the heading of this subitem with the following :

"PSDB 8.3.3.3 Compaction in road crossings"

And replace the sentence "The volume will be measured as specified in 8.2.2, 8.2.3 and 8.3.3.1" *with the following :*

"In the case of gravel roads, determining the volume, the depth will be measured from the underside of the gravel wearing course to the top of the fill blanket, and in the case of bitumen roads, from the underside of the subbase to the top of the fill blanket, unless a selected layer is specified then it will be measured from the bottom of the selected layer. The length of the trench used for compacting the quantity for payment will be the actual length under the road."

The rest of the trench shall be backfilled as specified in Clauses 5.9.3, 5.9.4 and 5.9.5, as applicable, and payment will be made under item 8.3.6.1."

PSDB 8.3.3.4 Overhaul

Delete this item.

No overhaul will be paid on material for the purposes of this contract and all the costs for transporting material shall be included in the applicable tendered rates and amounts.

PSDB 8.3.4 Particular Items

PSDB 8.3.4(a) Shore trench opposite structure or service

Replace the heading of this subitem with the following :

"PSDB 8.3.4(a) Shore trench opposite structure or service or in restricted work space

Add 'of the approved design, presentation of method statement' after 'if necessary', in the second sentence.

"Add the following after the last sentence :

The Contractor shall be responsible for the design of all lateral support and shoring. Designs certified by a Registered Professional Employer's Agent including all design assumptions, calculations, drawings and method statements must be submitted to the Employer's Agent for acceptance prior to ordering material and prior to any excavation work commences.

Add the following after the last sentence :

"Separate items will be measured for depths of trenches in increments of 1,0m. The rate for each stated category shall cover the cost of shoring from ground level up to the full depth of the stated category. Payment for this item will only be made if written instructions were issued by the Employer's Agent."

PSDB 8.3.5 Existing services that intersect or adjoin a pipe trench

PSDB 8.3.5(b) Services that adjoin a trench

Replace the last phrase "measuring for shoring" with the words "protected by shoring". The rate for this item shall cover the cost of any necessary shoring.

Add the following :

"(v) This rate shall also cover the additional cost of detection, exposure, hand excavation, protection, alteration and backfill material (the last if outside trench dimensions).

(vi) An existing service which has been abandoned at the time it is crossed, will not be measured.

PSDB 8.3.6 Finishing

PSDB 8.3.6.1 Reinstate road surfaces complete with all courses ..... Unit : m²

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Add the following :

(a) Paved Roads

The courses shall consist of 60 mm concrete interlocking paver on 20mm sand, on 150 mm thick G5 subbase to 95% Mod AASHTO on 150 mm in situ material compacted to 93% Mod AASHTO (100% for sand)

(b) Asphalt Roads

The courses shall consist of 35 mm Asphalt on MC-30 bitumen on 150 mm thick G4 base to 98% Mod AASHTO, on 150 mm thick G5 subbase to 97% Mod AASHTO on 300mm sand to 100% Mod AASHTO.

The tendered rate shall also include the application of a joint sealer, Viaseal or equivalent for all joints in the asphalt.

Where hot premix can not be obtained, road crossings shall be reinstated in accordance with the following.

Tosas Pothole Patch water resistant hot mixed cold bagged premix; or similar proven and approved

Product to satisfy :

- Grading as per COLTO Table 4202/7 for medium continuously graded asphalt
- With a typical active filter content of 1%, and
- base bitumen as per Clause 4202 (a) (1).
- Binder content between 4,8 and 5,8% by mass and specifically formulated binder additive 0,008 to 0,009% by mass (the lower value for hot conditions and higher value for cold conditions)
- Voids in mix 3,0 to 5,0
- Marshall properties :
  - Stability (kN)8,0 to 16,0;
  - Flow (mm) 2 to 14;
  - Immersion Index (%) 75(min)
- All weather application possible in case of emergency, but ambient temperature should be 20 degrees centigrade and rising.

(c) Gravel roads

The course shall consist of 150 mm G5 subbase compacted to 97% Mod AASHTO on 300 mm sand to 100% Mod Aashto.

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(d) Paved driveways

The courses shall consist of 60mm thick new brick paving of similar colour (no broken bricks) to the existing paving, on 20mm clean sand, on 150mm G5 subbase to 97% Mod AASHTO on 300mm of clean sand to compacted 100% Mod AASHTO. The tendered rate shall also include for all cutting of pavers.

(e) “Crazy Pave”

The courses shall consist of half bricks placed in a similar pattern to the existing paving with a sand cement (ratio 1 to 3) for the infill between bricks on 150mm G5 subbase compacted to 97% Mod AASHTO on 300mm of clean sand compacted to 100% Mod AASHTO.

(f) Concrete drive way

The courses shall consist of a 125mm Class 25MPa/19mm concrete on 150mm G5 subbase compacted to 97% Mod AASHTO on 300mm of clean sand compacted to 100% Mod AASHTO.

(g) Premix sidewalks

The courses shall consist of 30m premix on 125mm G5 subbase compacted to 98% Mod AAHTO, on 200mm clean sand compacted to 100% Mod AASTO.

"PSDB 8.3.7 Accommodation of traffic..... **Unit : sum**

The tendered rate for the accommodation of traffic shall include full compensation for all items of cost necessary for the accommodation of traffic and the construction and maintenance of bypasses, including existing roads used as bypasses, during the construction period. It shall also include full compensation for traffic control, the provision of traffic signs and, where necessary, communications equipment required for traffic control, the provision of traffic signs and, where necessary, communications equipment required to regulate traffic, for the construction of temporary drainage works, and for the maintenance of all drainage works, arranging for the moving of services, attending to traffic problems, complying with the requirements of the Road Traffic Ordinance and of the relevant local authorities.

Payment shall be made in equal monthly instalments."

PSDB 8.3.17 Testing of trench related works..... **Unit No**

Various test methods and materials to be tested shall be scheduled and only additional tests ordered by the Employer's Agent and which indicate compliant materials and workmanship will be paid for. Apart from DCP tests witnessed by the Employer's Agent all other tests must be undertaken by a registered independent laboratory. DCP tests shall be undertaken to a depth of 0,3m below the invert of the trench or the depth of the layer thickness being tested unless scheduled otherwise.

Tests results shall be tabulated in electronic format with a unique reference number, the position shall be indicated and the test results clearly referenced to the requirements.

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PSG **CONCRETE (STRUCTURAL)**

PSG 2 INTERPRETATIONS

PSG 2.4 **Explanation of Terms**

Add the following:

"PSG 2.4.4 Precast concrete

Concrete components of the general quality described in this specification, which have been cast and cured either elsewhere or on the site and placed in position to form an integral part of the structure."

PSG 3 MATERIALS

PSG 3.2 **Cement**

PSG 3.2.2 Alternative types of cement

Replace the contents of this subclause with the following:

"Only ordinary Portland cement, CEM 1 42,5 according to SABS ENV 197-1, may be used.

Should the contractor wish 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). "

PSG 3.2.3 Storage of cement

Add the following:

"Cement shall not be stored for longer than 12 weeks without the permission of the Employer's Agent."

PSG 3.4 **Aggregates**

PSG 3.4.3 Storage of aggregates

Add the following:

"Where aggregates of differing chloride content are stored on the site, the use thereof in the various classes of concrete, shall be strictly controlled."

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Add the following subclauses:

"PSG 3.9 **Waterstops**

PVC waterstops shall comply with the requirements of CKS 389."

PSG 3.10 **Roofing Felt**

Three-ply roofing felt shall comply with the requirements of SABS 92 for type 40 felt.

PSG 3.11 **Butyl Rubber Sealing Strips**

The dimensions of the sealing strip for use in the reservoir are shown on the drawings. The strips shall have a factory-applied bonding layer on one side.

The strip shall have an elongation at break of not less than 300% and a tensile strength of 8,0 MPa. The sealing strip shall be permanently bonded to the prepared concrete surface, in accordance with the manufacturer's instructions.

The completed joint shall be guaranteed to be 100% watertight and to be resistant to the long term effects of chemically treated water.

PSG 3.12 Alkali-Aggregate Reaction

Malmesbury hornfels (shale) or other potentially reactive aggregate shall not be used in conjunction with a high alkali cement in concrete in any part of the Works. For the purposes of this clause, a high alkali cement is one in which the equivalent alkali content (Na_2 O equivalent) exceeds 0,60% by mass of cement.

In order to ensure that the above requirement is met, the Contractor may elect to use a non-reactive aggregate, that complies with the requirements of SABS 1083. Alternatively, if the Contractor chooses to use Malmesbury hornfels or other potentially reactive aggregate, he shall comply with the following requirements regarding the cement:

a) Before commencing any particular section of the structure, the Contractor shall ensure that he has enough cement that is not a high alkali cement to complete the section.

b) Certificates stating the alkali content of each delivery of cement to the Site shall be supplied by the Contractor. These certificates shall be based on tests carried out at a laboratory approved by the Employer's Agent. The cost of testing, including sampling, transporting of samples, and issuing of certificates, shall be borne by the Contractor.

c) The Contractor shall be entitled to use an approved brand of cement as a means for ensuring that the permissible alkali content is not exceeded. The Contractor shall make allowance for the higher price of such brand, if he chooses to use this method.

d) High alkali cement delivered to the Site shall be rejected, and the cost of its removal and replacement with cement with an acceptable alkali content shall be borne by the Contractor.

PSG 4 PLANT

PSG 4.1 **General**

Add the following subclause:

"PSG 4.1.1 Minimum plant

The contractor shall have available and in sound working order the following minimum plant for the construction of the concrete reservoir:

(a) Two concrete mixers each of sufficient capacity to complete a circular section of the wall between horizontal construction joints within 4 hours and without interruption.

(b) Two weigh batchers to supply the mixers.

(c) Four concrete vibrators of which at least one shall be powered by an internal combustion engine.

(d) One air compressor.

(e) Suitable and adequate plant to transport and raise concrete and other material and equipment from the ground level to the top of the structure at all stages of construction.

(f) Elevated storage tanks of adequate capacity to ensure that sufficient water will be available before the commencement of every major concrete-placing operation.

Should the plant used for placing concrete for the reservoirs be electrically or mechanically powered, then he shall also provide some other approved, non-electrically powered standby means for the placing of concrete at an adequate rate in the event of a power or mechanical failure of the main plant.

Where the contractor elects to place a crane inside the circumference of the reservoir wall for the duration of the period of construction, he shall communicate with the Employer's Agent in good time to ensure that the design and layout of the panels which form the roof slab and floor allow for such positioning of the crane. Where sections of the roof and floor have to be redesigned to accommodate the crane, the costs of such redesign shall be borne by the contractor."

PSG 4.5 Formwork

PSG 4.5.1 Design

Add the following:

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"Any or all formwork or scaffolding required for any part of the works shall be designed by the contractor, and before commencing with the erection of any formwork or scaffolding, the contractor shall submit to the Employer's Agent, for approval, the methods which he proposes to use. The Employer's Agent shall have the authority to order any alterations to the design or in the sizes of any part of the formwork or scaffolding which he may consider necessary. The fact that the Employer's Agent approved or has altered any part shall not be construed as to relieve the contractor of his responsibility with regard to the strength and stability of the formwork or scaffolding."

PSG 4.5.3 Ties

Add the following:

"No plugs, bolts, ties or clamps of any description used for the purpose of holding the formwork will be allowed to project into or through the concrete unless with the express permission of the Employer's Agent.

Only approved tie-rods which consist of solid rods (which remain embedded in the concrete) and have removable ends shall be used to hold the formwork of the reservoir walls. The removable tie-rod ends shall be such that they can be removed without damaging the concrete, and no permanently embedded parts of such tie-rods shall have less than 50 mm cover to the finished concrete surface.

The cavities left in the concrete after the tie-rod end cones have been removed shall be soundly caulked with 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 the special tie-rods as well as filling the 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:

"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 cast into the concrete and the reinforcing shall nowhere be less than:

(a) 40 mm or

(a) 5 mm plus the maximum size of the coarse aggregate, whichever is the largest."

Add the following:

"PSG 5.2.5.6 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, slabs, etc. The propping may be required simultaneously on more than one level directly underneath one another. The requirements for continuous propping and/or backpropping shall be calculated to a theoretical model that is acceptable to the Employer's Agent, and details shall be submitted for the Employer's Agent's approval. Data required for such calculations, eg design loads and structural dimensions, will be supplied by the Employer's Agent on request."

PSG 5.3 **Holes, Chases and Fixing Blocks**

Add the following:

"Cover blocks for reinforcing and fixtures may be cast into the concrete provided the strength or any other desirable characteristic (such as the appearance) of the concrete section is, in the opinion of the Employer's Agent, not affected or impaired."

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PSG 5.5 **Concrete**

PSG 5.5.1.5 *Durability*

The exposure conditions for concrete are classified as “very severe".

Add the following values to table 5 :

"The maximum water/cement ratio for moderate sections, general reinforced concrete, exterior portions of mass concrete, as well as for internal concrete in buildings under conditions of very severe exposure, is 0,45”.

Notwithstanding the aforementioned, the cement content may under no circumstances be less than :

Structural concrete of □ 25 MPa	- 265 kg/m□
Exposed concrete and trafficable surfaces	- 280 kg/m□

PSG 5.5.1.7 *Strength Concrete*

Add the following:
“The concrete mixes shall be designed by the Portland Cement Institute or similar approved laboratory.

The shrinkage of concrete to be cast in floor systems, shall not exceed 0,02 % tested as per SABS 1085. Three tests shall be conducted on the mix design to confirm compliance. Test results shall be made available before the concrete is used on site.”

PSG 5.5.3.2 *Ready-mixed concrete*

Add the following:

"The Contractor shall confirm that sufficient continuous supply of concrete is secured to complete the portion of concrete work in one continuous pour."

PSG 5.5.7 Construction joints

Add the following:

"Horizontal construction joints are permitted in the reservoir walls, but must be clarified with the Employer’s Agent in advance.”

The wall shall be cast in lifts of such height that each lift can be poured without interruption in one continuous operation during normal working hours.

A payment item is provided to cover the costs (if any) of ensuring the watertightness of construction joints. It is the contractor's responsibility to ensure that such joints are watertight. The contractor's proposed method for ensuring the watertightness of such joints shall be submitted to the Employer’s Agent for his approval."

PSG 5.5.8 Curing and protection

Add the following:

“Should a curing compound be allowed by the Employer’s Agent then it shall be a resin based curing compound. Curing of columns, shafts and walls shall be done by either retaining the formwork for the required period of time or covering with plastic sheeting. On lesser shafts and walls the Employer’s Agent may allow a curing compound for curing.”

PSG 5.5.11 *Watertight concrete*

Add the following:

"The minimum cement content for OPC in water-retaining structures shall be 325 kg/m3, while the maximum shall be 400 kg/m3 in reinforced concrete, or 500 kg/m3 in prestressed concrete. Where OPC blended with PFA is permitted, the maximum cement content shall be 450 kg/m3 for reinforced concrete, and 550 kg/m3 for prestressed concrete.

The maximum water:cement ratio for water-retaining structures shall be 0,53 for OPC."

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PSG 6 TOLERANCES

PSG 6.2 Permissible Deviations

PSG 6.2.3 Specified permissible deviations

Add the following:

"Degree of accuracy II is applicable.

Every permissible deviation is binding on its own. The accumulative effect of permissible deviations will not be considered. The maximum permissible vertical deviation is subject to the other permissible deviations."

Replace subclause 6.2.3(d)(5) with the following:

	Permissible deviation Degree of accuracy		
	III	II	I
	mm	mm	mm
"Vertically, per metre height	5	3	2
subject to a maximum of	50	30	10

None of the prescribed permissible deviations will be taken as permission for violating any legal boundaries of properties by any part of a structure.

The above permissible deviations also apply to slip-form concrete, unless another set of permissible deviations have first been accepted by the Employer's Agent, in writing. Such amended permissible deviations shall clearly make provision for interfaces between structures erected with the aid of slip-form concrete and those erected with the aid of conventional concrete.

The maximum permissible deviation from a 3 m long straight line connecting two points on the surface of a finished floor is 5 mm."

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PSG 7 TESTS

PSG 7.1 **Facilities and Frequency Of Sampling**

PSG 7.1.1 Facilities

Add the following:

"The contractor shall provide the facilities necessary to test the concrete cubes made at the frequency specified in subclause 7.1.2.

The facilities shall consist of sufficient storage capacity and the testing of cubes:

(a) by means of an approved, calibrated cube testing press installed on site in a manner approved by the Employer's Agent, or

(b) by an approved laboratory.

The cost of all testing including the cost of sampling, storage and transport of samples shall be included in the rates tendered for concrete work."

PSG 7.3 **Acceptance Criteria for Strength Concrete**

Add the following:

"Test results obtained from the supplier of ready-mixed concrete will not be accepted for evaluation in terms of subclause 7.3 but samples for testing shall be taken of such concrete at the point of placing."

Add the following acceptance test for watertightness of the tank:

"TESTING FOR WATERTIGHTNESS

The structure shall be filled with water being gradually let in until the top water level has been reached. The water level will then be carefully noted and recorded by the Employer's Agent in relation to a fixed bench-mark, and the structure shall be allowed to remain filled for a period of two weeks to permit complete absorption of water by the concrete. This period may obviously be shorter should an earlier test prove to be successful.

Any loss of water which may have occurred shall then be made up by again filling the structure to the top water level and by allowing to be watertight if the drop in level in 96 hours (less the drop caused by evaporation) does to represent more than 0,06% of the volume of the reservoir.

The evaporation shall be measured by the mean drop in level caused by the evaporation of the water in three flat containers floating in the water, being recorded.

The contractor may attend the taking of all measurements by the Employer's Agent.

In the event of an appreciable leakage being evident or visible at any stage of the filling or testing, or in the event of the final degree of watertightness being unsatisfactory, the contractor shall, when so ordered by the Employer's Agent, discontinue such filling or testing and shall, at his own expense, take approved steps to rectify the leakage, until a test proves that a sufficient degree of watertightness has been obtained.

The costs of retesting the reservoir for watertightness shall be borne by the contractor."

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.3 **Measurement and Rates**

PSG 8.3.1 & PSG 8.3.2 Reinforcement

Replace the contents of this subclause with the following:

"The unit of measurement for steel bars shall be the ton of reinforcement in place in accordance with the drawings or as authorized by the Employer's Agent.

The unit of measurement for welded steel fabric shall be the kilogram of fabric reinforcement in place and the quantity shall be calculated from the netto area covered by the mesh, excluding laps.

Clips, ties, separators, stools and other steel used for positioning reinforcement shall not be measured, unless shown on the bending schedules.

The tendered rate shall include full compensation for the supply, delivery, cutting, bending, welding, placing and fixing of the steel reinforcement, including all tying wire, stools, supports and waste."

PSG 8.9 **Testing for water tightness** .....**Unit : No**

Various structures will be scheduled. The rate will include full compensation for the successful water tightness test in accordance with PSG 7.2.

The water tightness test will be paid by a lump sum separately for each structure.

The tendered sum shall make full compensation for all labour, equipment, water and materials to carry out the tests as specified in PSG 7.2, to rectify faults and to achieve a test result to the satisfaction of the Engineer.

The sum shall include for all water required for the successful watertight testing of the structure.

PSG 8.10 **Sterilise Reservoir** .....**Unit : Sum**

The rate shall cover the cost of all equipment, water, chemicals and labour necessary to sterilise the structure.

No additional payment will be made for re-sterilising the structure before re-testing for water tightness.

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PSG 8.11 **Brickwork and Plasterworks**.....**Unit : m²**

Building work shall be carried out in accordance with SANS 10400 and the specification and drawings.

8.11.1 Bricks

Bricks shall comply with SABS 227 and shall be of the class scheduled or shown on the Drawings.

Satisfactory proof of the load-bearing capacity of the bricks offered shall be submitted before deliveries are made to the Site.

Three samples of each type of brick shall be submitted to the Employer's Agent for approval. All subsequent deliveries shall be of a standard equal to or better than that of the approved samples.

Wall ties shall be of the galvanised, crimped, single-wire type with a 3,5 mm diameter, and shall comply with the requirements of SABS 28.

8.11.2 Construction of Brickwork and Plasterwork

8.11.2(a) Cement mortar

Cement mortar shall, unless otherwise specified, consist of 1 part of Portland cement to 4 parts of sand by volume for normal brickwork and 1 part of Portland cement to 3 parts of sand by volume for reinforced brickwork. The ingredients for cement mortar shall be measured in proper gauge boxes on a boarded platform and thoroughly mixed. Alternatively, mixing may be by means of an approved mechanical batch mixer. Only when the dry ingredients have been thoroughly mixed and a mixture of uniform colour has been obtained may the water be added in sufficient quantity to obtain mortar with the required consistency.

Cement mortar shall be used within two hours of adding water to the mix and shall not be used after two hours or if it has begun to set. Mortar shall be turned over frequently until it is used to prevent it from setting.

8.11.2(b) Brickwork

Dimensions of all the brickwork shall be set out and built as shown on the Drawings. Bricks shall be kept wet before laying and the top of brickwork shall be wetted before any further bricks are laid. Bricks shall be well buttered with mortar before being laid and all joints shall be thoroughly flushed up as the work proceeds. All joints to face brickwork shall be neatly made and key drawn with a 6 mm key.

Brickwork shall be carried up in a uniform manner with no portion being raised more than 1 m above an adjacent portion. All perpends, quoins, etc, shall be kept strictly true and square and the whole properly bonded together.

Brickwork shall be built in stretcher bond or english bond as shown on the Drawings, and bats shall not be used except where required for the bond. All joints shall be 10 mm wide and four courses shall measure 320 mm.

Brickwork for cavity walls and solid walls built in stretcher bond shall be tied with wall ties placed not more than one metre apart in every third course, and shall be staggered vertically. At openings, the ties shall be positioned not more than 300 mm apart along the periphery of the opening and 150 mm from the opening.
Face brickwork shall be kept perfectly clean and rubbing down of the brickwork shall not be allowed. Scaffold boards shall be turned back during heavy rain to avoid splashing. Soiled brickwork shall be cleaned at the Contractor's expense, and the cleaning method shall be approved by the Engineer.

8.11.2(c) Reinforced brickwork

Brickwork over door and window openings shall be reinforced with steel rods, welded or expanded mesh, etc. Reinforcement shall be placed in each course of brickwork for a minimum of 4 courses or as shown on the Drawings. Reinforced brickwork shall continue at least 300 mm on each side of the openings.

Brick lintels shall be built upon rigid temporary supports left in position for not less than 7 days after brick-laying. Prestressed concrete lintels may be used where approved by the Engineer.

8.11.2(d) Key for plaster

Joints of all brickwork receiving plaster shall be raked out, or the brick surfaces shall otherwise be prepared with an acrylic slurry or any other approved bonding agent.

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8.11.2(e) Damp-proofing

A damp-proof course shall be laid over the full width of all the walls at a minimum height of 150 mm above the final ground level or wherever else it may be required, and it shall be lapped for at least 150 mm at angles and joints. A damp-proof course shall also be laid and stepped up under all external sills.

8.11.2(f) General

Rough and fair cutting shall be performed as required, and the brickwork shall be fitted around any steel work. Face brickwork shall be carefully cut and fitted to suit fittings.

Chases shall be left or formed for edges of concrete floors, staircases, etc. Chases shall also be provided wherever they may be required for pipes, conduits, switch boxes, distribution boards, and the like. Joints shall be raked out for flashings.

8.11.2(g) Plaster coats

A plastered finish shall consist of a single coat, comprising one application of a 1:6 cement:sand mixture with a wood or steel-float finish.

8.11.2(h) Thickness

The total thickness of the plaster finish shall be 13 mm minimum and 20 mm maximum.

8.11.2(i) Workmanship

All plaster work shall be finished smooth and ready to receive paint. Plaster shall be flush with the faces of all switch and plug boxes, the interiors of which shall be kept free from plaster. Plastered surfaces shall be plumb and jambs and reveals shall be formed square.

The plasterer shall cut out and make good all cracks, blisters and other defects and leave the plaster work, on completion, in a state which is acceptable to the Engineer.

8.11.2(j) Measurement and payment for brickwork and plaster work will be as follows:

a) Brickwork:

(i) (Thickness, type and class indicated) ..... **Unit : m²**

(ii) Etc for other thicknesses, types and classes

The unit of measurement shall be the square metre of each type of brickwork built, calculated from the leading dimensions of the brickwork. Areas of pipes, etc, built into brickwork shall not be included in the areas measured. At corners and intersections common to more than one brick wall, the areas shall be measured only once.

The tendered rates shall include full compensation for the construction of the brickwork complete as specified, including pointing, the building-in of conduits, beams, lintels, pipe sleeves, doors, windows, the raking-out of joints, damp-proof course, brickforce reinforced as specified, etc.

b) Plaster Work:

(i) (Thickness of plaster and finish indicated) ..... **Unit : m²**

(ii) Etc for other thicknesses and finishes

The unit of measurement shall be the square metre of each type of coat completed as specified.

The tendered rates shall include full compensation for the construction of the plaster work, including the supply of all materials, mixing, applying, finishing, forming reveals, joints, narrow widths, rounded angles, v-joints, etc, complete as specified.

PSG 8.12 **Break into existing concrete channel wall**

Various items will be measured.

The tendered rate shall include full compensation for all excavation, labour and material to break into the existing channel wall and the disposal of the surplus material. The tendered rate shall also include the placing of sand bags to divert the flow if necessary.

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PSG 8.13 **Break into existing channel inlet, modify channel and make good** ..... **Unit : Sum**

The tendered rate shall include full compensation for all labour and material to break into the existing channel inlet, all excavation, the disposal of all surplus material, the modification of the channel inlet to accommodate the new 825mm dia pipeline into the new concrete wall, all formwork, concrete (reinforcement measured elsewhere) and the casting of the new pipeline into the new channel wall. The tendered rate shall also include the application of Sika Grout 121 around the pipeline before casting the pipeline into the channel wall.

PSG 8.14 **Preparation of existing concrete surface (top of channel)**..... **Unit : m²**

The tendered rate shall include full compensation for the delivery and supply of all material and labour to scabble the top of the existing channel wall and to apply a wet to dry epoxy to the top of the scabbled surface. The bonding agent shall be SikaTop-Armatec 110 EpoCem (or similar approved).

PSG 8.15 **Sand blasting of channel wall and floor to expose aggregate** ..... **Unit : m²**

The tendered rate shall include full compensation for the supply and delivery of all material and labour to sandblast the channel walls and floors before the application of Sika MonoTop-620.

PSG 8.17 **Cast in pipes with or without puddle flanges** ..... **Unit : No**

Various pipe diameters and wall thicknesses will be measured.

The tendered rate shall make full compensation for casting the pipe into the wall including grouting (if necessary), supplying and installing joints as per the detail drawing, adapting of formwork around the pipe and ensuring a watertight seal. Puddle flanges and other couplings are measured elsewhere.

PSG 8.22 **Dowels** .....**Unit : No**

Installation of dowels will be measured by number.

The Contractor shall prepare the existing surface where the concrete joins as follows:

(i) Scabble the entire area thoroughly, to expose the coarse aggregate or rock.
(ii) Install galvanised steel dowels along the length of the joint.
(ii) The dowels shall be installed minimum of 450mm deep into the existing concrete or rock using Sika AnchorFix-2 or Hilti-HIT-HY150, or equal, approved epoxy grout approved by the Engineer and 800mm deep into the new concrete area.
(iv) Wash and clean the entire contact area.
(v) Immediately before casting, and in accordance with manufacture's instructions, apply wet to dry epoxy to the entire contact area.

The rate shall cover the cost of all materials, including the dowels and epoxy grout and all labour and plant to execute the work as specified.

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PSG 8.23 **Preparation of existing concrete or rock surface** .....**Unit : m²**

The tendered rate shall include full compensation for the delivery and supply of all material and labour to scabble the top of the existing rock or weir and to apply a wet to dry epoxy to the top of the scabbled surface. The bonding agent shall be SikaTop-Armatec 110 EpoChem (or similar approved).

PSG 8.24 **Benching in large manholes**.....**Unit : No**

The tendered rate shall include full compensation for supplying, mixing, placing, forming to the required shape and slope as shown on the drawings, including all labour required to construct the benching of 25 MPa concrete with 20mm 1:3 cement mortar finished with 3mm thick layer of Sikagard-720 EpoCem and 2 No coats of Sikagard 63N or similar approved for large diameter manholes. Materials shall also comply with the requirements of SABS 1200 LD and sand shall be of dolomitic origin.

PSG 8.25 **Glass fibre mesh at air vents**.....**Unit : No**

The tendered rate shall include full compensation for all labour and material to install 18/16 glass fibre mesh bolted between two flanges with galvanised bolts at air vents.

PSG 8.26 **Stone on reservoir roof slab**.....**Unit : m³**

The tendered rate shall include full compensation for the delivery and supply of all material and labour to cover the reservoir roof slab with 19mm stone to a thickness of 75mm, between the edge coping and access opening.

PSG 8.28 **Bond Braker** ..... **Unit : m²**

The rate shall cover the cost of the supply and installation of the polyethylene bond breaker under the floor as specified in PSG 5.5.12.

PSG 8.29 **Coping around reservoir top slab** ..... **Unit : m**

The rate shall make full compensation to supply and install the coping as indicated on the relevant detail drawing complete around the outer perimeter of the reservoir top slab.

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PSHA STRUCTURAL STEELWORK (SUNDRY ITEMS) (SANS 1200 HA)

PSHA 3 MATERIALS

PSHA 3.1 Structural Steel

Add the following:

"Where stainless steel is to be used, the grade of stainless steel shall be grade 304L."

PSHA 5 CONSTRUCTION

PSHA 5.2 Fabrication and Assembly

PSHA 5.2.4 Welding

The Contractor shall submit with his shop drawings full details of welding procedures. All welds shall be continuous. Unless otherwise approved no longitudinal or overhead welding shall be carried out on site. Under no circumstances will cutting and welding of grid covers and frames be permitted on site.

Welders undertaking manual welding of permanent steelwork shall be experienced and competent artisans.

PSHA 5.2.6 Handrails

Add the following:

"Handrail stanchions shall be spaced at 1 300 mm centres unless otherwise indicated on the drawings or approved by the Engineer in writing. Handrails and stanchions shall be of the material as scheduled and all stanchion anchors shall be 12 mm diameter unless otherwise indicated on the Drawings."

PSHA 5.2.7 Ladder and step irons

Add the following:

"Ladders and step irons shall be galvanised mild steel with corrosion protection coatings as specified."

PSHA 5.2.8 Open grid floors

Add the following subitem:

"PSHA 5.2.8.3 All open grid floors and frames shall be galvanised mild steel with corrosion protection coatings as specified.

All open grid floor panels shall be open-ended as specified, except where bonding is specified on the Drawings. Cut outs shall be provided where indicated on the Drawings"

PSHA 8 MEASUREMENT AND PAYMENT

PSHA 8.3 Scheduled Items

PSHA 8.3.1 Structural steel

CHANGE "Unit : t" *to* " Unit : t, No or Sum ".

Add the following after the last sentence:

"Alterations to existing structural steelwork will be described in the Schedule and measured in number. Rates for these items shall include full compensation for all labour, tools, storing, additional steelwork, reinstallation, cleaning up, grinding, etc as described in the Schedule and shown on the Drawings."

PSHA 8.3.2 Handrails

Amend the sub-clause as follows:

“Handrails will be measured per running meter, and the tendered rate shall include for all stanchions, closure bends, sloping handrailings etc as shown on the relevant drawing.”

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PSHA 8.3.3 Ladders, complete and installed (Drawing number or type and length stated)

Replace this item with the following:

"PSHA 8.3.3 Ladders, complete (installation elsewhere) (Drawing number or type and length stated)

Separate items will be scheduled for ladders of different materials, dimensions and height… ..... **Unit: number**

The tendered rate shall include full compensation for all labour and material to erect the internal/external ladders for the reservoir. The ladders shall be made up of 48Ø x 3mm steel pipe with R20 steps 450mm long & welded @ 300 C/C, 750mm rings of 40 x 6mm steel plate @ 500mm C/C welded against ladder, 48Ø x 3mm struts @ 1000mm C/C with 200 x 60 x 10mm steel plate anchored to wall with M12 galvanized bolts and 200 x 60 x10mm base plate anchored in concrete with M12 bolts. All step iron parts to be of hot dipped galvanized., including welding where applicable."

PSHA 8.3.4 Flooring, complete and installed with frames (Drawing number stated)

Replace this item with the following:

"PSHA 8.3.4 Flooring, complete **(installation elsewhere)**

(a) Open grid floors ..... **Unit : m²**

(b) Floor-plate floors ..... **Unit : m² or t**

(c) Frames and kerbs for flooring ..... **Unit : m**

Separate items will be scheduled for grid floors, floor-plate floors, frames and kerbs of different materials, dimensions, weight and different methods of fixing.

The tendered rates shall include full compensation for the cost of supplying the specified or scheduled types of flooring, frames or kerbing complete, including welding where applicable."

PSHA 8.3.6 Corrosion protection

Replace this item with the following:

"PSHA 8.3.6 Corrosion protection ..... **Unit : Sum**

Separate items will be scheduled for different systems of corrosion protection. Separate subitems will also be scheduled for different elements to be coated/protected.

The tendered sums shall include full compensation for all material, preparation, etc, related to the specified corrosion protection system in accordance with the Particular Specification PQ."

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PSL MEDIUM-PRESSURE PIPELINES

PSL 2 INTERPRETATIONS

PSL 2.1 REFERENCES

PSL 3 MATERIAL

PSL 3.1 GENERAL

Add the following paragraphs:

"For each type of pipe to be delivered to the site the individual pipes shall have a standard length, which shall correspond with standard lengths offered by the pipe manufacturer in his catalogue, with a maximum allowable variation in length of± 2%.

A pipe which has a shorter or longer length than the defined standard will be rejected by the Employer's Agent, except where such non-standard lengths are required in terms of the contract and have been specifically manufactured or cut as such by the pipe manufacturer or supplier."

PSL 3.4 STEEL PIPES, FITTINGS AND SPECIALS

PSL 3.4.2 Pipes of nominal bore up to 150 mm

Add the following:

"The pipes shall be 'normalised' or seamless steel pipes and shall be used with malleable cast iron fittings complying with the requirements of SABS 509."

PSL 3.7 OTHER TYPES OF PIPES

PSL 3.7.1 PVC-U pipes

Replace "uPVC" with "PVC-U" in the heading and first sentence.

Replace "SABS 966" with "SANS 966 : PART 1:2000 (PVC-U).

Add the following:

"All PVC-U pipes shall be class/PN 16 unless otherwise specified using spigot and socket rubber ring joints. All fittings (bends, tee's reducers, etc.) to PVC-U pipes shall be Ductile Iron to EN12842, fusion bonded thermoplastic coated internally and externally with Plascoat PPA 571 HES, to minimum 0.25m coating thickness with EPDM rubber insert seal or 3CR12 flanged tees as billed."

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PSL 3.7.2 Polyethylene pipes

Replace "SABS 533" with "SANS ISO 4427 : 1996 (PE63, 80, 100)".

Add the following:

"All HDPE pipes shall be HDPE PE100 to SANS/ISO 4427 pipes, minimum class/PN16 or as specified and 20 to 40mm dia HDPE pipes shall be PN16. All fittings shall be class 16".

PSL 3.9 CORROSION PROTECTION

PSL 3.9.2 Steel Pipes

Steel pipes shall be mild steel or stainless steel as shown on the drawings or shown in the schedule of quantities.

All mild steel pipes, specials and fittings with nominal diameter up to and including 150mm shall be hot dipped galvanized to SANS 121 and SANS 32 and Carboguard (Product of Carboline) 891 coated or 3CR12 as billed. All steel pipes, specials and fittings with nominal diameter greater than 150mm shall be lined internally and coated externally with Protective Apoxy Paint Product Carboguard (Product of Carboline) 891, applied in three coats and minimum 125 microns dft (dry film thickness) per coat to manufacturer's specifications.

All bolts, nuts and washers for mild steel pipework shall be hot dip galvanized to SANS 121 and SANS 32. All bolts and nuts shall be grade 8.8 to SANS 1700 and ISO 898. Two washers shall be used with every bolt

connection to prevent damage to coatings. Nuts and bolts for 3CR12 and stainless steel pipe fittings shall be stainless steel 316 with anti seize compound

Suitable isolation shall be provided between flanges, washers and bolts to prevent galvanic corrosion between dissimilar metals (e.g. between stainless steel and mild steel or cast iron). Shaft thread shall be covered with heat shrink insulation (or similar approved) and 3mm Caf non-conductive washers shall be used with standard washers where dissimilar fittings are joined.

Plain ended fittings shall be joined with approved couplings coated with 300 microns of a Polymer Resin product to the manufactures specifications.

1) Specification

The cement mortar lining shall be applied in accordance with the American Water Works Association Specification C205-80 or as amended except where the Specification C205-80 is at variance with the requirements of this specification.

2) Thickness

The thickness of the cement mortar lining shall be 12 mm and shall be subject to a tolerance of 2 mm.

3) Roundness of pipe ends

The pipe ends shall be held truly round during the placing and the setting of the cement mortar lining.

4) Materials

Cement shall be freshly manufactured ordinary Portland cement complying with SABS 471-1971.

Sand shall consist of inert granular material and the grains shall be durable and uncoated. The sand shall be well graded and pass a 1,5-mm mesh screen. Sand shall be free from injurious amounts of clay, lumps, shale, soft or flaky particles, mica, loam, oil, alkali, and other deleterious substances. The total mass of such substances shall not exceed 3 per cent. The source of the sand shall be stated by the tenderer and be approved by the Employer's Agent.

Water shall be clean and free from injurious amounts of mud, oil, organic materials or other deleterious substances. Admixtures may be used provided the additive will not injuriously affect the water quality and written approval has been obtained from the Employer's Agent. The contractor shall submit test data to substantiate admixture performance.

The proportions of the ingredients shall be approved by the Employer's Agent. These proportions shall be determined from the characteristics of the aggregate. Measurement of the materials shall be by weight and the water-cement ratio shall be controlled and kept to a minimum, with an allowance being made as necessary for the most effective machine operation and adhesion of mortar to the pipe."

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PSL 3.9.3 Protection against Electrolytic corrosion

Add the following:

"All nuts and bolts for pipes, pipe specials etc must be provided with an approved insulating material to prevent Electrolytic corrosion."

PSL 3.9.5 Joints, Bolts, Nuts and Washers

Add the following:

All bolts, nuts and washers for mil steel pipework shall be hot dip galvanized to SANS 121 and SANS 32. All bolts and nuts shall be grade 8.8 to SANS 1700 and ISO 898. Two washers shall be used with every bolt connection to prevent damage to coatings. Nuts, Bolts and Washers for stainless steel pipes shall be stainless steel grade 316 and must be treated with a Nickel based anti-seize compound such as chestertou 725 or equivalent."

Only stainless steel bolts, washers and nuts shall be used on all fittings such as saddles, flanges, short collar couplings, etc.

PSL 3.9.6 Corrosive soil

Where shown on the drawings, steel pipes in contact with corrosive soil shall be wrapped with Densopol 80 HT or an equivalent approved product, strictly in accordance with the manufacturer's instructions.

PSL 3.10 VALVES

Replace the contents of this subclause with the following:

"Valves shall be the standard cast-iron gate valve for waterworks and shall comply with the following requirements:

(a) Valves shall be left hand closing with a non-rising spindle and spindle cap bolt to spindle with stainless steel 316 bolt.

(b) Valves shall be class 16.

(c) Valves shall comply with the requirements of SABS 664/1974. "AVK" or similar approved.

(d) Valves shall be the resilient seal type.

(e) Valves shall be coated before delivery with a 225 micron Copon EP 2300 epoxy paint applied to all internal services after it has been thoroughly cleaned by grit blasting to SA2½ finish in compliance with SIS 050900.

(f) The direction for turning the valve open or closing must be permanently marked on the valve."

"Fire hydrants shall be the standard cast-iron fire hydrant and shall comply with the following requirements :

(a) Fire hydrants shall be anti clockwise closing with a non-rising cast iron spindle and spindle cap and also fitted with a captop with a stainless bolt to attach the captop to the hydrant spindle. No clips, split pins or screws allowed. Hydrants shall be supplied and installed complete with a flanged extension piece complete with cadmium plated nuts and bolts to ensure depth not greater than 400mm.

(b) Fire hydrants shall be class 16

(c) Fire hydrants shall be a type 65 "AVK or Ainsworth" or any approved by the local authority

(d) Fire hydrants must have London Round thread outlets

(e) Hydrants shall be coated before delivery with a 225 micron Copon EP 2300 epoxy paint applied to all internal services after it has been thoroughly cleaned by grit blasting to SA2½ finish in compliance with SIS 050900.

(f) The direction for turning the fire hydrant open or closing shall be permanently marked on the fire hydrant.

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PSL 5 CONSTRUCTION

PSL 5.2.2 Welding of HDPE pipes

The HDPE pipes shall be supplied in straight lengths, and not in coils, to avoid the pipe ends from curling and thus hindering the welding process. To reduce the number of welds necessary, pipes should be supplied in the maximum straight lengths available.

The HDPE pipe shall be joined by means of heat fusion using approved butt welding equipment by fully trained operators in accordance with **SANS 0268-1** and the pipe manufacturer's specifications. The Contractor shall confirm with the Employer's Agent of the welding machine and of the welding parameters and tables to be used. Test welds shall be carried out and shall be tested and approved by the Employer's Agent before welding on site can commence. No additional payment will be made for test samples which are required and allowance must be made for one test weld per pipe diameter applicable to the contract.

The Contractor shall provide a digital thermometer or similar for the accurate measurement of the weld temperatures.

No separate payment shall be made for the welding of pipes and the removal of internal and external beading is not required, except where pipe bursting will be undertaken.

PSL 5.6 VALVE AND HYDRANT CHAMBERS

PSL 5.6.1 General

Replace the words "drawing L-1" in the second line with "the drawings".

PSL 5.6.2 Construction of chambers

Replace the words "drawing L-1, L-2 and L-3" in the fourth line with "the drawings".

PSL 5.10 DISINFECTION OF POTABLE WATER PIPELINE

Add the following :

"d) the pipeline shall also be flushed repeatedly through each saddle, prior to connecting to the existing house connection to ensure each house connection is clean before connecting to the existing house connection.

e) the local authority and Employer's Agent will be given at least 48 hours notice prior to disinfection of the pipeline, to arrange suitable attendance of the procedure."

PSL 5.11 STANDPIPES

Standpipes shall be erected in positions and to details shown on the drawings.

PSL 5.12 MARKER BLOCKS

Marker blocks shall be manufactured and positioned as shown on the drawings.

PSL 5.13 PIPELINE ROUTE MARKERS

Route markers for the various water pipelines shall be erected in positions and be manufactured according to details shown on the drawings."

PSL 7 TESTING

PSL 7.3 STANDARD HYDRAULIC PIPE TEST

PSL 7.3.1 Test pressure and time of test

PSL 7.3.1.2 Add the following:

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The test pressure for field testing shall be 1.25 times the working pressure indicated by the class of the pipe.

(e.g. Test at 15 bar for class 12 pipe).

"The Employer's Agent may order re-testing of any section of the entire network at any time after the trench is backfilled. The contractor will do the tests and any remedial work required at his own cost.

Any isolating valves and/or end caps, blank flanges, or other isolating devices required for testing mixed types of classes of pipelines which traverse over a wide range of altitudes, will be installed by the contractor at his own cost."

PSL 8 MEASUREMENT AND PAYMENT

PSL 8.2 SCHEDULED ITEMS

PSL 8.2.1 Supply, lay and bed pipes complete with couplings

Add the following before the first paragraph of the Clause:

"For the purposes of local content of designated sectors as determined by the Department of Trade and Industry the supply and the installation of the pipes shall be scheduled separately. The rates to supply the pipe shall include all cost to provide the scheduled pipe to site including all transport, handling, storage and other cost as may be necessary.

Add the following:

"The tendered rates shall also include full compensation for the cost of all labour, material, plant, chemicals and overheads for the complete sterilisation of the entire potable water reticulation system and the disposal of the sterilising solution as approved by the Employer's Agent."

PSL 8.2.11 Anchor/Thrust blocks and pedestals

Add the following:

"The tendered rates shall also include the wrapping of uPVC pipes and fittings with Densopol 80 or similar approved material where the pipes and fittings are in contact with concrete."

Add the following items:

PSL 8.2.15 Special wrapping in corrosive soil ..... Unit : m

Add the following:

"The tendered rate shall include full compensation for the construction of the wrapping as specified. The total cost for additional wrapping required for flanges and specials shall be deemed to be included in the rate.

The surface shall be clean, to minimum preparation ST2 according to Sib 055900-1967. The surface shall furthermore be brushed or sprayed with Denso priming solution or Denso SI05 Paste Denso Mastic to create a profile for Denso tape, so as to ensure that there are no air voids taming beneath the Denso tape. Denso tape shall then be wrapped spirally around the prepared area and then double wrapped with polyethelene tape (minimum 300 micron thick)".

PSL 8.2.17 Marker blocks / pipeline route markers

Measurement and payment shall be as per Scheduled item 8.2.9 (SABS 1200 LD).

PSL 8.2.18 Connection to existing watermain ..... **Unit : No**

The tendered rate shall include full compensation for the location of the main pipe, excavation, removal of surplus material, cutting into the main pipe supply and installation of all fittings and constructing the connection as shown on the drawings, backfilling with clean sand and compacting to 100% Mod Aashto.

The tendered rate will also include all liaison with the local authority and closing of the water supply and notifying affected residents.

PSL 8.2.19 (a) Reinforced cover slabs ..... **Unit : m^3**

The rate shall cover the cost for the construction of new reinforced concrete top slabs on existing chambers, including formwork.

(b) Extra-over item (a) above for installing GRP cover and frame ..... **Unit : m^3**

The rate shall cover the extra cost of installing a 700mm diameter Smart Locking Logic MD-700 Lockable GRP (sheet moulded compound) cover and frame. To conform to EN-124 (Class B 125) cast into cover slabs as instructed by the Engineer.

PSL 8.2.20 Inlet/Outlet to dams complete ..... **Unit : No**

The rate shall cover the cost for the complete construction of an inlet/outlet in earth dams as per detail drawing. The rate shall not include the cost for the supply and installation of the VJ Coupling (which is measured elsewhere).

PSL 8.2.21 Pipe crossing over channel complete as per detail drawing ..... **Unit : Sum**

The rate shall cover the cost for the complete construction of the pipe crossing as per detail drawing.

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PSLB BEDDING (PIPES) (1983)

PSLB 3.2 SELECTED FILL MATERIAL

Add the following:

"Where required, selected fill material used for bedding, is to be stabilised with 5% cement as specified under subclause PSDB 3.5(c)."

PSLB 3.3 BEDDING

Add the following:

"PVC-U and HDPE pipes are considered to be flexible pipes for the purpose of this subclause."

PSLB 3.4.1 Suitable material available from trench excavation

Replace the words "(but is not required)" in the fifth line with the words "(at his own cost)".

PSLB 5 CONSTRUCTION

PSLB 5.1 GENERAL

PSLB 5.1.2 Details of bedding

Add the following paragraph.

"The dimension "X" for flexible and rigid pipes as indicated on drawing LB-1 will be 150 mm unless otherwise indicated on the drawing. The dimension "X" will be measured from the invert of the pipe."

PSLB 5.1.4 Replace "90%"

with:

"90% (100% for sand)".

PSLB 7 TESTING

Add the following :

PSLB 7.3 ROUTINE TESTING

The Contractor must test the bedding density and grading every 50m. A laboratory grading analysis must be undertaken every 50m. All test positions must be recorded by the Contractor and submitted with test results to the Employer's Agent within 7 Days of placing the bedding.

PSLB 8 MEASUREMENT AND PAYMENT

PSLB 8.1 PRINCIPLES

PSLB 8.1.1 Supply of Bedding Materials measured separately

Insert the following words after the word "placing" in the last sentence : "density testing and grading analysis every 50m,".

PSLB 8.1.3 Volume of Bedding Materials

Add the following to paragraph (b):

"The depth of bedding as specified in PSLB 5.1.2 is applicable. The volume of bedding material displaced by the pipeline shall not be included in the calculation of the volume of bedding material."

PSLB 8.1.5 Disposal of Displaced Material

Replace the contents of this subclause with the following:-

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"Material displaced by the pipeline and by importation of material from sources other than trench excavation, shall be disposed of outside the boundaries of the site."

PSLB 8.1.6 Freehaul

Notwithstanding what is specified in subclauses 8.2.1, 8.2.2.2, 8.2.2.3, 8.2.4 and 8.2.5, the freehaul distance for disposal of all displaced (surplus) material, shall be unlimited."

PSLB 8.2 SCHEDULED ITEMS

PSLB 8.2.1 Provision of Bedding from Trench Excavation

Replace the paragraph "The rate shall ...." with the following :

"The rates shall cover the cost of acquiring, from within site boundaries, bedding that complies with the relevant requirements of the specification, of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, and of disposing of displaced material outside the site boundaries."

Add the following after the note:

“Bedding material excavated as part of the trench excavation, placed adjacent to the trench and used at the same point as bedding material will therefore not be measured separately, but will be deemed to be included in the rates for trench excavation and the supply, lay and bed of pipelines.”

PSLB 8.2.2 Supply only of bedding by Importation

PSLB 8.2.2.2 From borrow pits

Delete the words in brackets in the first four lines.

Add the following:

"Payment for opening up borrow pits and for removal of overburden shall be made under subclause 8.3.4 of SABS 1200 D."

PSLB 8.2.5 Overhaul of Material for Bedding Cradle and Selected Fill Blanket

Delete the contents of this Subclause.

"PSLB 8.2.6 Extra over items 8.2.1 and 8.2.2 for bedding stabilised with 5% cement ..... **Unit : m³**

The tendered rate shall include full compensation for selecting, mixing, backfilling and compacting the stabilised material to 90% of modified AASHTO density."

"PSLB 8.2.7 Provision of stone/geofabric to deal with water ..... **Unit : m³/m²**

If in the opinion of the Employer’s Agent, the Contractor complied with the requirements for dealing with water as specified in PSA 8.8.7, the Employer’s Agent may instruct the installation of crushed stone and filter fabric. Payment for these items will only be made where instruction was given in writing by the Employer’s Agent.

The provision of crushed stone bedding material will be measured by volume based on the specified trench width and a maximum layer thickness of 300 mm unless a greater depth has been specified by the Employer’s Agent.

The unit rate shall cover the cost of supplying and laying the crushed stone.

The filter fabric will be measured separately by area based on the specified trench width, a stone bedding thickness of 300 mm and an overlap of 300 mm.

The rate shall cover the cost of the supply, delivery and laying of the filter fabric."

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PSLC CABLE DUCTS

PSLC 3 MATERIALS

PSLC 3.1 DUCTS

Replace the subclause and replace with the following :

The construction of ducts shall comply with the following :

Ducting Design Criteria		
Duct to extend beyond kerb line (minimum distance) (Beyond sidewalk)		1.0m
Minimum depth below finished road surface	High voltage cables	1 000mm
	Medium voltage cables	1 000mm
	Low voltage cables	800mm
	Telkom and fibre optic	800mm
	All other ducts	1 000mm
Minimum trench width		600mm
Minimum side clearance (between trench wall and duct)		200mm
Minimum horizontal clearance between adjacent ducts		150mm
Minimum vertical clearance between ducts		100mm

Draw wires (nylon rope) to be installed in all ducting, with a 2m free length at each end.

Duct ends shall be sealed at end with uPVC end caps with rubber ring.

Ducting for Traffic Signals shall be provided with Cable Inspection Chamber at duct ends as per detailed drawing.

Ducting Pipe Materials

Ducting Pipe Materials		
Service Provider	**Pipe Diameter (mm Ø)**	**Specification**
Telecommunication	110	HDPE Class 16, type 5 complying with SABS 533 using compression fittings and joints.
Electrical: Low voltage	110	uPVC Class 400 KPa complying with SANS 1601 using spigot and socket rubber ring joint.
Electrical: High voltage	160	
Traffic signals	110	
Irrigation (parks)	110	uPVC Class 34 heavy duty complying with SABS 791 using spigot and socket rubber ring joints.

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All pipes ends shall have all sharp edges and irregularities removed prior to installation. Pipe ducts are to be arranged as shown on drawing R23A, R23B, R23C, R23D, R23E and R23F. The maximum allowed deviation in any direction is 30mm. Before the installation of end caps, all pipes shall be checked for obstructions, which shall be removed by suing a “pig”.

Add the following:

"PSLC 3.1.1 Telkom SA Limited (Telkom) materials

All material such as pitch-fibre pipes, screening wire and draw wire will be supplied, free of charge, by Telkom against a receipt signed by the Contractor when the material is collected.

The Contractor shall notify Telkom at least 2 weeks prior to the date on which the pipes are required.

The Contractor shall use the materials supplied by Telkom in the most economical manner. Materials lost or damaged through neglect on the part of the Contractor or his workmen shall be replaced by the Contractor at his own expense.

It is a condition of this Contract that the Works and all material and equipment handed to the Contractor shall be insured against damage or loss as stipulated in Clause 38 of the General Conditions of Contract.

On completion of the work, the Contractor shall deliver all surplus material to the nearest Telkom engineering yard.

PSLC 3.1.2 Split uPVC pipes

Split pipes shall only be used to provide ducts for existing services that cannot be severed and threaded through the ducts. The pipes shall be cut accurately in the middle, and opposite halves shall be matched as sawn. Split pipes shall be placed around the service, firmly bound by steel straps, and encased in concrete."

PSLC 3.4 CABLE DUCT MARKERS

Add the following:

"A cable duct marker shall consist of a 300 mm x 300 mm x 100 mm deep, class 20 MPa/19 mm concrete block, connected by means of a non-ferrous metal strip to a temporary plug to seal the end of the duct. The plug shall prevent moisture or soil from entering the duct. The metal strip shall be firmly connected to both the plug and the concrete block. The concrete block shall be positioned not further than 0,5 m horizontally from the end of the cable duct. The face of the concrete block shall be clearly marked "E" to indicate electricity cables."

OR

Duct Marking Details

Electrical duct crossings shall have danger tape installed on top of the concrete duct section just below the pavement structure of a road.

Services Type	Lettering	Colour	Specifications
Ducts			
Telkom	T	Green	Precast recessed kerbs are required.
Electrical	E	Red	
Traffic	R	Yellow	
Parks (Irrigation)	P	Black	

PSLC 5 CONSTRUCTION

PSLC 5.1 EXCAVATION OF TRENCHES

PSLC 5.1.1 Trench widths and depths

PSLC 5.1.1.2 Add the following:

"For telephone services the pipe trench shall have a minimum depth to provide a cover of not less than 600 mm between the top pipe and the finished road surface level. Where this depth cannot be maintained due to the nature of the ground, the depth may be altered at the discretion of the Telkom Employer's Agent. When the pipe has less cover than 600 mm it shall be covered by concrete slabs with a minimum thickness of 50 mm and a width equal to 400 mm plus the diameter of the pipe they protect, unless otherwise directed by the Telkom Employer's Agent. The concrete slabs shall be provided by the Contractor."

PSL 5.3 DUCT LAYING

PSLC 5.3.1 Straight laying

Add the following:

"If the trench is to contain more than one pipe exceeding 75 mm internal diameter, the base of the trench shall slope so that water may drain away from the pipes. The level of the bottom of the trench shall fall at least 75 mm per 30 m."

PSLC 5.3.3 Draw wire

Replace the contents of this subclause with the following:

"A length of 3,05 mm diameter galvanised iron wire (supplied by Telkom) shall be attached to the cleaning-brush and drawn into the pipe and left for use as a draw wire. A surplus of wire of at least 2 m in length, shall be left neatly coiled at each end of each duct. All open pipe ends must be plugged to prevent the ingress of dirt."

Add the following subclauses:

"PSLC 5.3.5 Jointing of pitch-fibre pipes

Pitch-fibre pipes with tapered ends shall be jointed by tapered socket couplings. The pipe end and the inner surface of the coupling shall be clean before the spigot is pushed into the socket.

The end of the first pipe placed in the trench shall be butted firmly against a solid object to ensure that hammer blows applied to subsequent pipe lengths will drive the tapered pipe ends firmly into the tapered sockets. A coupling shall be fitted to the leading end of the pipe and tapped firmly home, using a 1,8 kg hammer applied to a wood block (230 mm x 175 mm x 50 mm) held flush against the open end of the coupling. The end of the next pipe shall be inserted into the coupling and a coupling shall be placed over its leading end. This pipe length shall then be tapped home and the process repeated throughout the length of the line. In general, the pipe shall not be driven further into the socket than 6 mm beyond hand tightness.

The Contractor shall cut the pitch-fibre pipes according to the requirements of the work. Pipes shall be cut to length with a sharp coarse-toothed saw. The Contractor shall re-machine the cut ends of the pitch-fibre pipes. Tapering on Site shall be carried out with a Santar hand turning machine.

PSLC 5.3.6 Screening

PSLC 5.3.6.1 General

Pipe ducts shall be screened against electrical interference by copper wires. All joints in screen wires shall be soldered.

PSLC 5.3.6.2 Composition of screen for pipe ducts

The screen shall consist of two strands of 2,50 mm diameter copper wire, bound together by two turns of similar copper wire every 5 m. The binding shall be undertaken by the Contractor. The screen shall be placed approximately 200 mm above the pipe or the top layer of pipes."

PSLC 5.6 LAYING OF CABLES WITH OTHER SERVICES

Add the following:

"Trenches for telephone ducts shall be excavated so that pipes can be laid at least 300 mm from power cables. Where this is not possible, pipes shall be separated from power cables by vertically placed concrete or paving slabs."

PSLC 5.7 CROSSING OF TELEPHONE AND ELECTRICITY CABLE DUCTS

Replace this subclause with the following:

"PSLC 5.7 CROSSING OF TELEPHONE DUCTS WITH OTHER SERVICES

When a duct crosses an existing service such as an electricity supply cable, a water supply pipe or a sewerage pipe, the telecommunication duct shall, if possible, be laid not less than 25 mm above the existing service. Where the depth of the existing service is insufficient for this to be done, the telecommunication duct shall be laid to pass not less than 25 mm below the other service."

PSLC 5.8 ROAD CROSSINGS

Replace “0,5 m" with "1,0m" in the last sentence.

Add the following:

"Duct ends must be blanked off with endcaps, and all ducts laid are to be provided with galvanized draw-wires for subsequent cable-pulling operations by others."

PSLC 7 TESTING

PSLC 7.1 ACCESS FOR EMPLOYER’S AGENT

Add the following:

"The Telkom Employer’s Agent shall have free access to the Site at all times. He has the right to inspect work on telecommunication ducts at any stage and may reject any work not executed in an approved, substantial and workmanlike manner and in accordance with the specifications.

No pipes shall be covered before inspection by a Telkom Employer’s Agent. At least 24 hours' notice is required prior to the inspection."

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Add the following subclause:

"PSLC 7.4 FINAL INSPECTION

A final inspection will be take place on completion of the work. The Contractor shall, at his own cost, expose all pipe ends prior to the final inspection, after which they may be finally plugged and closed."

PSLC 8 MEASUREMENT AND PAYMENT

PSLC 8.2 SCHEDULED ITEMS

PSLC 8.2.5 Supply, lay, bed, and prove duct:

Replace the payment paragraph with the following:

""For the purposes of local content of designated sectors as determined by the Department of Trade and Industry the supply and the installation of the pipes shall be scheduled separately. The rates to supply the pipe shall include all cost to provide the scheduled pipe to site including all transport, handling, storage and other cost as may be necessary. Separate items are scheduled for each diameter of duct.

The rates shall cover -

(a) for Telkom ducts, the cost of collecting the ducts, draw wire and screening wire and the cost of laying the ducts and screening wire, installing the draw wire, jointing, bedding and providing all as specified, and

(b) for all other ducts, the cost of providing all the material and the cost of laying the ducts, installing the draw wire, jointing, bedding and providing all as specified.

(c) Where split sleeves are specified, the rate shall, in addition to the provisions of the above sub-clauses, include the cost of cutting the pipes, securing the pipes around existing services and the protection of such existing services."

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PSME **SUBBASE (1981)**

PSME 3 **MATERIALS**

PSME 3.2 **Physical Properties**

PSME 3.2.1(d) Regional factor

The regional factor for the area is 0.60.

PSME 3.2.2 Gravel shoulder and gravel wearing course material

Replace the contents of this subclause with the following :

‘‘The material used for the gravel wearing course shall comply with the following parameters as defined in TRH 20; subject to such other requirements involving future upgrading, where so indicated on drawings or directed by the Employer’s Agent:

Maximum Size : 37.5mm
Oversize Index : 0
Shrinkage Product : 100 to 240 based on
linear shrinkage x per cent passing 0.425mm sieve
Grading Coefficient : 16 to 34 based on
(%passing 26,5mm-%passing 2,0mm) x % passing 4.75mm/ 100
CBR: 15% at 95% of Mod AASHTO density (soaked)

Where gravel shoulders or staged construction is contemplated for low volume roads (lightly trafficked), a base material as specified in PSMFL 3.2 and PSMFL 3.3 may be required to function as a gravel shoulder and/or wearing course.”

PSME 5 **CONSTRUCTION**

PSME 5.3 **Processing**

b) Heavy grid rolling

Insert the following after the first sentence:

“Research has shown that grid rolling is only effective for material where the Treton impact value is in excess of twenty(20).”

PSME 5.4 **Placing and Compaction**

PSME 5.4.1 Placing

Substitute “the project specification” in the second paragraph of ME 5.4.1 with “ME 6.1.4”

Add the following:

”Where size reduction is required to comply with the specifications, and grid rolling is required to attain such requirements, the process shall be carried out as outlined in PSME 5.3(b) “

PSME 5.4.4 Compaction

Replace the sub-subclause with:

“The sub-base shall be compacted to a density of at least 97% of modified AASHTO density(or 100% of modified AASHTO density in the case of sand complying with subclause 2.2 of SABS 1200M and deemed suitable as a subbase under very specific circumstances), unless otherwise specifically indicated on drawings. Gravel shoulders and any gravel wearing course shall be compacted to a density of at least 97% of modified AASHTO density unless otherwise specified and/or indicated on drawings. “

PSME 5.7 **Transport**

Replace the contents of this subclause with the following:

"All movement of material shall be regarded as free-haul. No haulage shall be paid."

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PSME 7.2.2 Routine Inspection and Testing

Replace the values in Table 3 with the applicable criteria for minimum average density and minimum density value for any single test, for the specified density, based on the number of tests per lot as specified in PSM 7.4.

PSME 8 **MEASUREMENT AND PAYMENT**

PSME 8.1 **Basic Principles**

Insert a semi-colon in the first line of paragraph (b) after the words ".... will be paid for once only" and delete the rest of the paragraph.

Replace paragraph (d) with the following:

(d) that in the case of material from a commercial source or from borrow pits selected by the contractor, no additional payment will be made for the class of excavation, method of processing (except stabilising), or overhaul unless otherwise specified in the project specification."

PSME 8.3 **Scheduled Items**

PSME 8.3.3 Construct the sub-base course/shoulders/gravel wearing course with material from commercial sources or designated borrow areas

Replace the heading of this item with the following:

"PSME 8.3.3 Construct the sub-base course/shoulders/gravel wearing course with material from commercial sources"

Add the following to the payment description paragraph:

"This item shall also be applicable to the construction of sub-base course/ shoulders/gravel wearing course with material from borrow pits selected by the contractor."

PSME 8.3.9 Overhaul (haul exceeding 2 km)

Delete this item.

No overhaul will be paid on material for the purposes of this contract and all the costs for transporting material must be included in the applicable tendered rates and amounts."

"PSME 8.3.11 Treatment of subbase with:

(a) Weed killer ..... **Unit : m^2**

(b) Insecticide ..... **Unit : m^2**

The tendered rates shall include full compensation for the supply, spreading and mixing-in or application of the poison.

Only areas that were treated on the written instructions of the Employer's Agent will be measured for payment."

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PA FENCING

PA 01 SCOPE AND ORDER OF PRECEDENCE

This is a particular specification and covers the erection of new fences and partial replacement of existing fences. The specification shown on the drawings and schedule will have precedence over these particular specifications.

PA 02 TYPE OF FENCE

The fence shall be a security fence which is locally manufactured in totality in the Western Cape and shall be erected in accordance with the dimensions shown on the drawings.

PA 03 MATERIALS

PA 03.1 POSTS, STAYS AND STANDARDS

Posts, stays and standards shall be of the type and size indicated on the drawings. Posts shall include gateposts, straining posts and corner posts.

Metal posts, stays and standards shall comply with the requirements of CKS 82 and SABS 280. "Acceptable" in CKS 82 means "acceptable to the engineer".

All posts shall be galvanized in accordance with SABS 1461 Table 1 for type B-articles.

Corner, gate and straining posts shall be suitably drilled for stay bolts or gate fittings as indicated on the drawings.

PA 03.2 BOLTS FOR STAYS, POSTS, GATE POSTS AND CORNER POSTS

All nuts, bolts and washers shall be stainless steel. The length and diameter of the bolts shall be as shown on the drawings. All the necessary bolts, together with nuts and washers, shall be supplied with each post.

PA 03.3 WIRE

All wire shall conform to the requirements of SANS 10244-2 and SANS 675 and shall be class A fully galvanized.

(a) Barbed wire

Barbed wire shall be one or both of the following types :

(i) High-tensile grade, oval shaped, single-strand wire, 2,60 mm x 2,00 mm.

(j) Mild-steel grade, double strand, uni-directional twist wire, each strand 2,50 mm in diameter.

Barbs shall be spaced at not more than 150 mm intervals.

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(b) Smooth wire

Smooth wire shall be of the types specified below :

(i) Straining wire shall be mild-steel wire, minimum 4,00 mm in diameter.

(ii) Fencing wire shall be high tensile grade, 4,00 mm diameter wire.

(iii) Tying wire or binding wire shall be 2,50 mm diameter, mild-steel, class C galvanized wire for tying fencing wire to standards and 1,60 mm diameter, mild-steel, class C galvanized wire for tying wire mesh to fencing wire.

(c) Barbed-tape concertinas

Barbed- tape concertinas shall comply with the requirements for type A in CKS Specification 592 and shall consist of close-coiled high-tensile wire with a continuous strip of flat steel barbs (barbed tape) crimped to the wire along the entire length of the wire. The coils shall further be attached together by clips to give a concertina configuration when pulled apart. The coils shall be of the diameter as shown on the drawings. Each concertina shall have a minimum of 55 coils, and the maximum effective length of open concertina, when pulled apart, shall depend on the diameter of the roll, but shall be at least 12 m. The high-tensile wire shall be Grade 304L stainless steel.

The barbed tape shall be made of Grade 304l Stainless steel.

The concertina clips shall be manufactured from Grade 304L stainless steel strip.

PA 03.04 GATES

Gates shall comply with the requirements of CKS 146 and shall be manufactured to the dimensions shown on the drawings.

Gates shall be complete in every respect, and shall include hinges, washers, bolts and the locking mechanism shown on the drawings.

PA 03.05 CONCRETE

Concrete used for fencing shall comply with the requirements of SABS 1200 G.

PA 04 CLEARING OF FENCE LINE

Strip clearing for the fence shall be carried out and paid for in accordance with SABS 1200 C.

PA 06 INSTALLING BARBED-TAPE CONCERTINAS

Barbed-tape concertinas shall be positioned on the fence as shown on the drawings. The concertinas shall be fastened to the appropriate fencing wires at each standard as well as at 0,5 m maximum intervals between standards.

Rolls of barbed-tape concertinas shall be joined with binding wire at four points, spaced at equidistant intervals around the circumference of the loop. Joints shall be made to coincide with the positions of standards.

PA 07 INSTALLING GATES

Gates shall be installed at the positions indicated on the drawings or pointed out on site. The gates shall be hung on gate fittings in accordance with the details shown on the drawings. Gates shall be so erected that they swing in a horizontal plane at right angles to the gateposts and clear of the ground in all positions. Double swing gates shall close to have a gap of not more than 25 mm between them, and other gates shall close to be no further than 25 mm from the gatepost.

PA 08 FENCING

The fencing must be erected strictly in accordance to the local manufacturer's instructions.

PA 09 MEASUREMENT AND PAYMENT

PA 09.01 FENCING

Items shall be measured separately as scheduled. The unit of measurement shall be the number, linear metre or sum as scheduled for the applicable item.

The tendered rate (or sum) shall include full compensation for manufacturing, supply and installation each item complete as shown on the drawings including all excavation, backfilling and disposal of surplus material as specified.

PA 09.03 Apply Weed Killer along fence line up to 1m both sides of fence after construction..... **Unit : m**

The rate tendered shall make full compensation to apply roundup or similar approved weed killer according to manufacturer specifications along the fence line up to 1m from the fence both sides once fence has been constructed.

The rate shall also include all health and safety equipment necessary

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C3.5 Management

CONTENTS

3.5.1 CONTRACT ADMINISTRATION

3.5.2 LABOUR INTENSIVE CONSTRUCTION / PARTICIPATION OF TARGETED LABOUR

3.5.3 PARTICIPATION OF TARGETED ENTERPRISES

3.5.1. CONTRACT ADMINISTRATION

The Contractor shall submit with each monthly statement for payment, the following returns – the format of which are: are included in C3.6 : Annexes.

Annex 1: B-BBEE Sub-contract Expenditure Report

Annex 2: Project Labour Report

Annex 3: Targeted Labour Contract Participation Expenditure Report

Annex 4: Targeted Enterprise Contract Participation Expenditure Report

The Project Labour Report must include details of all labour (including that of sub-contractors) that earns less than R200 per day (excluding any benefits) employed from within the Target Area 1 – Local Area on this contract in the month in question.

3.5.2. LABOUR INTENSIVE CONSTRUCTION / PARTICIPATION OF TARGETED LABOUR

In support of the National Department of Public Works' Expanded Public Works Programme which is aimed at the alleviation of poverty through the creation of employment opportunities, the Employer is seeking to increase the intensity of labour, as appropriate, in all of its infrastructure sector projects.

It is a requirement of this Contract, therefore, that the work be executed in such a manner so as to maximise the use of labour intensive construction methods in order to provide low and semi-skilled employment opportunities and employ workers from the local community.

3.5.2.1 Minimum Targeted Labour contract participation

To this end, a minimum targeted labour contract participation goal (CPG_{2L}) set by the Employer for this Contract is specified in Section 3.3.3 of Part C3.3: Procurement in the Scope of Work, which shall be achieved by the Contractor in the performance of the contract, failing which, penalties as described will be applied.

The minimum Targeted Enterprises and Targeted Labour (Local Resources) contract participation goal set by the Employer may be such that the Contractor will have to carry out some of the work that would normally have been undertaken using mechanised construction methods, by using labour intensive construction methods instead. It is left to the discretion of the Contractor to identify suitable work activities for the intensification of labour. The Contractor shall, within 5 working days of being requested in writing by the Engineer to do so, submit details of his/her plan to achieve the minimum targeted labour contract participation goal (CPG_{2L}).

3.5.2.2 Recruitment of targeted labour

Where targeted labour is to be drawn from specific local communities (defined in terms of the target area), such labour shall be identified using the relevant Regional / District / Sub-Council Job-Seekers Database. The Contractor shall request, via a Community Liaison Officer (if required in terms of the contract), a list of suitable candidates from the database, from which the Contractor shall make his/her final selection. The contractor shall enter into written contracts of temporary employment with all targeted labour.

Any difficulty experienced by the Contractor in identifying candidates though the Job-Seekers Database, or as regards any matter relating to the employment of targeted labour, shall be immediately referred to the Engineer.

3.5.2.3 Records

Credits towards the achieving the minimum targeted labour contract participation (CPG_{2L}) shall be granted by converting the total monetary value of wages paid to targeted labour to a percentage of the net value of the contract. No credits

shall be accorded should the contractor fail to enter into written contracts with the targeted labour. Furthermore, no credits shall be accorded in respect of targeted labour employed on work in respect of provisional sums or prime cost items. Such labour shall nevertheless be recorded on the Project Labour Report which is required to be furnished by the Contractor.

In addition to the forms required for contract administration (the Project Labour Report and Targeted Labour Contract Participation Expenditure Report, in particular), the Contractor shall furnish the Engineer with copies of the employment contracts entered into with targeted labour, as well as evidence of payments to the such labour in the form of copies of payslips or payroll runs.

3.5.2.4 Training of targeted labour

The Contractor is required to provide all informal (on-the-job) skills training so as to ensure that a minimum level of competence is achieved and maintained, such that the various activities are carried out safely and to the required standard. The cost of informal training shall be included in the rates for the various work activities.

3.5.3. PARTICIPATION OF TARGETED ENTERPRISES

It is a requirement of this contract that enterprises located within the target area, as defined, be engaged by the Contractor for the provision of supplies, services or works necessary for the performance of this contract.

3.5.3.1 Minimum Targeted Enterprises contract participation

To this end, a minimum targeted enterprises contract participation goal (CPG_{2E}) set by the Employer for this Contract is specified in Section 3.3.3 of Part C3.3 : Procurement in the Scope of Work, which shall be achieved by the Contractor in the performance of the contract, failing which, penalties as described will be applied.

The Contractor shall engage targeted enterprises directly or indirectly in the performance of the contract to the extent that the total monetary value of such engagements (exclusive of VAT), expressed as a percentage of the value of the contract, is sufficient to achieve the specified minimum targeted enterprises contract participation (CPG_{2E}). The Contractor shall, within 5 working days of being requested by the Engineer to do so, submit details of his/her plan to achieve the minimum targeted enterprises contract participation (CPG_{2E}).

3.5.3.2 Records

Credits towards achieving the minimum targeted enterprises contract participation goal (CPG_{2E}) shall be granted by converting the total monetary value (exclusive of VAT) of the agreements between the Contractor, or Contractor's sub-contractors, and targeted enterprises, to a percentage of the value of the contract.

No credits shall be accorded should the Contractor (or sub-contractors):

a) make direct payment to third parties in connection with the contract on behalf of targeted enterprises, when such payment is recovered by making deductions from payments due to the targeted enterprise;
b) fail to enter into written contractual agreements with the relevant targeted enterprises.

Credits claimed towards the contract participation goal shall be denied where such written contractual agreements contain any of the following:

i) conditions which are more onerous than those that exist in the prime contract (this contract);
ii) payment procedures based on a pay when paid system;
iii) authoritarian rights given to the employing contractor, with no recourse to independent adjudication in the event of a dispute arising.

No credits may be claimed in respect of targeted enterprises that that do not adhere to statutory labour practices. No credits shall be accorded in respect of targeted enterprises engaged on work in respect of provisional sums or prime cost items.

In the event that a targeted enterprise sub-contracts to another targeted enterprise, only the value of the higher level sub-contract shall be granted as credit towards achieving the specified minimum CPG_{2E}.

In addition to the form required for contract administration (the Targeted Enterprises Contract Participation Expenditure Report), the Contractor shall furnish the Engineer, upon written request, with documentary evidence that the targeted enterprises have their base of operations in the target area, copies of the contractual agreements with the various targeted enterprises, as well as documentary proof of payments made to the various targeted enterprises.

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C3.6 Annexes

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Annex 1: B-BBEE Sub-contractor Expenditure Report

Annex 2: Project Labour Report

Annex 3: Targeted Labour Contract Participation Expenditure Report

Annex 4: Targeted Enterprise Contract Participation Expenditure Report

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ANNEX 1

CONTRACT NO. AND NAME: .....

CONTRACTOR: .....

B-BBEE SUB-CONTRACT EXPENDITURE REPORT BASED ON PAYMENT CERTIFICATE NO. .....

Value of the contract (as defined in Schedule 21: Preferencing Schedule) (**P***)	R	B-BBEE Status Level of Prime Contractor	

Name of Sub-contractor (list all Sub-contractors)	**B-BBEE Status Level of Sub-contractor[1]**	**Total Value of Sub-contract (Excl VAT)[1]**	**Value of Sub-contract work to date (Excl VAT)**	**Value of Sub-contract work to Sub-contractors with a lower B-BBEE Status Level than Prime Contractor**
Sub-contractor A				
Sub-contractor B				
Sub-contractor C				
[1]Documentory evidence to be provided			Total:	
			Expressed as a percentage of **P***	%

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Signatures

Contractor: ..... **Date:** .....

Engineer/ Engineer's Representative: ..... **Date:** .....

ANNEX 2 Project Labour Report

Project/Contract Name:		**Budget:** (tick one) **Capital** ✓	**Operating**
Project/Contract Number:		**WBS No./Cost Centre No.:**	
Contractor:		**Project/Contract Start Date:**	
Consultant:		**Project/Contract End Date:**	
CLO Name:	**CLO ID Number:**	**Project/Contract Value (incl. allowance for escalation/excl. VAT):**	
Month:		**Project Labour Intensity Target/ Specified Minimum Targeted Labour Contract Participation Goal:**	
Total value of work done to date (incl. escalation/excl. VAT):			

Number of workers	Name	Surname	ID Number/DOB	Targeted Labour (Y/N)	Daily Rate	Number of days worked this month (incl. training)	Disabled (Y/N)	Number of training days this month	Course Name	Training Service Provider
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
	Totals for sheet									
	Sheet of									

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Signatures

Contractor: ---------- **Date** ----------

Consultant/Project Manager: ---------- **Date** ----------

ANNEX 3

CONTRACT NO. AND NAME: .....

CONTRACTOR: .....

TARGETED LABOUR CONTRACT PARTICIPATION EXPENDITURE REPORT BASED ON CERTIFICATE NO. ...

Value of the contract (as defined in Schedule 21: Preferencing Schedule) (**P***)	R

Specified Targeted Labour Contract Participation Goal	%

Name of Contractor/Sub-contractor (list all)	**Total previous expenditure on wages in respect of targeted labour**	**Net Amount for this month[1]**	**Total expenditure on wages in respect of targeted labour**
Contractor			
Sub-contractor A			
Sub-contractor B			
		Total:	
		Expressed as a Percentage of **P***	%

[1]Documentory evidence to be provided

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Signatures

Contractor: ..... **Date** .....

Engineer/ Engineer's Representative: ..... **Date** .....

ANNEX 4

CONTRACT NO. AND NAME: .....

CONTRACTOR: .....

TARGETED ENTERPRISES CONTRACT PARTICIPATION EXPENDITURE REPORT BASED ON CERTIFICATE NO. .....

Value of the contract (as defined in Schedule 21: Preferencing Schedule) (**P***)	R

Specified Targeted Enterprises Contract Participation Goal	%

Name of Targeted Enterprise (list all)	**Total previous expenditure (excl VAT) in respect of targeted enterprises**	**Net Amount for this month[1]**	**Total expenditure (excl VAT) in respect of targeted enterprises**
Enterprise A			
Enterprise B			
Enterprise C			
		Total:	
		Expressed as a Percentage of **P***	%

[1]Documentory evidence to be provided

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Signatures

Contractor: ..... **Date** .....

Engineer/ Engineer's Representative: ..... **Date** .....

C4 Site Information

The rates tendered are deemed to be based on the Contractors own inspection, investigations and site visits and Clause 2.1 of the GCC 2015 (3rd Edition) is applicable in this regard.

The Geotechnical Investigations completed are included here as well as the Construction Environmental Management Plan.

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Report to Neil Lyners and Associates on a Geotechnical Investigation carried out for the Proposed 3Ml Reservoir, Pipelines and Pump Stations, Robertson, Western Cape

Project No.: 21-109R01

Date Issued: October 2021

Report to Neil Lyners and Associates on a Geotechnical Investigation carried out for the Proposed 3Ml Reservoir, Pipelines and Pump Stations, Robertson, Western Cape

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Appendix A : Inspection Pit Logs
Appendix B : Laboratory Test Results

Figures 1 and 2

	PREPARED:
DATE:	**October 2021**
NAME:	**Mark Richter**
SIGNATURE:	

Report to Neil Lyners and Associates on a Geotechnical Investigation carried out for the Proposed 3Ml Reservoir, Pipelines and Pump Stations, Robertson, Western Cape

1. INTRODUCTION

Gondwana Geo Solutions (Pty) Ltd (or GGS) was requested by Mr Carel Davids of Neil Lyners and Associates to provide a cost estimate for a geotechnical investigation for the proposed new 3Ml Reservoir, Pipelines and Pump Stations in Robertson, Western Cape. A cost estimate was submitted on 21st of September 2021. Mr Davids subsequently instructed GGS to proceed with the investigation as proposed.

This report contains the results of the geotechnical investigation as well as recommendations for excavation requirements, foundations, groundwater and materials.

2. INFORMATION SUPPLIED

The following information was provided by Neil Lyners and Associates:

- Google Image of the site boundaries.
- Electronic files titled "*Erf 2891 - Robertson - Figures 1 to 4"*

3. SITE DESCRIPTION

The positions of the test pits required by Mr Davids were provided on a Google image which has been used to compile Figure 1 of this report. The project involves an upgrade to the water reticulation on Erf 2891 and will involve a new 3Ml reservoir, pipelines and pumpstations.

The new 3Ml reservoir is to be located adjacent to the existing reservoir, which is situated on a south facing slope on the mountain on the northeast of Robertson CBD. This area was investigated by inspection pits IP1 to IP3.

The remainder of the site area for the pumpstations and pipelines (i.e. inspection pits IP4 to IP6) is located on the gently sloping foothills on the south, and which are developed with existing housing and municipal infrastructure.

The following plates provide a more detailed perspective of the site:



Plate 1: Test Pit Positions TP1 to TP3 – Reservoir 3



Plate 2: Location of Test Position TP4



Plate 3: Location of Test Position TP5



Plate 4: Location of Test Position TP6

4. FIELDWORK

The fieldwork for the investigation was carried out on the 2nd October 2021 and comprised the digging of six inspection pits. The inspection pits, designated IP1 through IP6, were excavated using a JCB TLB at the approximate positions indicated by Mr Davids on Figure 1.

The inspection pits were dug to depths of between 0.60 and 2.60 metres below existing ground level (mbegl). The inspection pits were profiled[1] and representative soil samples were recovered for later laboratory testing.

The inspection pit information is summarised in Table 1 below and the detailed logs are provided in Appendix A.

Table 1
Summary of Inspection Pit Details

IP No.	Depth (mbegl)	Comments
IP1	0.60	Refusal on soft to medium hard rock shale No groundwater seepage No sidewall collapse
IP2	1.30	Refusal on very soft to soft rock shale No groundwater seepage No sidewall collapse
IP3	1.40	Refusal on very soft to soft rock shale No groundwater seepage No sidewall collapse
IP4	2.60	No Refusal No groundwater seepage No sidewall collapse
IP5	2.40	No Refusal No groundwater seepage No sidewall collapse
IP6	1.20	Refusal on soft to medium hard rock shale No groundwater seepage No sidewall collapse

Note: mbegl = metres below existing ground level

[1] Guidelines for Soil and Rock Logging in South Africa, *Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG*, 1990

5. SITE GEOLOGY

An extract from the 1:250 000 Worcester 3319 geological map prepared by the Council for Geosciences given in Figure 2 indicates that the proposed new reservoir is underlain by the shales (greywacke) rocks of the Norree Formation (Nn) of the Malmesbury Group. The reservoir site is located on a south facing slope of the mountain which rises above the general CBD of Robertson on the northeast. While the regional dip of the shale beds is 40 degrees the south, the inspection pits dug (IP1 through IP3) indicated much flatter bedding plane angles occurring locally.

The inspection pits (IP4, IP5 & IP6) dug in areas investigated for the pumpstations and pipeline, respectively, however, are underlain by the recent, transported deposits (T-Ql) which comprise poorly cemented gravelly sands.

6. GROUNDWATER

No groundwater seepage was encountered in any of the inspection pits put down on site.

It can generally be expected, however, that groundwater seepage will occur at the interface between the soil mantle and underlying shale rock, particularly during or after periods of heavy rainfall.

7. LABORATORY TESTING AND MATERIALS EVALUATION

7.1 Materials Usage

In order to classify materials and to assess their suitability for the construction of earthworks, pipe bedding materials and roads, the following laboratory testing was conducted on soils taken from the inspection pits.

- Foundation Indicator testing to determine Atterberg Limits, Particle Size Distribution and clay activity.
- Modified AASHTO Density and California Bearing Ratio (CBR) Tests to determine the suitability of the materials for roads and platform construction.

The results of the laboratory tests are provided in Appendix B and summarised in Table 2 below.

Table 2
Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations and CBR tests

IP No	Depth (m)	Description	Particle Size %				Atterberg Limits			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)					Compact-ibility	Swell (%)	Classification & Activity
			Clay	Silt	Sand	Gravel	LL	PI	LS%		MDD (kg/m³)	OMC %	90	93	95	98	100			
IP2	0.40-1.30	Grey to brown highly weathered very closely bedded and jointed very soft to soft rock SHALE.	1.6	1.8	21.7	74.8	28	SP	1.5	2.45	2072	7.9	10	21	33	69	113		0.00	A-1-a(0); GP-GM; Low; G6; Type B Gravel Wearing Course
IP4	0.20-2.60	Slightly moist reddish brown mottled grey dense gravelly clayey SAND. Hillwash/Talus.	22.3	11.7	49.2	16.8	32	13	6.5	0.96								0.4		A-6(5); CL; Low; Type D Gravel Wearing Course
IP5	0.60-1.00	Slightly moist dark reddish brown dense to very dense clayey gravelly partially laminated SAND with poorly formed calcrete nodules. Talus.	6.5	2.8	42.4	48.4	41	13	6.5	1.86								0.3		A-2-7(0); SM; Low; Type E Gravel Wearing Course
IP6	0.00-1.00	Dry reddish brown mottled grey dense sandy fine to large shale GRAVEL. Talus.	2.9	1.4	22.6	73.1	22	8	4.5	2.45								0.2		A-2-4(0); GW-GC; Low; Type B Gravel Wearing Course

LL - Liquid Limit
PI - Plasticity Index
LS - Linear Shrinkage
GM - Grading Modulus
MDD - Maximum Dry Density
OMC - Optimum Moisture Content

Classification in Terms of:
USPRA[2]
Unified Soil Classification System[3]
Van Der Merwe (1964)[4]
COLTO[5]
TRH20 (1990)[6]

Suitability for Gravel Wearing Course
A - Erodible Materials
B - Ravels and Corrugates
C - Ravels
D - Slippery when Wet
E - Good

[2] ASTM D 2487-06 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). June 2006
[3] US Public Roads Administration Classification (Modified from Allen 1945)
[4] D.H. Van Der Merwe (1964). The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer, pp 103-107
[5] COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998)
[6] TRH20 (1990) - The Structural Design, Construction and Maintenance of Unpaved Roads, Committee of State Road Authorities

7.2 Materials Evaluation

The materials underlying the site have been classified in terms of their suitability for use in pipe bedding, road and fill construction based on field observations and laboratory test results.

Weathered Shale:

The information in Table 2 indicates that the sample of the weathered shale taken from IP3 at Reservoir 3 was Slightly Plastic, with Grading Modulus (GM) of 2.45, and a combined silt & clay content of 4%, with the remainder comprising (22%) and gravel (75%). The material classifies as A-1-(a) in the PRA system and GP-GM in terms of the USC system. In terms of COLTO this material classifies as G6.

This material is suitable for subbase/ base layers in road construction. If it is processed to the correct sizes by crushing, it can also be suitable as a general pipe bedding material. It may also be used as a gravel wearing course of unsurfaced roads, but being Type B, however, the materials will ravel and corrugate.

Talus/ Hillwash Material

The talus or hillwash soils encountered in Inspection Pits IP4 and IP5 and IP6 have Plasticity Index values in the range 8 to 15, combined silt & clay content of 4 to 34%, GM values in the range 0.9 to 2.45, and GM in the range 0.96 to 2.45. The soils classify as A-6(5) to A-2-4(0) and CL through to GC. They have compactibility test values in the range 0.2 to 0.4. There is thus a large range in material quality.

While these materials do not meet the strict requirements of bedding material in terms of SANS 1200LB, they will generally be suitable as bedding and blanketing materials for flexible pipes such as uPVC, GRP, HDPE, ductile iron and steel types provided they are not too clayey. Where too clayey, they will be difficult to compact in the haunch area beneath the curved underside of the pipe and may need to be rejected. Ideally, material used for the bedding [7] and embedment must be a cohesionless, free-draining material (5 percent fines or less), and the maximum size should not exceed 19mm. In addition, not more than 25 percent of the material should pass the 2mm sieve. This latter requirement prevents the use of fine sands which can be difficult to compact.

It may therefore be more cost effective to import ideal bedding and blanketing materials for the pipelines. Care should be taken to not over-compact the blanketing layer as this could cause pipe deformation (ovality) with the pipes which have weaker hoop strengths such as uPVC, HDPE etc.

All materials removed from the trench may be used as common backfill, Compaction of the common backfill over the blanket layer should be minimum 93%MDD. Where the pipelines run under paved areas and roads, the backfill should be well compacted to ensure that no settlement depressions occur along the trench outline. For roads trafficked by heavy vehicles, the use of stabilised soil for backfill may be considered to eliminate potential rutting or depression problems. About 5% cement stabiliser by mass could be considered for this purpose.

The materials range in Type B to E in terms of TRH20 and may be used as wearing course materials for unsurfaced roads. They will ravel and corrugate (Type B) in some areas, while others will be good (Type E).

8. DEVELOPMENT RECOMMENDATIONS

8.1 Proposed Development

The proposed development will consist of infrastructure upgrade for the area designated as Erf 2891 of Robertson. It will involve a new 3Ml reservoirs, new pumpstations and pipelines.

[7] United States Department of the Interior Bureau of Reclamation Technical Service Center Geotechnical Services Denver, Colorado1996

8.2 Excavations & Trenching

8.2.1 Bulk Excavation - Reservoir

The cutting for the building platform for the 3Ml reservoir should be constructed with a batter slope similar to the existing reservoir. The batter slope of the cutting face should not be steeper than about 1V:1H. Steeper slopes will give rise to potential bedding plane and wedge failures. In any event it is recommended that GGS inspect the open excavation to verify the stability of the cutting slope.



Plate 5: Shale bedrock at very shallow depths



Plate 6: Slope of existing reservoir cutting into the hill is approximately 1V:1H; the dip of the shale beds out of the cutting face is about 10˚ on average.

8.2.2 Trenches

An indication of the depth to which Soft Excavation[8] material occurs is obtained from the results of the inspection pits and is summarised in Table 3 below.

Table 3
Summary of Excavation / Trenching Requirements

Area	IP No.	Depth (m)	Excavation Requirements
Reservoir No 3	IP1	0.0 - 0.6	Soft Excavation
		0.6+	Intermediate becoming Hard Excavation with depth
	IP2	0.0 - 1.3	Soft Excavation
		1.3+	Intermediate becoming Hard Excavation with depth
	IP3	0.0 - 1.4	Soft Excavation
		1.4+	Intermediate becoming Hard Excavation with depth
Pipeline from Reservoir No 3	IP4	0.0 - 2.6	Soft Excavation
Pipeline to WTW	IP5	0.0 - 2.4	Soft Excavation
Pipeline from Reservoir in town	IP6	0.0 - 1.2	Soft Excavation
		1.2+	Intermediate becoming Hard Excavation with depth

[8] SANS634:2012: Geotechnical Investigations for Townships: pp16, Table 5 - Classification of material for machine excavation

All inspection pit sidewalls were stable on the day of fieldwork and trenches up to 1.2m below existing ground level will be stable with vertical sides for a period of 24 hours. However, trenches likely to be left open for any sustained period should be limited to prevent ongoing deterioration of trench stability, or should be laterally supported if left open indefinitely.

Trenches deeper than 1.2m should be shored to ensure safety of workers inside. Rainfall or groundwater seepage will potentially destabilise trenches and should be monitored closely. All excavations must be inspected daily by a competent person to confirm that they are safe for entry.

8.3 Foundations

New 3Ml Reservoir

The proposed new reservoir is underlain by shale bedrock which occurs from about 0,5m below existing ground level. The reservoir may be founded on the bedrock where a maximum allowable bearing pressure of 250kPa may be adopted for the shale of at least very soft rock to soft rock strength.

Other Structures

A maximum allowable bearing pressure of 60kPa for the founding of structures such as pumpstations, scour and air valve chambers may be adopted for the talus/ hillwash material. Such structures are best founded using concrete rafts placed on the insitu soils which should first be ripped to 300mm, wet and recompacted to minimum 93% MDD before being blinded.

Thrust Block Foundations

The following maximum bearing pressures are recommended for thrust block foundations. These values apply to horizontal forces only:

Depth (m)	Soil Horizon	Maximum Horizontal Allowable Bearing Pressure (kPa)
0 – 1m	Hillwash/talus	30kPa
1 – 2m	Hillwash/ Talus	50kPa
0 – 1m	Shale bedrock	60kPa
>1m	Shale Bedrock	100Kpa

Should higher loads need to be accommodated in thrust block design then alternatives such as passive concrete blocks, dead-man anchors and rock/soil anchors may be considered.

It is recommended that GGS inspect and approve all foundation excavations to confirm depth of founding and bearing pressure.

9. CONCLUSIONS

This report contains the results of a geotechnical investigation carried out for the proposed Robertson 3Ml Reservoir, Pipelines and Pump Stations in Robertson, Western Cape.

The proposed new reservoir is located on the rising slope of the mountain on the northeast of the Robertson CBD and is underlain by the shales of the Norree Formation of the Malmesbury Group. The remainder of the site area incorporating the proposed infrastructure comprising the pumpstations and pipelines is underlain by the transported hillwash/talus soils.

Recommendations are given for excavations and trenching, lateral support, bedding and other usage of insitu materials and foundations for the reservoir and other structures.

Finally, the ground conditions described in this report refer specifically to those encountered in the inspection pits done on site. It is therefore quite possible that conditions at variance with those discussed above can be encountered elsewhere. It is therefore important GGS carry out periodic inspections of the earthworks and open foundation excavations. Any change from the anticipated ground conditions can then be taken into account to avoid unnecessary expense.

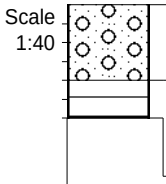
APPENDIX A

GONDWANA GEO SOLUTIONS

NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd
Robertson 3ML Reservoir, Pipelines and Pump Stations

HOLE No: **IP1**
Sheet 1 of 1

JOB NUMBER: 21-109



0.00	Dry greyish brown sandy GRAVEL to gravelly SAND. Talus.
0.40	Greyish brown highly to moderately weathered very closely to closely laminated and jointed soft to medium hard rock SHALE.
0.60	

NOTES

1) Final depth at 0.60m. Refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : MVR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 02/10/2021
DATE : 02/10/2021

DATE : 20/10/2021 08:42
TEXT : ..Stations\Logs\IP1IP6.doc

ELEVATION :
X-COORD :
Y-COORD :

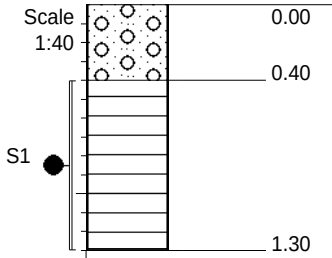
HOLE No: **IP1**

GONDWANA GEO SOLUTIONS

NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd
Robertson 3ML Reservoir, Pipelines and Pump Stations

HOLE No: **IP2**
Sheet 1 of 1

JOB NUMBER: 21-109



0.00	Dry greyish brown sandy GRAVEL to gravelly SAND. Talus.
0.40	Grey to brown highly weathered very closely bedded and jointed very soft to soft rock SHALE. Note: (J1) Major joint set (bedding planes) 5-10 degrees to west (downslope).
1.30	

NOTES

1) Final depth at 1.30m. Refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.40--1.30m (3 x Bulk)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : MVR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 02/10/2021
DATE : 02/10/2021
DATE : 20/10/2021 08:42
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ELEVATION :
X-COORD :
Y-COORD :

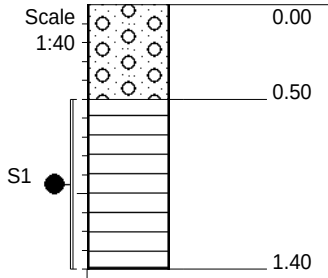
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GONDWANA GEO SOLUTIONS

NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd
Robertson 3ML Reservoir, Pipelines and Pump Stations

HOLE No: **IP3**
Sheet 1 of 1

JOB NUMBER: 21-109



Dry greyish brown sandy GRAVEL to gravelly SAND. Talus.

Grey to brown highly weathered very closely bedded and jointed very soft to soft rock SHALE.
Note: (J1) Major joint set (bedding planes) 5-10 degrees to west (downslope).

NOTES

1) Final depth at 1.40m. Refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.50--1.40m (3 x Bulk)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : MVR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 02/10/2021
DATE : 02/10/2021
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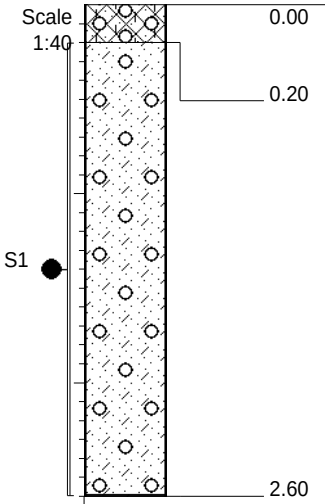
ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **IP3**

NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd
Robertson 3ML Reservoir, Pipelines and Pump Stations

HOLE No: **IP4**
Sheet 1 of 1

JOB NUMBER: 21-109



Slightly moist reddish brown loose silty SAND with gravel and refuse matter, plastic etc. Fill.

Slightly moist reddish brown mottled grey dense gravelly clayey SAND. Hillwash.

NOTES

1) Final depth at 2.60m. No refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.20--2.60m (1 x Small)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : MVR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
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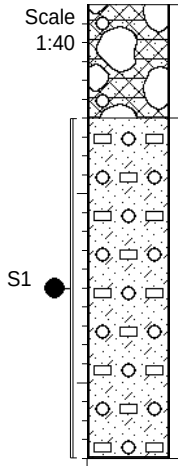
ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **IP4**

NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd
Robertson 3ML Reservoir, Pipelines and Pump Stations

HOLE No: **IP5**
Sheet 1 of 1

JOB NUMBER: 21-109



0.00 Dry to slightly moist grey mottled brown loose to medium dense gravelly SAND with occasional shale cobbles and boulders. Fill.

0.60 Slightly moist dark reddish brown dense to very dense clayey gravelly partially laminated SAND with poorly formed calcrete nodules. Talus.

2.40

NOTES

1) Final depth at 2.40m. No refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.60--2.40m (1 x Small)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : MVR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 02/10/2021
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Y-COORD :

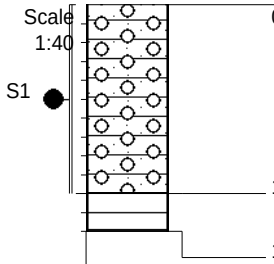
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GONDWANA GEO SOLUTIONS

NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd
Robertson 3ML Reservoir, Pipelines and Pump Stations

HOLE No: **IP6**
Sheet 1 of 1

JOB NUMBER: 21-109



0.00 Dry reddish brown mottled grey dense sandy fine to large shale GRAVEL. Talus.

1.00 Greyish brown closely laminated soft to medium hard rock SHALE.

1.20

NOTES

1) Final depth at 1.20m. Refusal on shale.

2) No groundwater seepage.

3) No sidewall collapse.

4) Samples taken :
S1 0.00--1.00m (1 x Small)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : MVR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 02/10/2021
DATE : 02/10/2021

DATE : 20/10/2021 08:42
TEXT : ..Stations\Logs\IP1IP6.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **IP6**

APPENDIX B

SGS MATROCAST

SGS MATROCAST (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2000/030983/07 - VAT. Reg.No.: 4130197405
a SANAS Accredited Testing Laboratory, No. T0245

4 HARBOT CLOSE , BRACKENDUST ,7560
P.O.BOX 1106 , BRACKENFELL
Tel. : 021 9815558/9
Fax : 021 9816724
Email : glyn.hudson@sgs.com

CLIENT :	GONDWANA GEOSOLUTIONS	OUR REF.:	86727
ADDRESS :	17 KINGSMEAD DRIVE WESTVILLE 3630	YOUR REF.:	21-109/1
ATTENTION :	MR M.RICHTER	DATE :	12.2021

PROJECT : ROBERTSON

SGS MATROCAST

a SANAS Accredited Testing Laboratory, No. T0245

Tests marked * "Not SANAS Accredited" in this Report are not included in the SANAS Schedule of Accreditation for the laboratory.

TEST REPORT / RESULTS

Sample/s:

Sampled by : CUSTOMER
Date Received / Sampled : 05.10.2021
Date Tested : 05.10.2021-12.10.2021

Sampling method : AS PER CUSTOMER

Section / Position tested identified by : CUSTOMER

Number of pages in this Report : 7

General : FOUNDATION AND COMPACTABILTY FACTOR

Opinions and interpretations expressed herein are outside the Scope of SANAS Accreditation.
Results only have bearing on the samples tested.
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Technical Signatory : Mr Gregory F.Bell (N.Dip Civ.Eng)

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SGS MATROCAST

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVER
WESTVILLE
DURBAN
3630
MR M.RICHTER

Project : ROBERTSON

Your Ref. : 21-109/1
Our Ref : 86727
Date Reported : 12.10.2021

COMPACTIBILITY FACTOR : SABS 1200

Lab. Number	Test Pit No.	Depth	Material Description	Compactibility Factor
C 14112	IP4	0.2-2.6	Red Brown Gravelly Silty Sand	0.4
C 14113	IP5	0.6-1.0	Red Brown Gravelly Silty Sand	0.3
C 14114	IP6	0.0-1.0	Red Brown Gravelly Silty Sand	0.2

REMARKS : SAMPLED AND DELIVERED BY CUSTOMER

Technical Signatory: Gregory Bell (N.dip - Civ.Eng)

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t +27(0)21 981 558/9 f +27(0)21 981 6724 www.za.sgs.com Company Registration Number: 2000/030983/07
Member of the SGS Group (SGS SA)
Directors: A.V. Deshpande, J.F.G.M.P. Herren, J.P. Vollenweider

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Email : glyn.hudson@sgs.com

sanas Testing Laboratory T0245

TEST RESULTS

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVE
WESTVILLE
3630
Attention: MR M.RICHTER

Project : ROBERTSON

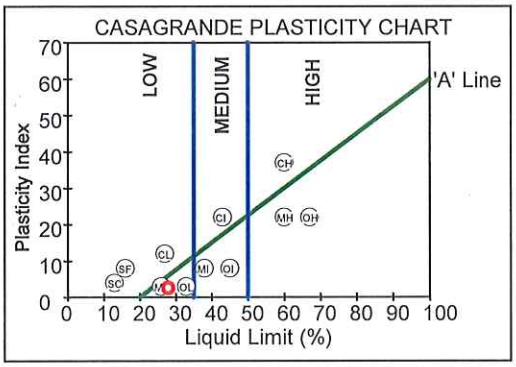
Your Ref : 21/109/1
Our Ref : 86727
Date Reported : 12.10.2021

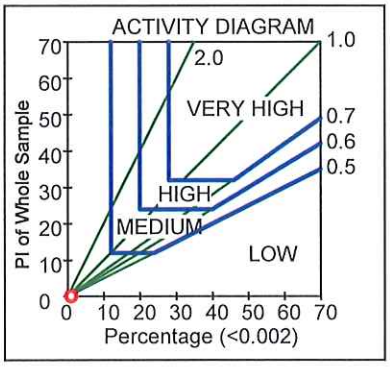
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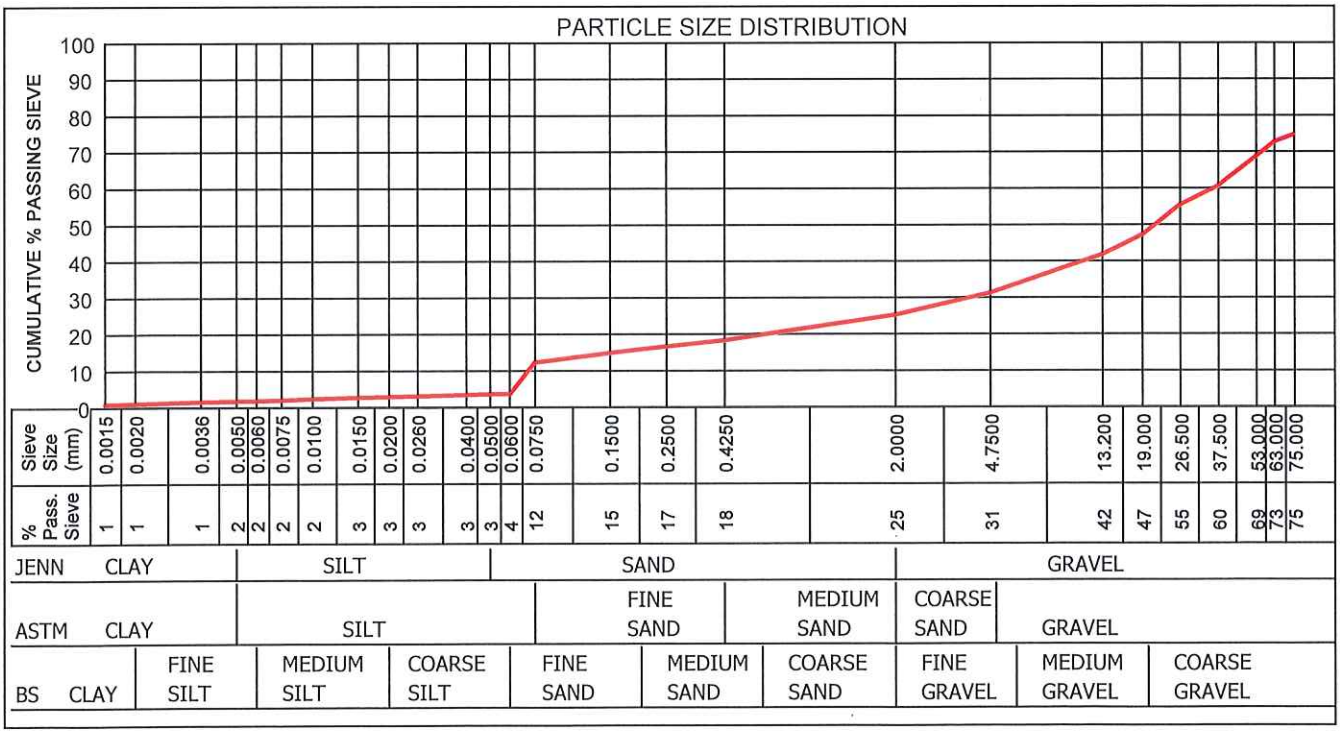
Sample No.	: C 14111
Hole No.	: IP2
Depth	: 0.4-1.3
Liquid Limit (%)	: 28
Plasticity Index	: SP
Linear Shrinkage (%)	: 1,5
PI of Whole Sample	: 0
P.R.A. Classification	: A-1-a(0)
Unified Soil Classificati	: GW-GM
Activity	: 0,00
Heave Classification	: LOW
Grading Modulus	: 2,45
Percentage (<0.002)	: 1,0
Moisture Content (%)	: 3,3
Relative Density	: 2,271

Material Description : GREY+BROWN WEATHERED SHALE

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	1,6	1,8	21,7	74,8	SAND
Astm	1,6	10,5	19,0	68,9	SILTY SAND
British Standard	0,9	2,7	21,6	74,8	SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	1	1	1	2	2	2	2	3	3	3	3	3	4	12	15	17	18	25	31	42	47	55	60	69	73	75

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT		FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL			
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : SAMPLED AND DELIVERED BY CUSTOMER IN A GOOD CONDITION

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Mr Gregory F.Bell (N.Dip Civ.Eng)

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Email : glyn.hudson@sgs.com

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TEST RESULTS

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVE
WESTVILLE
3630
Attention: MR M.RICHTER

Project : ROBERTSON

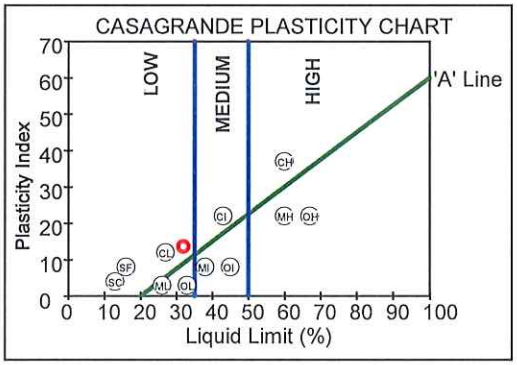
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Our Ref : 86727
Date Reported : 12.10.2021

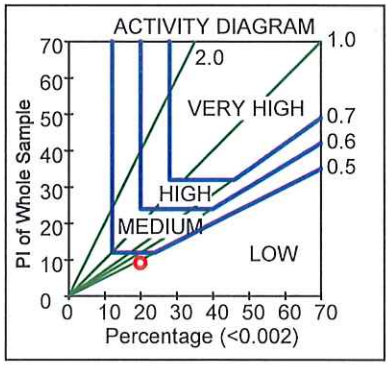
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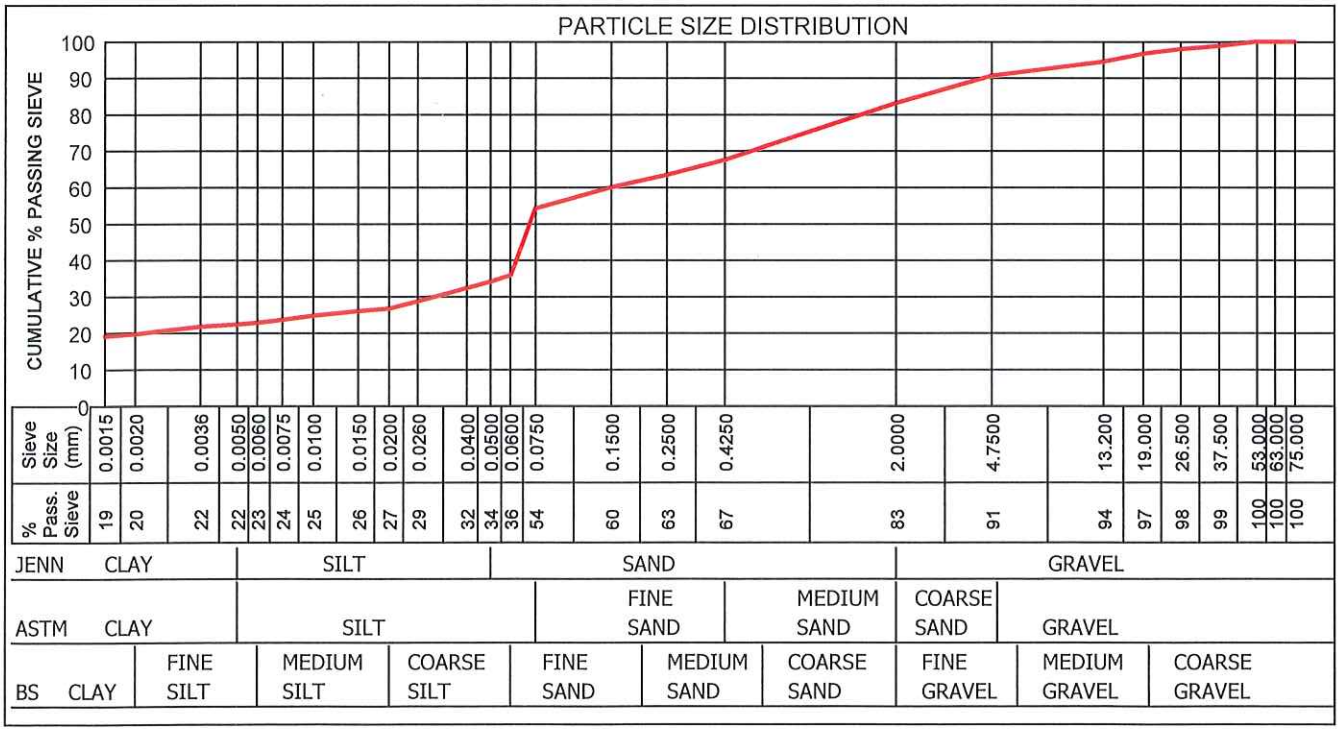
Sample No.	: C 14112
Hole No.	: IP4
Depth	: 0.2-2.6
Liquid Limit (%)	: 32
Plasticity Index	: 13
Linear Shrinkage (%)	: 6,5
PI of Whole Sample	: 9
P.R.A. Classification	: A-6(5)
Unified Soil Classificati	: CL
Activity	: 0,45
Heave Classification	: LOW
Grading Modulus	: 0,96
Percentage (<0.002)	: 20,0
Moisture Content (%)	: 7,9
Relative Density	: 2,631

Material Description : RED BROWN GRAVELLY SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	22,3	11,7	49,2	16,8	CLAYEY SAND
Astm	22,3	31,8	36,4	9,4	CLAYEY SAND
British Standard	19,7	16,1	47,4	16,8	CLAYEY SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	19	20	22	22	23	24	25	26	27	29	32	34	36	54	60	63	67	83	91	94	97	98	99	100	100	100

JENN	CLAY		SILT			SAND			GRAVEL	
ASTM	CLAY		SILT			FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : SAMPLED AND DELIVERED BY CUSTOMER IN A GOOD CONDITION

FORM: A6

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TEST RESULTS

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVE
WESTVILLE
3630
Attention: MR M.RICHTER

Project : ROBERTSON

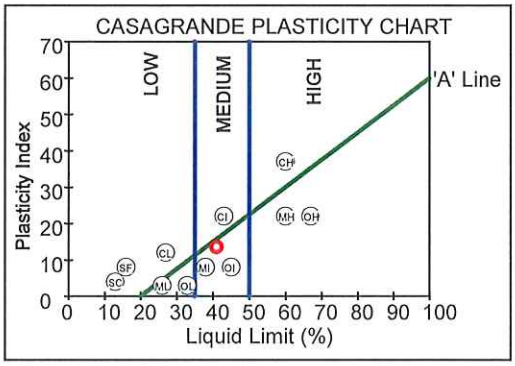
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Our Ref : 86727
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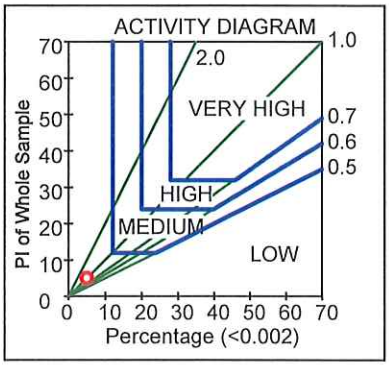
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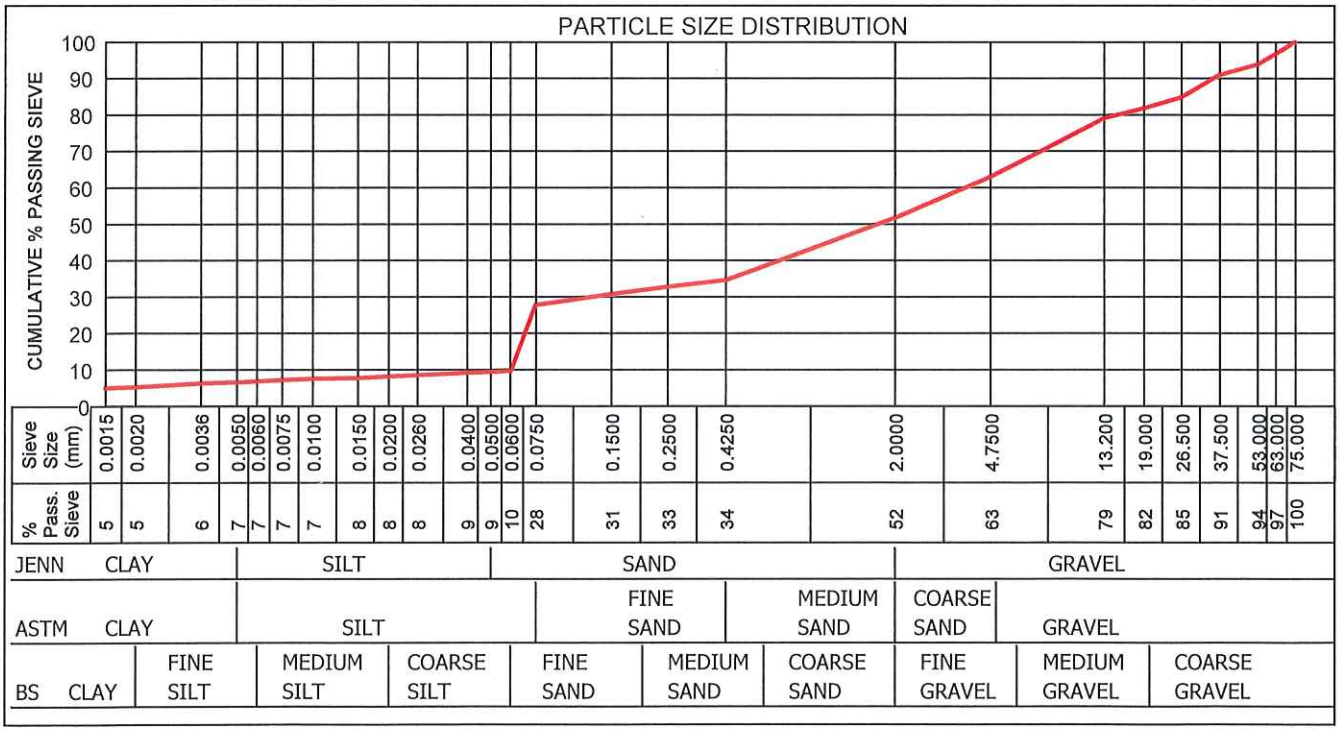
Sample No.	: C 14113
Hole No.	: IP5
Depth	: 0.6-1.0
Liquid Limit (%)	: 41
Plasticity Index	: 13
Linear Shrinkage (%)	: 6,5
PI of Whole Sample	: 5
P.R.A. Classification	: A-2-7(0)
Unified Soil Classificati	: SM
Activity	: 1,00
Heave Classification	: LOW
Grading Modulus	: 1,86
Percentage (<0.002)	: 5,0
Moisture Content (%)	: 5,4
Relative Density	: 2,459

Material Description : RED BROWN GRAVELLY SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	6,5	2,8	42,4	48,4	SAND
Astm	6,5	21,1	35,2	37,2	SILTY SAND
British Standard	5,2	4,4	42,1	48,4	SAND







Remarks : SAMPLED AND DELIVERED BY CUSTOMER IN A GOOD CONDITION

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Mr Gregory F.Bell (N.Dip Civ.Eng)

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Project : ROBERTSON

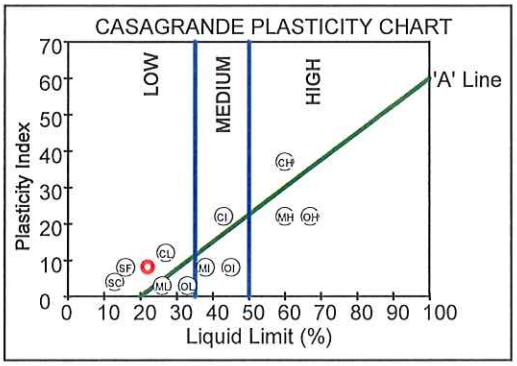
Your Ref : 21/109/1
Our Ref : 86727
Date Reported : 12.10.2021

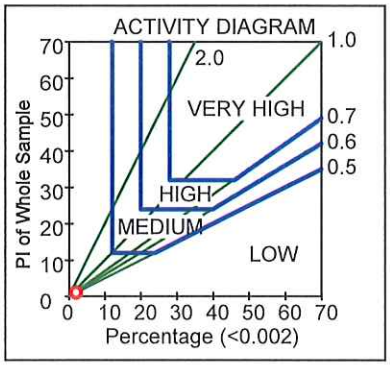
FOUNDATION INDICATOR (ASTM: D422)

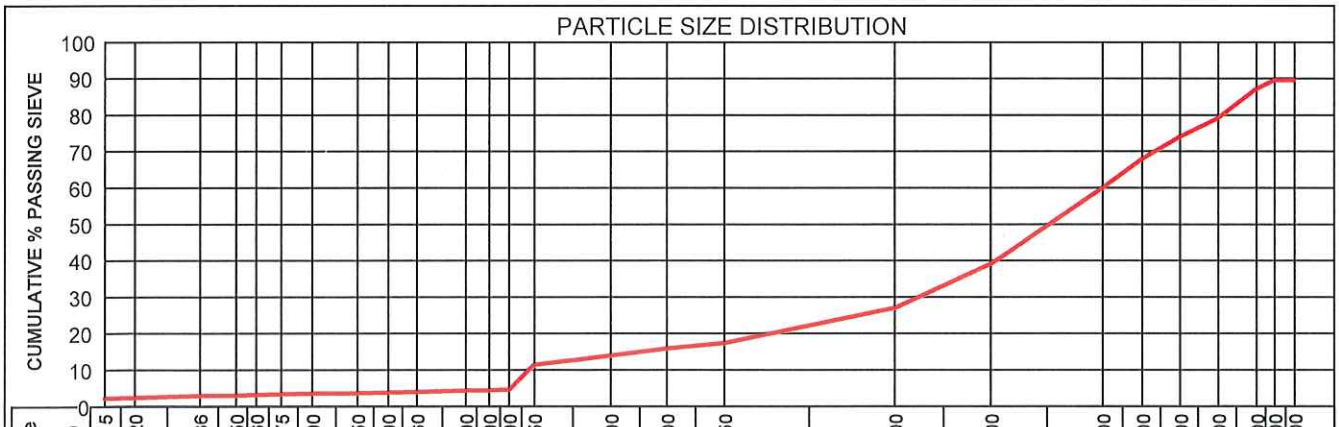
Sample No.	: C 14114
Hole No.	: IP6
Depth	: 0.0-1.0
Liquid Limit (%)	: 22
Plasticity Index	: 8
Linear Shrinkage (%)	: 4,5
PI of Whole Sample	: 1
P.R.A. Classification	: A-2-4(0)
Unified Soil Classificati	: GW-GC
Activity	: 0,50
Heave Classification	: LOW
Grading Modulus	: 2,45
Percentage (<0.002)	: 2,0
Moisture Content (%)	: 2,4
Relative Density	: 2,583

Material Description : RED BROWN GRAVELLY SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	2,9	1,4	22,6	73,1	SAND
Astm	2,9	8,3	27,7	61,0	SILTY SAND
British Standard	2,2	2,2	22,4	73,1	SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	2	2	3	3	3	3	3	3	4	4	4	4	4	11	14	16	17	27	39	60	68	74	79	87	89	89

JENN	CLAY		SILT		SAND			GRAVEL		
ASTM	CLAY		SILT		FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : SAMPLED AND DELIVERED BY CUSTOMER IN A GOOD CONDITION

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Mr Gregory F.Bell (N.Dip Civ.Eng)

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P.O.BOX 1106 , BRACKENFELL
Tel. : 021 9815558/9
Fax : 021 9816724
Email : glyn.hudson@sgs.com

CLIENT :	GONDWANA GEOSOLUTIONS	OUR REF.:	86727
ADDRESS :	17 KINGSMEAD DRIVE WESTVILLE 3630	YOUR REF.:	21-I09/1
ATTENTION :	MR M.RICHTER	DATE :	14.10.2021

PROJECT : ROBERTSON

SGS MATROCAST

a SANAS Accredited Testing Laboratory, No. T0245

Tests marked * "Not SANAS Accredited" in this Report are not included in the SANAS Schedule of Accreditation for the laboratory.

TEST REPORT / RESULTS

Sample/s:

Sampled by : CUSTOMER
Date Received / Sampled : 05.10.2021
Date Tested : 05.10.2021-14.10.2021

Sampling method : AS PER CUSTOMER

Section / Position tested identified by : CUSTOMER

Number of pages in this Report : 5

General : CBR CLASSIFICATION TEST RESULTS

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Results only have bearing on the samples tested.
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Email : glyn.hudson@sgs.com

TEST RESULTS

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVE
WESTVILLE
3630
Attention: MR MARK RICHTER

Project : ROBERTSON

Your Ref : 21-I09/1
Our Ref : 86727
Date Reported : 14.10.2021

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR(SANS 3001:GR1,GR10,GR12,GR20,GR30,GR40)

SAMPLE NO.	C 14111				Specification
HOLE NO.	Sample.3B / IP2				Min : Max
ROAD NO.	Robertson				
DEPTH	0.4-1.3				
CHAINAGE	On Site				
LAYER TYPE	-				
STABILISED WITH	Neat				
SUPPLIER	N/a				
CURING METHOD	N/a				
DATE TESTED					
DESCRIPTION	Grey to Brown Weathered Shale				
SIEVE ANALYSIS (% PASSING)					
100 mm	88				
75 mm	75				
63 mm	73				
50 mm	69				
37.5 mm	60				
28.0 mm	55				
20.0 mm	47				
14.0 mm	42				
5.0 mm	31				
2.0 mm	25				
0.425 mm	18				
0.075 mm	12				
SOIL MORTAR					
COARSE SAND <2.0mm >0.425mm	28				
FINE SAND <0.425mm >0.075mm	24				
MATERIAL <0.075mm	48				
CONSTANTS					
GRADING MODULUS	2,45				
PRA CLASSIFICATION	A-1-a(0)				
UNIFIED SOIL CLAS.	GP-GM				
COLTO CLASSIFICATION	G6				
LIQUID LIMIT (%)	28				
PLASTICITY INDEX (0.425mm)	SP				
LINEAR SHRINKAGE (%)	1,5				
MDD					
MAXIMUM DRY DENSITY (kg/m^3)	2072				
OPTIMUM MOISTURE CONTENT(%)	7,9				
MOULDING MOISTURE (%)	7,9				
TYPE OF TEST	CBR				
CBR-UCS @ 100% MDD	113				
CBR-UCS @ 98% MDD	69				
CBR-UCS @ 97% MDD	54				
CBR-UCS @ 95% MDD	33				
CBR-UCS @ 93% MDD	21				
CBR-UCS @ 90% MDD	10				

CBR-UCS @ % MDD derived from calculation.

% SWELL MOULD [A][B][C]	0,00	0,00	0,00													

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FORM: GR40

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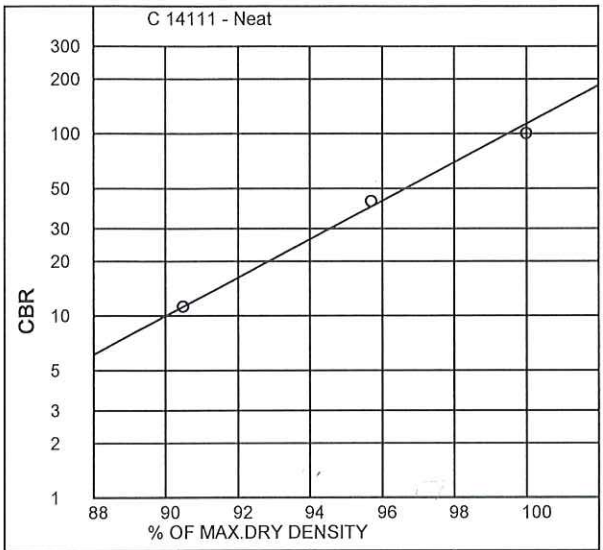
TEST RESULTS

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVE
WESTVILLE
3630
Attention: MR MARK RICHTER

Project : ROBERTSON

Your Ref : 21-I09/1
Our Ref : 86727
Date Reported : 14.10.2021

CBR-UCS GRAPH/S (OPTIONAL INFORMATION)



	PROC	NRB	MOD
COMPACTION (%)	90,5	95,7	100,0
CBR	11	43	99

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TEST RESULTS

GONDWANA GEOSOLUTIONS
17 KINGSMEAD DRIVE
WESTVILLE
3630
Attention: Mr. C Hartley

Project : ROBERTSON

Your Ref : 21-I09/1
Our Ref : 86727
Date Reported : 12.10.2021

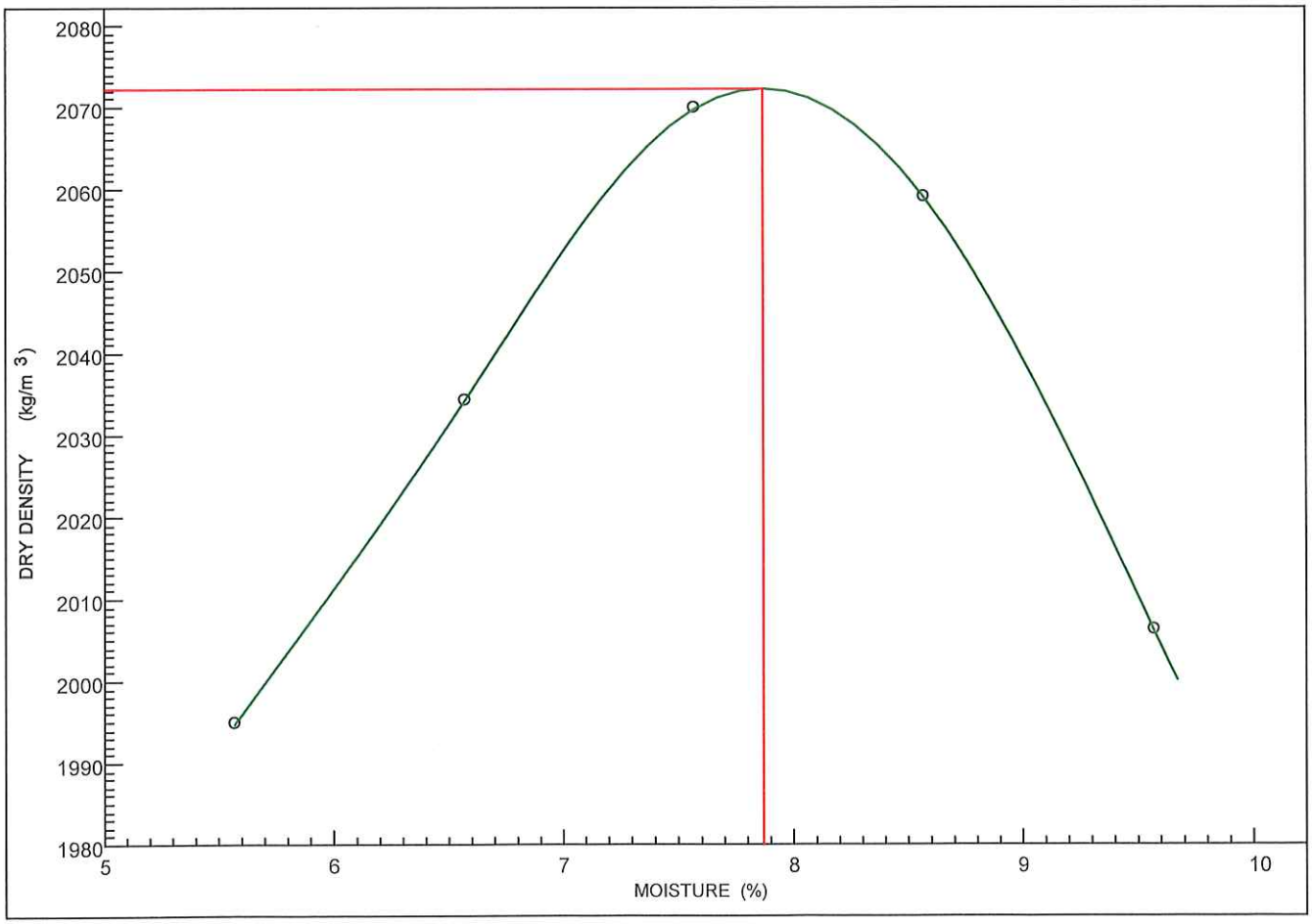
MOISTURE / DENSITY RELATIONSHIP(SANS 3001: GR30(MOD))

Sample No.: C 14111	Hole No. : Test No.IP2	Depth (mm) : 0.4-1.3
Origin : -	Stabilized With : Neat	Compaction Energy : MOD
Material Description : Grey to Brown Weathered Shale		

Maximum Dry Density (kg/m^3): 2072

Optimum Moisture Content (%) : 7,9

Point No.	1	2	3	4	5			
Moisture (%)	5,6	6,6	7,6	8,6	9,6			
Density (kg/m^3)	1995	2034	2070	2059	2006			



Remarks :

FORM: GR30

4.4.1(SGS)(2019.12.04)

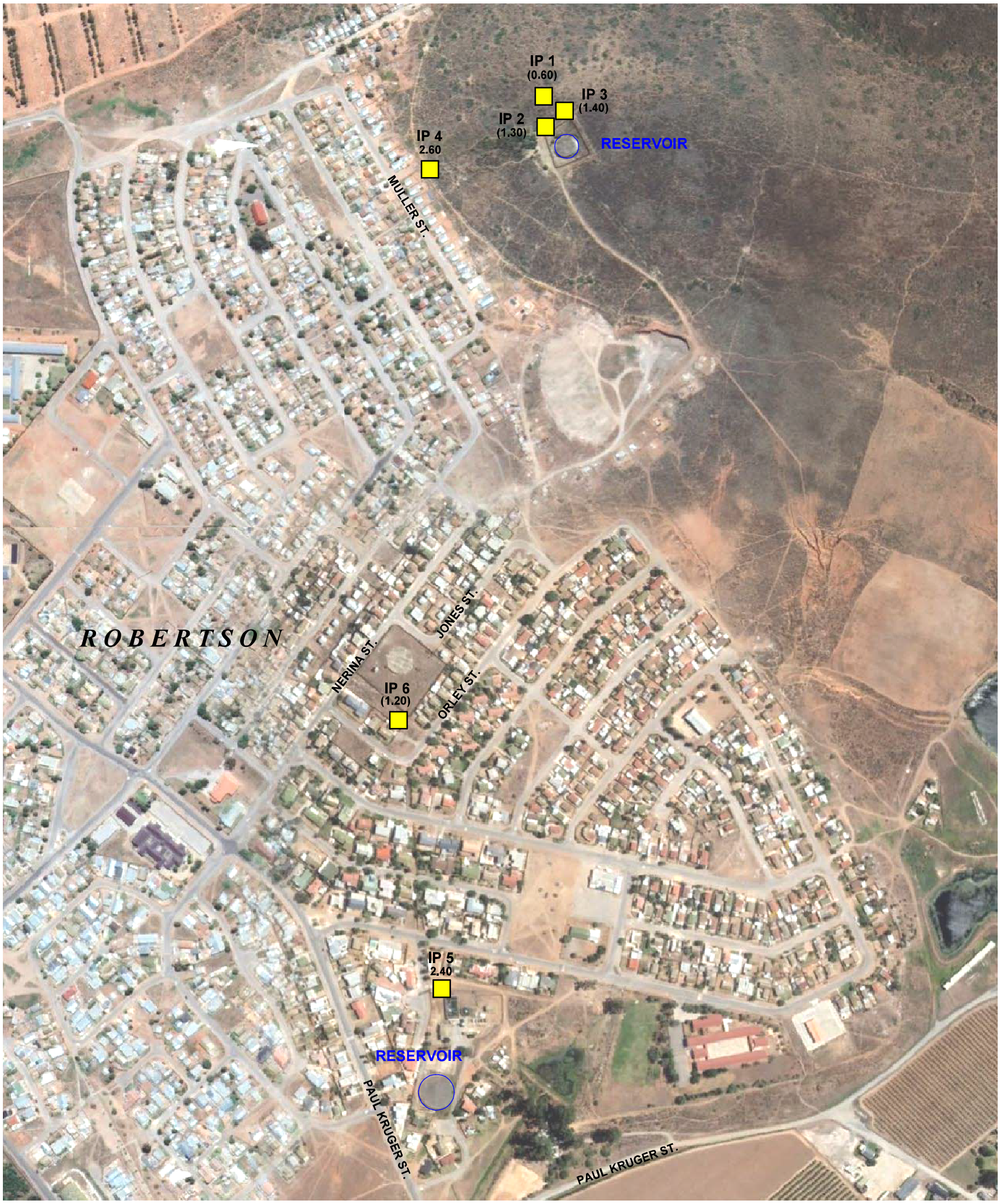
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FIGURES



KEY :

IP 1
0.60
(0.60)

Approximate position of Test Pit showing final depth or depth to refusal ( ) in metres below existing ground level.

0m 50m 100m 250m

Graphic Scale
1 / 5 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

DRAWING DESCRIPTION

Site Plan showing approximate positions of :

a.) Test Pits.

Scale 1 : 5 000 (On A3 Original)

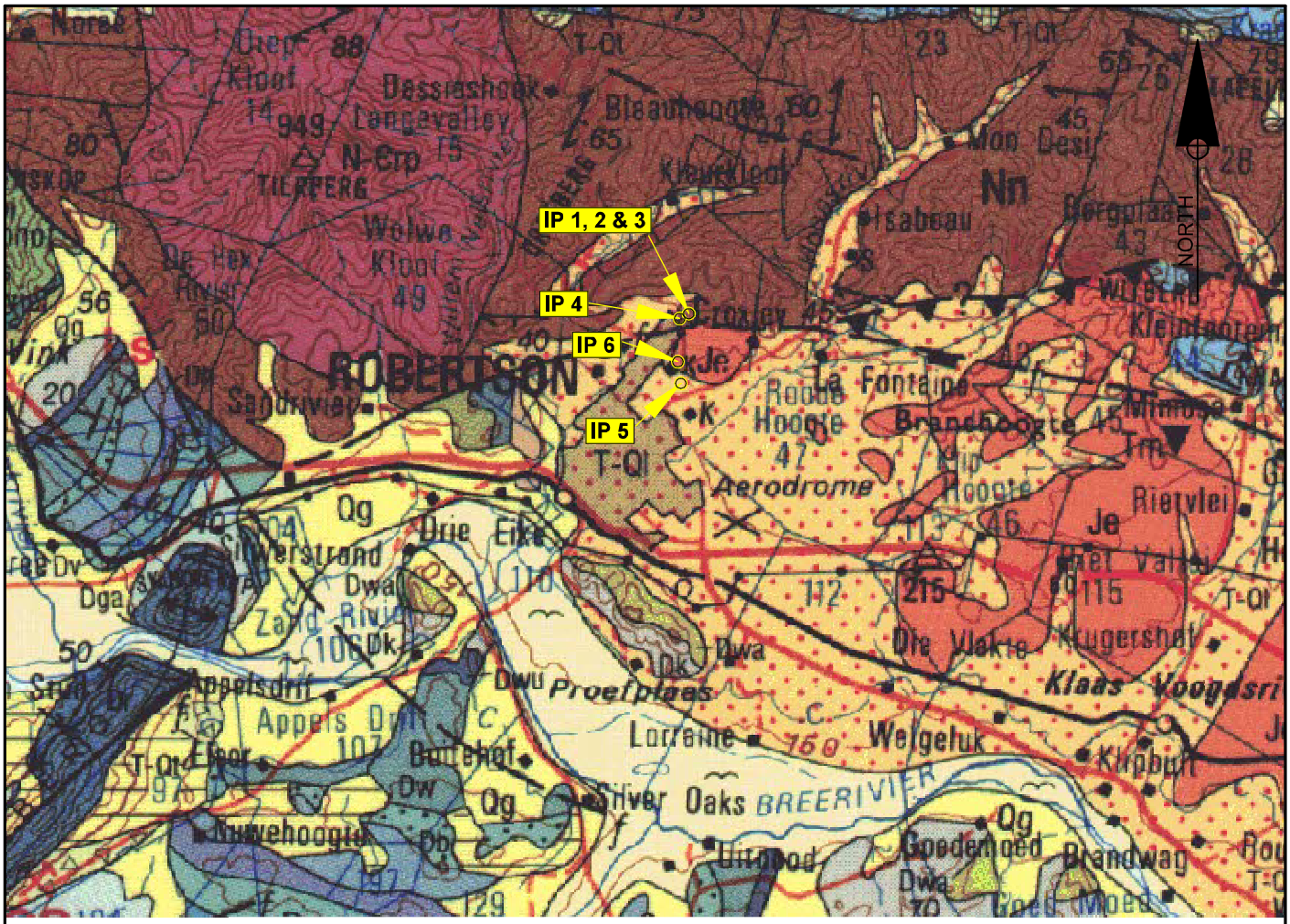
CLIENT
NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd

PROJECT
Geotechnical Investigation for Robertson Reservoir and Pipelines

GONDWANA GEO SOLUTIONS

DATE	20/10/2021
DRAWN	A.S.
CHECK	M.V.R.
REFERENCE No.	21 - 109
FIGURE No.	1
REV.	0

21-109 Fig1 Site Plan.drg



LEGEND

0m 2km 4km 6km 8km 10km

Graphic Scale
1 / 100 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

	Alluvium
Qg	Light-grey to pale-red sandy soil (wind blown sand)
T-Ql	Loam and sandy loam
Je	Reddish conglomerate; thin lenses of mudstone and sandstone. Enon Formation. UITENHAGE GROUP
Dwa	Silstone, arenaceous shale, mudstone and thin, light-grey sandstone beds: exceptionally micaceous, weather brown. Wagen Drift Formation. WELTEVREDE SUBGROUP. WITTEBERG GROUP
Dw	Dark-grey siltstone and shale with intercalated mudstone and immature sandstone. Waboomberg Formation. BIDOUW SUBGROUP. BOKKEVELD GROUP
Db	Light-grey, feldspathic and micaceous sandstone; subordinate shale; siltstone. Boplaas Formation. CERES SUBGROUP. BOKKEVELD GROUP
Dr	Light-grey, well-bedded quartzitic / feldspathic sandstone; subordinate siltstone and shale. Rietvlei Formation. NARDOUW SUBGROUP. TABLE MOUNTAIN GROUP
N-€rp	Medium-to fine-grained porphyritic granite; sheared in marginal areas; foliated granite porphyry, aplogranite, pseudo-quartz-porphyry. Robertson Plutons. CAPE GRANITE SUITE
Nn	Phyllite, medium-grained to gritty greywacke, feldspathic and sericitic quartzite, limestone, dolomite and gritstone; (greenstone), highly sheared and partly replaced by calcite and chert. Norree Formation. MALMESBURY GROUP

Drawing prepared from 1 / 250 000 GEOLOGICAL SERIES : WORCESTER 3319

DRAWING DESCRIPTION

Locality Plan showing Regional Geology

Scale 1 : 100 000 (On A4 Original)

CLIENT
NEIL LYNERS AND ASSOCIATES (RF) (Pty) Ltd

PROJECT
Geotechnical Investigation for Robertson Reservoir and Pipelines

GONDWANA GEO SOLUTIONS

DATE	20/10/2021
DRAWN	A.S.
CHECK	M.V.R.
REFERENCE No.	21 - 109
FIGURE No.	2
REV.	0

21-109 Fig 2 Reg Geo Plan.drg

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE CONSTRUCTION OF A RESERVOIR ON ERF 1241, ROBERTSON

Second Draft

NOVEMBER 2018

Prepared for: Langeberg Municipality
Private Bag X2
Ashton
6715
Tel: 023 615 8001
Email: mm@langeberg.gov.za

Prepared by: Eco Impact Legal Consulting (Pty) Ltd
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7735
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eco impact Environmental Health & Safety Legal Consulting	**Title:** **PROPOSED CONSTRUCTION OF A RESERVOIR ON ERF 1241, ROBERTSON** **2nd DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME**
Carried Out By: Eco Impact Legal Consulting (Pty) Ltd P.O. Box 45070 Claremont 7735 Tel: 021 671 1660 Fax: 021 67 9976 E-mail: admin@ecoimpact.co.za	**Client:** Langeberg Municipality Private Bag X2 Ashton 6715 Tel: 023 615 8001 Email: mm@langeberg.gov.za
Author: Jessica Hansen	**Client Contact Person:** Municipal Manager
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Verification	Capacity	Name	Signature	Date
By Author	Senior EAP	Jessica Hansen	J Hansen	15 November 2018

COMMITMENT AND DECLARATION OF UNDERSTANDING BY CONTRACTOR AND DEVELOPER FOR THE CONSTRUCTION OF A RESERVOIR ON ERF 1241 ROBERTSON

I, the undersigned ....., as duly authorized by the Contractor, have studied and understand the contents of this document. On behalf of the Contractor, I confirm that the Contractor undertakes to adhere to the conditions as set out herein, unless specifically otherwise agreed to in writing.

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

.....
For Contractor

I, the undersigned ....., as duly authorized by the Developer have studied and approve the contents of this document on behalf of the Developer, for implementation by all Contractors involved at the site.

Signed at ..... on this ..... day of .....20.....

.....
Developer's Representative

DEFINITIONS

Auditing:	A systematic and objective assessment of an organization's activities and services conducted and documented on a periodic basis based to a (e.g. ISO 19011:2003) standard.
Biodiversity:	The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.
Contractor:	An employer, as defined in section 1 of the Occupational Health and Safety Act 85 of 1993, who performs construction work and includes principal contractors
Environment:	A place where living, non-living and man-made features interact, and where life and diversity is sustained over time.
Evaporation:	The change by which any substance (e.g. water) is converted from a liquid state into and carried off as vapour.
Developer:	One who builds on land or alters the use of an existing building for some new purpose
Independent:	Is independent and has no interest in any business related to the development site, nor will receive any payment or benefit other than fair remuneration for the task undertaken
Groundwater:	Subsurface water in the zone in which permeable rocks, and often the overlaying soil, are saturated under pressure equal to or greater than atmospheric.
Landowner:	Holder of the estate in land with considerable rights of ownership or, simply put, an owner of land
Monitoring:	A systematic and objective observation of an organisation's activities and services conducted and reported on regularly.
Natural vegetation:	All existing vegetation species, indigenous or otherwise, of trees, shrubs, groundcover, grasses and all other plants found growing on a site.
Pollution:	The result of the release into air, water or soil from any process or of any substance, which is capable of causing harm to man or other living organisms supported by the environment.
Protected Plants:	Plant species officially listed under the Threatened or Protected Species regulations as well as on the Protected Plants List (each province has such a list), and which may not be removed or transported without a permit to do so from the relevant provincial authority.
Red Data Species:	Plant and animal species officially listed in the Red Data Lists as being rare, endangered or threatened.
Rehabilitation:	Making the land useful again after a disturbance. It involves the recovery of ecosystem functions and processes in a degraded habitat. Rehabilitation does not necessarily re-establish the pre-disturbance condition, but does involve establishing geological and hydro logically stable landscapes that support the natural ecosystem mosaic.
Site:	Property or area where the proposed development will take place

ACRONYMS

DEA&DP:	Department of Environmental Affairs and Development Planning
DWS:	Department of Water and Sanitation
ECO:	Environmental Control Officer
EA:	Environmental Authorisation
EIA:	Environmental Impact Assessment
EM:	Environmental Manager
EMPr:	Environmental Management Programme
EO:	Environmental Officer
ER:	Engineer's Representative
I&AP:	Interested and Affected Party
IEM:	Integrated Environmental Management
MMP:	Maintenance Management Plan
PM:	Project Manager
SANS:	South African National Standards

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DEVELOPER'S COMMITMENT

Langeberg Municipality ("LM") has committed itself to a set of values that include the maintenance of good relations and transparent communications with all stakeholders, and the dynamic engagement of the larger community.

LM undertakes to implement suitable management systems for all the areas and aspects of this operation. This will ensure that development itself and management of the project will comply with legal, technical, environmental and transformation policies and standards. LM, in drafting this EMPr for implementation, intends to enable continuous improvement in legal compliance and the sustainable operation of the site.

The EMPr intends to change the way in which the owners, the construction process they have commissioned and the contractor plan for and manage resources to achieve sustainability. The satisfactory implementation of the EMPr on site will require both the full support and commitment of all personnel.

CHAPTER 1

1.1. Executive Summary

This EMPr has been prepared principally in compliance with the requirements of section 24N and Section 34 of the National Environmental Management Act 107 of 1998. This document, together with the conditions in the Environmental Authorisation, must be adhered to.

The EMPr must be included as part of all contract documentation for all contractors in the construction phase of the development.

The Author and Eco Impact Legal Consulting (Pty) Ltd ("Eco Impact")

Jessica Hansen has completed her professional registration in terms of section 20(3) (b) of the Natural Scientific Professions Act, 2003 (Act 27 of 2003) as a Professional Natural Scientist in the field of practice Environmental Science (Registration number 400192/16). She obtained her BSc (Honours) in Environmental and Geographical Science in 2011 from the University of Cape Town and subsequently obtained her MSc in Zoology (Applied Marine Science) in 2013.

Jessica has trained as an Environmental Assessment Practitioner since August 2013 and has been involved in the compilation, coordination and management of Basic Assessment Reports, Environmental Impact Assessments, Environmental Management Programmes, Waste Licence Applications, Water Use Licence Applications and Baseline Biodiversity Surveys for numerous clients. ***See attached hereto curriculum vitae of the EAP.***

1.2. Project Description

This section of the report is included in compliance with Section 24N (2) (e) of the National Environmental Management Act, 107 of 1998.

The development is proposed on erf 1241 situated in Robertson. The property is bordered by commercial farming on the north and east boundaries and formal housing on the west boundary and south boundaries. There is an existing reservoir on the property.

Construction of a Reservoir

The project proposes the construction of a 3mega litre reservoir and associated infrastructure to augment reservoir storage capacity at the Robertson no. 3 reservoir. The reservoir will be a round 30 diameter concrete structure with an estimated 50x50 fenced off area for excavations and the fence itself. The pipeline will follow the same route as the existing route and will link to existing services and infrastructure. Bulk supply pipelines and network upgrade involving the installation of new supply pipe.

LOCALITY MAP INDICATING THE SITES IDENTIFIED FOR THE PROPOSED ACTIVITIES: OLD HELSHOOGTE ROAD UPGRADE



Locality Map 1

Scale: 1:2 257
Date created: October 1, 2018

Western Cape Government
Agriculture

CHAPTER 2

This section of the report is included in compliance with Section 24N (2) (e) of the National Environmental Management Act 107 of 1998.

It deals with issues relating to the implementation of the EMPr.

2.1 Organizational Structure

The organizational structure identifies and defines the responsibilities and authority of the various persons and organizations involved in the project. All instructions and official communications regarding environmental matters must follow the organizational structure.

The Environmental Official (EO), to whom the Engineer's Representative (ER) and/or Environmental Control Officer (ECO) must report and interact, must be the responsible client representative.

The EMPr must be an agenda item at the monthly site and operations meetings and the responsible client representative(s) may attend these meetings in order to provide input with respect to compliance with the EMPr.

2.2 Responsibilities and Functions of the Environmental Control Officer

The ECO will be responsible for monitoring, reviewing and verifying compliance with the EMPr and/or EA by all contractors and site management during the initial and closure inspections.

The ECO duties in this regard will include the following:

With the assistance, where necessary of the ER, to ensure all necessary environmental authorizations and permits have been obtained and are available and visible on site.

- monitor and verify that the EMPr and/or EA is adhered to at all times and by taking action if the specifications are not followed;
- monitor and verify that environmental impacts are kept to a minimum;
- review and approve construction method statements, with input as appropriate from the ER;
- assist the contractor in finding environmentally responsible solutions to problems;
- report on the environmental issues at the site meetings and other meetings that may be called regarding environmental matters, if requested by ER;
- inspect the site and surrounding areas regularly with regard to compliance with the EMPr and/or EA;
- monitor the environmental awareness training for all personnel coming onto site;
- advise management on the removal of person(s) and/or equipment not complying with the specifications, after collaboration with the ER. Recommendations must be recorded by the ER in a Site Instruction Book;
- ensure that activities on site comply with known legislation of relevance to the environment;
- recommend the issuing of penalties via the developer for contraventions of the EMPr and/or EA;
- keep a photographic record of progress on site from an environmental perspective; and
- undertake a continual internal review of the EMPr and/or EA and submit a report to the developer and the responsible DEA&DP Environmental Official according to EA conditions.

2.3 Agreed Work Plan and Site Visit Schedule of ECO

An ECO site visit should be scheduled for the initial pre-construction inspection and thereafter once a month.

Information recording activity on site, and any guidelines or instructions emanating there from will be routinely made available electronically to the developer and applicable contractors and a copy of the report must be available at the site office.

Clearly matters of urgency or immediate action may be channelled appropriately on an urgent basis.

2.4 Site Manager

The site manager will have the following environmental control responsibilities:

- In conjunction with the ECO will present the environmental education programs to all persons employed on site.
- Consult with the ECO, landowner, developer and any contractor to resolve all environmental issues.
- Issue any instructions from the ECO to the management team via a formal site instruction book or appropriate management tool used for the purpose.
- Take responsibility for the penalty system. The ECO and developer recommendations must be considered when deciding whether or not to impose a penalty.
- The engineer will, via the ECO actions, be accountable for the overall implementation of the Environmental Management Programme.
- Keep a site diary and complaints register.

2.5 Contractors

As part of any tender, the tendering contractor must submit a first draft of a contractor's programme, to the developer which must include the environmental considerations to be followed prior to appointment.

The appointed Contractor's representative will have the following responsibilities:

- Ensure that all staff is familiar with the Environmental Management Programme, which explains the environmental policy for the project.
- Allow for sufficient time between surveying the exact locations where services will be intended and actual construction, for the ECO to facilitate and instruct for the removal of plants, seeds and cuttings if necessary.
- The contractor must keep his personnel fully aware of environmental issues and ensure they show adequate consideration to all environmental aspects.
- Establish environmental signs to be erected on the construction site at locations identified by the ECO and approved by the engineer.
- Be responsible for the cost of the restoration of any damage caused, in environmentally sensitive areas, as a result of contractor responsibility regarding negligence. This must be done in accordance with the engineer / ECO's specifications.
- Take responsibility and active steps to avoid any increase in the fire hazard.
- The contractor must take responsibility for implementing all the relevant provisions of the EMPr, or if he encounters difficulties with the specifications, he must discuss alternative approaches with the ECO and engineer prior to proceeding.

Failure to comply with the EMPr may result in the application of fines as set out, and any reported non-compliance may result in the suspension of work or termination of a contract.

2.6 Record keeping of activities, inclusive of recording of non-compliances and corrective actions

The site must keep a record of all activities relating to environmental matters on site, including:

- meetings attended;
- method statements received and approved;
- issues arising on site;
- cases of non-compliance with the EMPr;
- corrective actions taken and penalties issued.

This information will be recorded in an appropriate manner in a site diary, registers, issues/warning book, etc.

2.7 Compliance with other legislation

It is important that all on site staff are aware of other relevant legislation that may relate to the activities taking place on site, especially local authority required compliances.

CHAPTER 3

Applicable Legislation, Policy and Environmental Principles

3.1 Applicable Legislation Identified

1. National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]
2. National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) [NEMWA] and relevant regulations
3. National Environmental Management: Biodiversity Act 10 of 2004 [NEMBA]
4. National Environmental Management: Air Quality Act, 39 Of 2004 [NEMAQA] and Relevant Regulations
5. National Water Act, 1998 (Act No. 36 of 1998) [NWA] and relevant regulations
6. Conservation Of Agricultural Resources Act, 43 Of 1983 [CARA
7. National Health Act, 61 of 2003 [NHA]
8. Constitution of the Republic of South Africa, 1996
9. Fencing Act, 31 of 1963
10. National Heritage Resources Act 25 of 1999 [NHRA]
11. National Veld and Forest Fire Act 101 of 1998 [NVFFA]
12. Langeberg Local Municipality Water By-Law
13. Cape Winelands District Municipality Municipal Health By-Laws

CHAPTER 4

This section of the report is included in compliance with Section 24N (2) (e) of the National Environmental Management Act, 107 of 1998.

Compliance

4.1 Monitoring and Auditing

4.1.1 Introduction

In keeping with current environmental and associated legislation, all environmental management procedures and actions must be reviewed and refined on an ongoing basis.

This is in accordance with the dynamic nature of environmental management and allows for the timeous identification and mitigation of issues as they come to light.

The process of review and refinement, built into the requirements of the EMPr, is known as monitoring and auditing.

4.1.2. Roles and responsibilities

Efficient implementation of the performance specifications, effective monitoring and auditing, as well as clear responsibility and accountability allocation requires that various role-players be defined for the construction implementation project.

Depending on the nature and scale of a project, implementing teams could be composed of any number of role-players, each with their own specified responsibilities.

Therefore, for the purpose of this document, the following role-players are defined, based purely on responsibility and accountability allocation. The actual designation of role-players may vary, but the responsibilities will largely remain as stated.

4.1.2.1. Developer/landowner or custodian of the land

The developer/landowner or custodian of the land is the person or organization with decision making capacity for the land in question, and thus ultimately accountable for what takes place on that land.

4.1.2.2. Contractor

Contractors are appointed to undertake the works as specified in the contract. It is the responsibility of the contractor to do whatever is necessary from their side to ensure that he or an appointed advisor is well versed in environmental studies, so that they may accurately and efficiently carry out the requirements of the environmental specification.

The contractor is liable for any and all remedial work required in terms of the environmental specification, resulting from his environmental negligence, mismanagement and / or non-compliance.

4.1.2.3. Environmental Control Officer

An environmental control officer will manage and undertake monthly environmental inspections for the duration of the construction phase of the project as required.

The contractors or line management are answerable to the ECO for non-compliance. Issues of non-compliance raised by the ECO/EO must be taken up by the project manager, and resolved as per the conditions of his contract.

Decisions regarding environmental procedures, specifications and requirements which have a cost implication (i.e. those that are deemed to be a variation and not allowed for in the performance specification) must be endorsed by the project manager.

4.2 The Monitoring Procedure

Environmental monitoring is the continuous evaluation of the status and condition of environmental elements. Its purpose is to detect change that takes place in the environment over time and involves

the measuring and recording of physical, social and economic variables associated with development impacts.

Many techniques for environmental monitoring have been proposed, each detailing a specific protocol. Regardless of which technique is used, the ultimate aim is that each environmental management specification be checked by means of a system in which a score may be allocated for:

- Full compliance;
- Satisfactory performance;
- Unsatisfactory performance; and
- No action taken.

Completed monitoring reports will be submitted to the project engineer, developer/landowner and the contractor, who will attend to issues. These reports must be kept on file and be made available upon request by any environmental authority requesting such.

All persons employed, the contractor or his sub-contractors, must abide by the requirements of these performance specifications as they apply to the works. Any employees, the contractor or his sub-contractors found to be in breach of any of the environmental specifications, may be ordered to vacate the site forthwith and/or be subject to a disciplinary process.

The order may be given orally or in writing by the ECO. Confirmation of an oral order will be given as soon as practicable, but lack of confirmation in writing must not be a cause for the offender to remain on site, or not be subject to a disciplinary process. Supervisory staff, the contractor or his sub-contractor may not direct any person to undertake any activities which would place such person in contravention of the EMPr, legislation and specifications.

The contractor and staff are deemed not to have complied with the performance specifications if:

- There is evidence of wilful or accidental contravention of any specification included in the specification;
- There is evidence of the contractor carrying out activities not permitted in terms of the EMPr, contract and / or the specification;
- There is evidence of environmental negligence and / or mismanagement resulting in negative impacts on the environment;
- Has failed to meet with the requirements of the approved schedule.

The contractor and developer/landowner will be informed via ECO monthly reports, as well as by means of direct instruction (if necessary) as to what corrective actions are required in terms of environmental compliance.

Disregard for an instruction, and failure to respond adequately to complaints from the public will be construed as non-compliance. Non-compliance may lead to parties being penalised.

In more serious cases, the ECO may give notice, and halt operations until such a time that the corrective action is taken and the site complies with the performance specifications.

In cases of persistent non-compliance, the contractor or staff may be evicted from site after disciplinary process is followed. Only the developer/landowner may issue such instruction, retaining any costs required to remedy situations perpetuated by environmental negligence, mismanagement and / or non-compliance.

4.3 The Auditing Procedure

Environmental auditing is the process of comparing the impacts predicted with those which have actually occurred during implementation.

An environmental performance audit examines and assesses practices and procedures which, in the event of failure, would cause an environmental impact or result in an environmental risk. During each

of the lifecycle phases, various issues will be monitored. The performance audit will ensure that the monitoring was correctly undertaken and that compliance was best achieved.

To these ends the project will be audited versus this EMPr for effectiveness. ISO/SANS 19011:2011 auditing standards will be applied.

Audits will be undertaken at completion of the construction phases. Audit reports will be submitted to management, who will attend to all noted issues.

These reports must be kept on record and be made available upon request by the developer/landowner/custodian of the land and any environmental authority or I&AP requesting such.

4.4 Retentions and Penalties

It is recommended that a penalty retention system be combined with the penalty system to both motivate and compel the contractor to adhere to the EMPr for the duration of the contract.

In this way incentives may be created to perform (i.e. in the form of the retention amounts that will only be paid to the contractor at the end of the contract), without creating the misunderstanding that adherence to the EMPr is optional.

Persistent non-compliance will not only result in the contractor forfeiting any retention amount, but he will also be fined.

Of importance is that the contract specifies exactly how the penalty and retention system will operate, as well as how any funds resultant from retentions and penalties will be utilised.

All such funds must be used to improve environmental conditions on the site in general.

4.4.1. The Retention System

For this system, a percentage value for each of the sections priced for in the environmental bill of quantities is retained until the full completion of the contract works.

If the monitoring process reveals persistent and/or wilful non-compliance with any aspect of the environmental performance specifications, then the full retention associated with that particular item will be withheld.

The project may then apply these retained funds to rectify the problem on site possibly making use of other or alternate resources at his disposal.

At the end of the contract or action, all remaining environmental retention amounts will be paid out to the contractor or staff pending approval by the ECO, after having confirmed full compliance with the relevant performance and rehabilitation specifications.

4.4.2. Penalty System

A system of penalties will be introduced to reinforce environmentally sensitive and prudent behaviour. The maximum penalties that will be fined per incident that may be enforced are listed below. The penalty amount will be determined (inter alia) by the severity of the offence.

Non-compliance	R 5 000.00 (ex VAT) per non-compliant act, per day until compliance is achieved
Casual Litter on site resulting from operation	R250 / offence / day
Disposal of any litter or construction material in non-specified area or by non-compliant means	R5000 / m^3 / per day
Dumping of cement, concrete, fuel or oil in an area or other than that authorised and suitable	R10 000 per offence / day

Failure to use portable / toilets	R100 / observed incident or evidence of human excrement on site

In addition to the above, all costs incurred by the client / developer to remedy any damage will be the responsibility of the offender.

Should the monitoring process reveal acts of persistent and / or wilful non-compliance with the environmental performance specifications, then the contractor or staff member will be fined according to the specified value of that item.

4.5 Method Statements

Contractors must provide written statements for discussion with the ECO on environmentally sensitive aspects of the contract. Environmentally sensitive aspects include by example excavations, work close to sensitive areas, collection and storage of top soil and vegetation, erosion control, wash water control, waste control, etc.

CHAPTER 5

This section of the report is included in compliance with Section 24N (2) (e) of the National Environmental Management Act 107 of 1998.

5.1. Good Housekeeping

The developer/landowner will ensure the maintenance of "good housekeeping" practices during operations.

This will help avoid several disputes regarding responsibility and will allow for the smooth running of the operation as a whole.

Good housekeeping extends beyond the environmentally sensitive construction methods to include the care for and preservation of the surrounding environment.

5.2 Record Keeping

The developer/landowner will ensure that a filing system, identifying all documentation related to the EMPr, is established.

A list of reports likely to be generated during the project is set out below.

All applicable documentation must be included in the environmental filing system catalogue or document retrieval index.

- Approved EMPr, authorizations, licenses or permits;
- Final design documents and diagrams issued;
- All communications detailing changes of design/scope that may have environmental implications;
- Daily, weekly and monthly site monitoring reports;
- Complaints register;
- Environmental training manual;
- Environmental training attendance registers;
- Incident and accident reports;
- Emergency preparedness and response plans;
- Copies of all relevant environmental legislation;
- Permits and legal documents as part of emergency preparedness teams e.g. fire teams, etc.;
- Material data sheets of all chemicals utilised on site;
- Crisis communication manual;
- Disciplinary procedures;
- Monthly site meeting minutes during construction;
- All relevant permits;

- All method statements for all phases of the project.

All registers and records should be kept on site and must be made available to the department on request.

5.3 Document Control

The developer/landowner will be responsible for establishing a procedure for document control.

The document control procedure must comply with the following requirements:

Documents must be identifiable by organisation, division, function, activity and contact person;
Every document must identify the person and their positions, responsible for drafting and compiling the document, for reviewing and recommending approval, and final approval of the document for distribution;

All documents must be dated, provided with a version number and reference number, filed systematically, and retained for a specified period.

The owner will ensure that documents are periodically reviewed and revised where necessary, and that current versions are available at all locations where operations essential to the functioning of the EMPr are performed. All documents will be made available to the external auditor.

5.4 Reporting Requirements

All advice and recommendations made by the ECO must with the project engineer/engineers compliance be recorded on site in the site instruction book/ suitable register for his attention.

All spills will need to be documented and reported to the relevant authorities.

The contractor must ensure that "Any emergency incident, originating at the facility, which falls within the definition of section 30(1) of the National Environmental Management Act (NEMA), Act 107 of 1998, must be dealt with by the facility in accordance with Section 30 of NEMA". In the event of any incident the facility must ensure containment by the responsible person and report the incident to the Cape Winelands District (Shaun Minnies: Disaster Management) Shaun@capewinelands.gov.za, Tel: 021 888 5847 and DEA&DP (Mr. Simon Botha, 021 4830752, Simon.Botha@westerncape.qov.za). On-site emergency plans must be reviewed regularly.

Any event resulting in the spill or leak of fuels or any other hazardous solvents into the water courses (e.g. that of hazardous substances), must be reported to all relevant authorities, including DEA&DP Directorate: Pollution and Chemicals Management, within 14 (fourteen) days. This requirement is in terms of Section 30 (10) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) that pertains to the control of emergency incidents and should include the reporting, containment and clean-up procedure of such incident and the remediation of the affected area. All necessary documentation must be completed and submitted within the prescribed timeframes. Containment, clean-up and remediation must commence immediately in the case of NEMA Section 30 incidents.

CHAPTER 6

6.1. Public Communication Protocols

This section of the report is included in compliance with Section 24N (2) (e) of the National Environmental Management Act, 107 of 1998.

The developer/landowner must be responsible for regulating public access to information and compliance reporting.

The developer/landowner must respond to third party or public queries and complaints.

The developer/landowner must also be responsible for maintaining the compliance register to record complaints received and action taken. All complaints receive by the facility must be documented.

CHAPTER 7

This section of the report is included in compliance with Section 24 N 2 (d - g) and 3 (a - b) of the National Environmental Management Act, 107 of 1998.

Goal for Planning and Design (PD)

Overall Goal for Planning and Design: Undertake the planning and design phase of the construction of a reservoir in a way that:

- Ensures that the design of the reservoir responds to the identified environmental constraints and opportunities.
- Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements.
- Ensures that adequate regard has been taken of any landowner concerns and that these are appropriately addressed through design and planning (where appropriate).
- Ensures that the best environmental options are selected for the project.
- Enables the construction of a reservoir to be undertaken without significant disruption to other land uses in the area.
- In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE PD1: PRE-CONDITIONS

The following pre-conditions must be fully met before any construction activities commence.

A site meeting between the contractors and the representatives of the developer/landowner must take place at least 5 days prior to commencement of construction work to:

- Demarcate working boundaries and **no-go areas**;
- Discuss methods of stockpiling (vegetation, topsoil, sub-soil, shell-grit, etc);
- Check required toilets and fire-fighting facilities to be in place;
- Discuss and agree restricted access to construction site;
- Sign the Declaration of Understanding (Contractors);
- Discuss and agree communication channels including contact details;
- Discuss and agree areas of responsibility;
- Discuss and agree the demarcation and control of construction and building sites.

Minutes of this site meeting must be kept, and are to be distributed to all parties.

The following equipment must be on site before any construction work is due to start (***as and when required***):

- Sufficient and suitable chemical toilet facilities.
- Sufficient refuse bins, which are weather and wind proof, with proper lids.
- 1 x type ABC (all purpose) 12.5 kg fire extinguisher

All equipment and vehicles must be maintained to minimized noise from engines and ensure adherence to the Noise Regulations (SANS 10103).

This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE PD2: LAYOUT PLAN CONTROLS

The contractor must ensure that a copy of the signed approved layout plan is available at the office on site at all times for inspection by the developer or his representative(s). Any variation to the approved layout plan must be submitted to the developer for signed approval and may only be implemented once the approved variation is available to the contractor and available on site at the office. The variation of changes to the layout must be approved by the competent authority as per the EA conditions.

This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE PD3: ADVERTISING

The contractors may place no advertising material on the property unless prior formal written permission has been obtained from the landowner.

This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE PD4: METHOD STATEMENTS

To ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMPr.

The environmental specifications are required to be underpinned by a series of Method Statements, within which the contractors and service providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMPr will be met. That is, the contractor will be required to describe how specified requirements will be achieved through the submission of written method statements to the site manager.

A method statement is defined as "a written submission by the contractor in response to the environmental specification or a request by the site manager, setting out the plant, materials, labour and method the contractor proposes using to conduct an activity, in such detail that the site manager is able to assess whether the contractor's proposal is in accordance with the specifications and/or will produce results in accordance with the specifications".

The method statement must cover applicable details with regard to:

- Details of the responsible person/s
- Construction procedures
- Materials and equipment to be used
- Getting the equipment to and from site
- How the equipment/material will be moved while on-site
- How and where material will be stored
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
- Timing and location of activities
- Compliance/non-compliance with the specifications
- Any other information deemed necessary by the site manager

Method statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities.

Specific areas to be addressed in the method statement pre, during and post construction (where applicable) include:

General Administration:

- Designate access road and the protocol on while roads are in use.
- Preparation of the site (i.e. any clearing vegetation, compacting soils and removing existing infrastructure and waste).

Soil Management:

- Soil management/stockpiling and erosion control.
- Excavations and backfilling procedure.

Water Management:

- Stipulate the storm water management procedures recommended in the storm water management method statement.
- Ablution facilities (placement, maintenance, management and servicing).

Fire Prevention and Management:

- Fire management protocols and procedures to be put in place on site in accordance with relevant legislature.

Indigenous Fauna and Flora:

- Fauna and flora protection process on and off site

Environmental Reporting:

- Incident and accident reporting protocol

Solid Waste Management:

- Description of the waste storage facilities (on site and accumulative).
- Management and collection of waste process.
- Recycle, re-use and removal process and procedure.

Liquid Waste Management:

- The design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter.

Dust and Noise Pollution:

- Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
- Procedure to control dust at all times on the site (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.

Hazardous Substance Storage:

- Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, bitumen, cement, pesticides and any other harmful and hazardous substances and materials (South African National Standards apply).
- Lists of all potentially hazardous substances to be used. Appropriate handling, storage and disposal procedures.
- Prevention protocol of accidental contamination of soil at storage and handling areas. All storage areas, (i.e.: for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).

The contractor may not commence the activity covered by the method statement until it has been approved by the site manager, except in the case of emergency activities and then only with the consent of the site manager. Approval of the method statement will not absolve the contractor from their obligations or responsibilities in terms of their contract.

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE PD5: ENSURE THE DESIGN RESPONDS TO THE IDENTIFIED ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES

Project Component/s	Construction of a reservoir
Potential Impact	Design fails to respond optimally to the environmental consideration.
Activities/Risk Sources	Poor planning and design of the reservoir structure and bulk supply structures. Poor consideration of the natural landscape features.
Mitigation: Target/Objective	Ensure that the design responds to the identified environmental constraints and opportunities.

Mitigation: Action/Control	Responsibility	Timeframe
Plan and conduct pre-construction activities in an environmentally acceptable manner.	Developer	Pre-construction

The holder of an environmental authorisation has the responsibility to notify the competent authority of any alienation, transfer and, change of ownership rights in the property on which the activity is to take place.	Developer	Pre-construction
Fourteen (14) days written notice must be given to the Department that the activity will commence. The notification must include a date on which the activity will commence as well as the reference number.	Developer	Pre-construction
ECO to be appointed prior to the commencement of any authorised activities. Once appointed the name and contact details of the ECO must be submitted to the DEA&DP.	Developer	Pre-construction

Performance indicator	Design meets objectives and does not degrade the environment. Design responds to the mitigation measures and recommendations in the BA report. Minimal impact on the surrounding agricultural land and residential development.
Monitoring	Ensure that the design implemented meets the objectives and mitigation measures in the BA report through review of the design by the Project Manager, Developer and the Contract or prior to the commencement of construction.

CONSTRUCTION AND REHABILITATION PHASE

Overall Goal for Construction (C):
Undertake the construction of a reservoir in a way that:

- Ensures that construction activities are properly managed in respect of environmental aspects and impacts;
- Enables construction activities to be undertaken without significant disruption to other land uses in the area, in particular concerning impacts on noise impacts, dust, traffic and road use, and effects on local residents;
- Minimises the impact on the surrounding area;
- Minimises impacts on fauna using the site; and
- Minimise possible health impacts.

Objectives
In order to meet this goal, the following objectives have been identified, together with the necessary actions and monitoring requirements.

OBJECTIVE C1: ALIEN/INVASIVE PLANTS

Project Component/s	Reservoir and no-go areas.
Potential Impact	Alien/invasive plant species are allowed to spread into natural/indigenous vegetation areas.
Activities/Risk Sources	Activities associated with facility construction.
Mitigation: Target/Objective	To protect and mitigate impacts on the environment.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
No on-site burying, dumping or stockpiling of any weeds and aliens or invasive species shall occur. Such should be removed from the site to a suitable dumping site from which seed cannot escape.	Contractor	Construction phase

Performance indicator	All possible introduction and spreading of alien invasive plant species are controlled.
Monitoring	This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE C2: ARCHAEOLOGY AND PALAEONTOLOGY MANAGEMENT

Project Component/s	Development area.
Potential Impact	The loss of cultural or heritage resources.
Activities/Risk Sources	Activities associated with construction of the reservoir.
Mitigation: Target/Objective	To protect and mitigate the potential loss of cultural and heritage resources.

Mitigation: Action/Control	Responsibility	Timeframe
Should any heritage or fossil remains be exposed during any excavation or related activities, these must immediately be reported to the provincial heritage resource authority of the Western Cape, Heritage Western Cape (in terms of the National Heritage Resources Act, 1999 (Act No.25 of 1999) via the ECO. Heritage remains uncovered or disturbed during earthworks must not be disturbed until inspection and verified by the professional.	Contractor	Construction phase

Performance indicator	Protection of heritage resources.
Monitoring	This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE C3: ANTI-EROSION MEASURES AND DUST CONTROL

Project Component/s	Construction of the reservoir.
Potential Impact	Wind/water erosion as a result of construction/clearing activities. Erosion due to bare soil. Dust generation.
Activities/Risk Sources	Activities associated with the construction of a reservoir.
Mitigation: Target/Objective	Reduce the impact of erosion by implementing anti-erosion measures. Areas must be left bare for the shortest time possible.

Mitigation: Action/Control	Responsibility	Timeframe
The contractor must monitor soil erosion and restrict development of the impact area throughout the construction phase. Erosion must be monitored and area rehabilitated and stabilized as soon as signs of erosion occur. Storm water must be monitored and managed to prevent erosion. Caution should be exercised during the construction phase so that the slope at the site is not destabilized by the construction activities, including vehicle movements that could cause further destabilization as a result of erosion by run-off if construction takes place during the wet season. The contractor shall take all appropriate and active measures to prevent erosion, especially wind and water erosion, resulting from operations and activities, specifically of storm water control measures to the satisfaction of the ECO/ER. During the construction of the reservoir the contractor shall protect areas susceptible to wind and water erosion, by installing all the necessary	Contractor	Construction and operational phase

temporary and permanent works. Measures can include brush packing, anchovy net stabilisation, etc. Where required erosion protection measures must be installed. Aspects normally covered in construction contracts in terms of protection of works are standard and are not to be confused with those under environmental legislation. Dust suppressant methods may be required for this development. The contractor must consider the best available environmental method in terms of sustainable water use for the purposes of dust suppression throughout the process. Use of grey water may be required.		

Performance indicator	All possible dust and erosion impacts are controlled and rehabilitated.
Monitoring	This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE C4: DIESEL FUEL AND LUBRICANT HANDLING PROGRAMME AND WASTE MANAGEMENT

Project Component/s	Construction of a reservoir.
Potential Impact	Contamination of soil, storm and ground water resources as a result of an oil/diesel/lubricant spill/leak.
Activities/Risk Sources	Refuelling and use of equipment and machinery.
Mitigation: Target/Objective	To protect and mitigate impacts of contaminants on the environment and hydrological features.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Servicing of construction vehicles and machinery to take place of site. All vehicles must be in a good condition with no leakages leading to possible contamination of soil or water supplies. The following conditions related to the temporary fuel tanks must be implemented: The fuel tanks must be designed and installed in accordance with relevant Oil Industry standards and SANS codes where applicable for the aboveground storage tanks. The tanks must be located within a bund (110 % of the tanks capacity) in order to contain potential spills. During fuel tanker delivery, the tanker driver must be present at all times during product offloading. Should an incident occur the supply vehicle emergency cut-off switch must be activated to immediately stop fuel delivery. Flexible hoses with dry-break couplings and emergency isolation must be used. All spillage incidences and actions taken consequent thereto must be reported to the ECO and recorded in the site register. All fuel and flammable liquids should be stored under secure and fenced conditions and in a bunded site with the volume of the bunding capable of holding 110% of the liquid. The applicant must ensure that effective stock inventory monitoring and regular auditing take place for the early identification of possible leaks.	Contractor	Construction phase

The requirements of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), must be adhered to. Within three months of the tanks ceasing to be used the tanks must be removed at the expense of the applicant, and the site, including all associated infrastructure must be rehabilitated to the satisfaction of the relevant authority. **Refuelling:** Refuelling of equipment must be conducted from the bunded fuel tank and pump at the contractor's camp. Fuel tanks must be bunded and supplied with a concrete apron. The concreted refuelling apron will be constructed with a drain along its extremities to collect any diesel contaminated run-off and channel it to the oil trap where separated oil will be collected and disposed of in the oil recycling container and process. Any spills on the concrete apron of floor below the tank are to be treated with OT8 or Spillsolve or equivalent as per the product instructions. A 500 litre drawn trailer to convey diesel to the equipment for re-fuelling may also be used. Such trailer will be drawn by a specified vehicle and driver, with alternate nominated as approved by the Project Engineer. Such tow vehicle may travel at 20kms per hour maximum at any time, be clearly identifiable as such, and may only tow the diesel cart should the pre-requisite drip trays and emergency equipment be on the vehicle at the time. In situ refuelling activity may only take place during a standard specified daily time slot as displayed in the construction office, unless specific per day permission has been given to refuel at any other time by the ECO. This must be pre-recorded in the site record book. Staff will require instruction in the identification of diesel and oil leaks and the use of Spillsolve (or equivalent) products. **On-Site emergency repairs:** Only small mobile plant and emergency repairs are to take place on site. These will require the provision of drip trays and funnels to ensure that no oil or fuel leakages occur onto the ground. Should such spill take place, then the oil saturated soil is to be placed in suitable containers and disposed of at a licenced hazardous waste disposal site. Certificates of safe disposal must be obtained. Any contamination of soil is to be treated with Spillsolve or similar product. Contaminated water as a result of an oil or fuel spillage on the area should similarly be treated in appropriate way, and the polluted water should not be specifically removed and not allowed to merge with run-off water collected in the trap collecting all run offs from the slab. **Collection of contaminated spares and waste oils:** Contaminated spares, oil filters, gaskets, water, etc. will be collected in separate holders at the designated storage facility for disposal at a licensed H:h site. Staff will require instruction in: • Deleterious effects of oil / fuel on the environment • Identification of oil leaks • Handling of oil / fuel leaks into soil • Location and method in storage of contaminated spares		

• Fire prevention and emergency drills in case of an accident All building rubble at the construction site can be disposed at the Bessiekop (Montagu) Builder's Rubble Facility. Certificates of safe disposal must be obtained.		

Performance indicator	Ensure that no spillages occur and if it does occur that it is handled and cleaned up accordingly.
Monitoring	This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

OBJECTIVE C5: STORM WATER MANAGEMENT

Considering the natural slope of the development area, special attention must be paid to the storm water to ensure adequate drainage of the development area.

Project Component/s	Storm water infrastructure.
Potential Impact	Erosion due to poor storm water infrastructure. Pooling and ponding of water / flooding in portions of the development site due to poor storm water infrastructure design and engineering. Polluted runoff contaminating groundwater resources and adjacent ESA due poor storm water infrastructure design and implementation.
Activities/Risk Sources	Activities associated with facility construction, poor storm water infrastructure.
Mitigation: Target/Objective	To manage storm water effectively and prevent erosion and the pollution of surface and ground water resources.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Areas disturbed during construction must be re-vegetated as soon as possible. All roads need to be maintained and monitored and visible signs of possible erosion immediately rehabilitated. Construction of storm water infrastructure to ensure that rain/storm water does not pool or accumulate. Undertake storm water management measures as required. Rehabilitate or stabilise eroded areas immediately to prevent any increase in erosion.	Contractor	Construction phase

Performance indicator	All possible erosion impacts are controlled. No signs of storm water pollution or accumulation that will result in a nuisance. No surface, ground or storm water may be polluted as a result of any activities on the site.
Monitoring	This will be monitored by the ECO during site visits and recorded, reported and proof included in the audit report to be submitted once construction is completed.

There are no operational aspects of the listed activity. Operation will just include the reservoir and standard municipal maintenance and upkeep of infrastructure.

The perimeter fence (Betafence / Clearvu with a height of 2,4m) is critical to the safety and security of the site, and its maintenance and upkeep must be detailed in the EMP, in light of the potential for vandalism.

Betafence and its subsidiaries (hereafter "Betafence") guarantee hereby its Betafence branded fencing products for a period of 10 years starting from the date of invoice. This guarantee does not cover failure or damage due to improper use or application, soil or structural movement, natural disasters, fire, abuse or misuse, vandalism, war, negligence, failure to perform proper routine maintenance.

Clearvu's unique method of galvanizing and our patent Marine Fusion Bond coating offers a 25-year-maintenance-free life (Under normal conditions).

6-monthly inspections must be conducted on the fence and any defects must be repaired immediately.

A telemetry system will be introduced. The system is required to be cleaned once a year. This will entail the inlet to be closed and water used, until 200 mm is left in the reservoir. After this it is opened again and the reservoir is filled again. During this period the inside can be checked for any problems and rectified. Due to the water shortage in the Western Cape, it is not an option to evacuate all water from the reservoir.

CHAPTER 8

ENVIRONMENTAL REPORTING

In order to ensure that the necessary environmental issues are adequately addressed and recorded, the following environmental reporting shall be undertaken:

- Incident reporting; and
- Compliance reporting

See below for a template of an Incident Report to serve as a guideline for the recording and addressing of emergency incidents as and when they occur.

ENVIRONMENTAL INCIDENT REPORT

DATE:	**File Ref:**
NAME:	**Copy to:**
EXACT LOCATION OF INCIDENT:	

SECTION 1 : DESCRIPTION OF INCIDENT

SECTION 2 : REMEDIAL ACTION REQUIRED

Remedial Action Due Date:
Confirmation of implementation: **Name:** **Date:**

SECTION 3 : RELEVANT DOCUMENTATION

SECTION 4 : SIGNATURES

Municipal Engineer:

.....

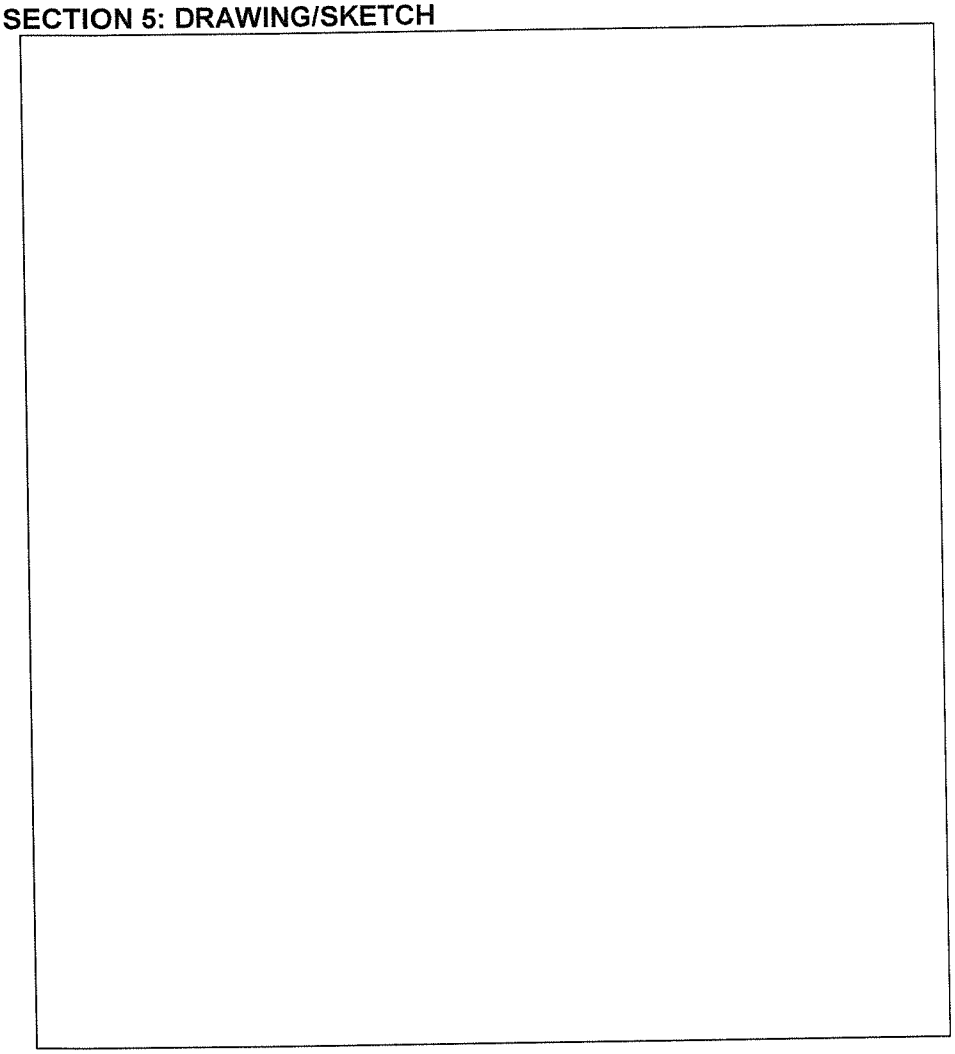
Name:
Date:

ECO:

.....

Name:
Date:

SECTION 5: DRAWING/SKETCH



CHAPTER 9

DECOMMISSIONING PHASE

As the final phase in the project cycle, decommissioning may present positive environmental opportunities associated with the return of the land for alternative use and the cessation of impacts associated with operational activities. However, depending on the nature of the operational activity, the need to manage risks and potential residual impacts may remain well after operations have ceased.

The decommissioning phase EMPr provides specific guidance with respect to the management of the environmental risks associated with the decommissioning stage of a project.

Closure and decommissioning impacts are likely to be similar to the construction phase impacts. The management actions and control under the construction phase EMPr need to be implemented to mitigate the negative impacts on the environment and to restore the property to its natural state.

A decommissioning phase is where a structure is removed or otherwise modified to make it incapable for re-use for the original design purpose.

The results of environmental monitoring during the decommissioning phase will be used to assess the impact of the decommissioning on the surrounding environment and demonstrate compliance with regulatory requirements.

The actual scope of the decommissioning environmental monitoring will be established following consultation with the regulatory authorities. The format of decommission management strategy will probably be similar to that of earlier development phases and consist of the following:

- Management Principles
    - Develop monitoring procedures in accordance with standard protocols and the requirements of the environmental legislation.
    - Undertake environmental monitoring during the decommissioning phase as shown below.

Environmental monitoring during the decommission phase will include terrestrial flora rehabilitation monitoring.

CHAPTER 10

REHABILITATION SPECIFICATIONS AND SITE CLEAN-UP

The construction areas must be cleared, and cleaned to the satisfaction of the developer.

Stabilisation and rehabilitation must take place immediately after construction operations have been completed. No vehicles or unauthorised personnel must be allowed onto areas that have been rehabilitated.

The areas impacted during construction must be stabilised and shaped according to the natural surrounding contours. If topsoil was removed during construction the topsoil must be used to stabilise the impacted areas.

If erosion occurred the ECO must be informed immediately who will then recommend erosion mitigation measures to be implemented.

CHAPTER 11

ENVIRONMENTAL AWARENESS INDUCTION COURSE MATERIAL

This section of the report is included in compliance with Section 24N (3) (c) of the National Environmental Management Act 107 of 1998.

WHAT IS THE ENVIRONMENT?

- Soil
- Water
- Plants
- People
- Animals
- Air we breathe



WHY MUST WE LOOK AFTER THE ENVIRONMENT?

- It affects us all as well as future generations
- We have a right to a healthy environment
- A Policy and System will be signed

C5 Health and Safety Specification

The attached Health and Safety Specification is applicable to this project

LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

safe working practice
OCCUPATIONAL HEALTH AND SAFETY GROUP

Project Health and Safety Specification

In terms of Construction Regulations 2014

Project Client

LANGEBERG MUNICIPALITY

Description of Project Works

CONSTRUCTION OF RESERVOIR

Project Location

ROBERTSON

Preparation Date

OCTOBER 2021

Project Health and Safety Specification developed by:

Mark Winter PrCHSA, (SACPCMP)
Safe Working Practice (Cape Town) Pty Ltd
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PROJECT HEALTH AND SAFETY SPECIFICATION

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1.0 SPECIFIC PROJECT INFORMATION

1. 1 INTRODUCTION AND DEFINITIONS

THE REQUIREMENTS OF THE CONSTRUCTION REGULATIONS 2014 (AND GUIDANCE NOTES OF 2017) HAVE BEEN IN EFFECT SINCE 7TH AUGUST 2014. THE REGULATIONS PLACE LEGAL DUTIES UPON PRINCIPAL CONTRACTORS AND CONTRACTORS. ALTHOUGH THIS HEALTH AND SAFETY SPECIFICATION INCLUDES MUCH OF THE CONTENT OF THE REGULATIONS, THE CONTRACTOR WILL BE DEEMED TO BE FAMILIAR WITH THE REQUIREMENTS OF THESE REGULATIONS, AND OTHER ASSOCIATED HEALTH AND SAFETY REGULATIONS, AND TO HAVE FACTORED IN ALL THE DUTIES PLACED UPON CONTRACTORS AND PRINCIPAL CONTRACTORS IN THE TENDER. A COPY OF THE REGULATIONS CAN BE VIEWED ON THE DEPARTMENT OF LABOUR'S WEBSITE.

PLEASE NOTE THAT THE TERMS "CONTRACTOR" AND "PRINCIPAL CONTRACTOR" HAVE THE SAME MEANING AS THAT IN THE CONSTRUCTION REGULATIONS AND ARE USED INTERCHANGEABLY IN THIS DOCUMENT, I.E., REFERENCES TO "CONTRACTOR" REFER TO PRINCIPAL CONTRACTOR AND/OR CONTRACTOR AS THE REGULATIONS PERTAIN TO THEIR FUNCTIONS.

This Health and Safety Specification contains clauses that are generally applicable to construction activities, as well as imposing pro-active controls associated with activities that impact on Health and Safety as it relates to work on site. Compliance to the requirements of the Occupational Health and Safety Act 1993 is an additional requirement of this Health and Safety Specification and is part of the Contractor's responsibility. The Client, and/or their agents, will monitor that all Contractors comply with the requirements of such legislation.

ALL REFERENCES TO CLIENT IN THIS HEALTH AND SAFETY SPECIFICATION ALSO REFER TO SAFETY AGENT, WHERE SO APPOINTED.

Definitions (as per the Construction Regulations 2014) applicable to this Health and Safety Specification:

"agent" means a competent person who acts as a representative for a Client;

"angle of repose" means the steepest angle of a surface at which a mass of loose or fragmented material will remain stationary in a pile on the surface, rather than sliding or crumbling away;

"bulk mixing plant" means machinery, appliances or other similar devices that are assembled in such a manner so as to be able to mix materials in bulk for the purposes of using the mixed product for construction work;

"client" means any person for whom construction work is being performed;

"competent person" means a person who has, in respect of the work or task to be performed, the required knowledge, training and experience and, where applicable, qualifications, specific to that work or task: Provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No.67 of 2000), those qualifications and that training must be regarded as the required qualifications and training; and is familiar with the Act and with the applicable regulations made under the Act;

"construction manager" means a competent person responsible for the management of the physical construction processes and the coordination, administration, and management of resources on a construction site;

"construction site" means a workplace where construction work is being performed;

"construction supervisor" means a competent person responsible for supervising construction activities on a construction site;

"construction vehicle" means a vehicle used as a means of conveyance for transporting persons or material, or persons and material, on and off the construction site for the purposes of performing construction work;
"construction work" means any work in connection with -

- the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure; or
- the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system; or the moving of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work;

"construction work permit" means a document issued in terms of regulation 3;

"contractor" means an employer who performs construction work;

Note:
a) Includes organisations and or self-employed person that contracts with a client, principal contractor, or a contractor to carry out construction work.

"demolition work" means a method to dismantle, wreck, break, pull down or knock down of a structure or part thereof by way of manual labour, machinery, or the use of explosives;

"design" in relation to any structure, includes drawings, calculations, design details and specifications;

"designer" means a competent person who-

- prepares a design;
- checks and approves a design;
- arranges for a person at work under his or her control to prepare a design, including an employee of that person where he or she is the employer; or
- designs temporary work, including its components;
- an architect or engineer contributing to, or having overall responsibility for a design;
- a building services engineer designing details for fixed plant;
- a surveyor specifying articles or drawing up specifications;
- a contractor carrying out design work as part of a design and building project; or
- an interior designer, shop-fitter, or landscape architect;

"ergonomics" means the scientific discipline concerned with the fundamental understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimise human well-being and overall system performance;

"excavation work" means the making of any man-made cavity, trench, pit or depression formed by cutting, digging or scooping;

"explosive actuated fastening device" means a tool that is activated by an explosive charge and that is used for driving bolts, nails, and similar objects for the purpose of providing fixing;
"fall arrest equipment" means equipment used to arrest a person in a fall, including personal equipment, a body harness, lanyards, deceleration devices, lifelines, or similar equipment;

"falsework" means a combined system of formwork and support work;

"formwork" means temporary or permanent shutters used to form wet concrete into elements of a structure, and includes both horizontally and vertically placed shutters;

"fall prevention equipment" means equipment used to prevent persons from falling from a fall risk position, including personal equipment, a body harness, lanyards, lifelines or physical equipment such as guard-rails, screens, barricades, anchorages or similar equipment;

"fall protection plan" means a documented plan, which includes and provides for -

- all risks relating to working from a fall risk position, considering the nature of work undertaken;
- the procedures and methods to be applied in order to eliminate the risk of falling; and
- a rescue plan and procedures;

"fall risk" means any potential exposure to falling either from, off or into;
"health and safety file" means a file, or other record containing the information in writing required by these Regulations;

"health and safety plan" means a site, activity or project specific documented plan in accordance with the Client's health and safety specification;

"health and safety specification" means a site, activity or project specific document prepared by the Client pertaining to all health and safety requirements related to construction work;
"material hoist" means a hoist used to lower or raise material and equipment, excluding passengers;

"medical certificate of fitness" means a certificate contemplated in regulation 7(8);

"mobile plant" means any machinery, appliance or other similar device that is able to move independently, and is used for the purpose of performing construction work on a construction site;

"National Building Regulations" means the National Building Regulations made under the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), and promulgated by Government Notice No. R. 2378 of 30 July 1990, as amended by Government Notices No's R. 432 of 8 March 1991, R. 919 of 30 July 1999 and R. 547 of 30 May 2008;

"person day" means one normal working shift of carrying out construction work by a person on a construction site;

"principal contractor" means an employer appointed by the Client to perform construction work;

"Professional Engineer or Professional Certificated Engineer" means a person holding registration as either a Professional Engineer or Professional Certificated Engineer in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000);

"Professional Technologist" means a person holding registration as a Professional Engineering Technologist in terms of the Engineering Profession Act, 2000;

"provincial director" means the provincial director as defined in regulation 1 of the General Administrative Regulations, 2003;

"scaffold" means a temporary elevated platform and supporting structure used for providing access to and supporting workmen or materials or both;

"shoring" means a system used to support the sides of an excavation and which is intended to prevent the cave-in or the collapse of the sides of an excavation;

"structure" means-

- any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, bulk mixing plant, pylon, surface and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;
- any falsework, scaffold or other structure designed or used to provide support or means of access during construction work; or
- any fixed plant in respect of construction work which includes installation, commissioning, decommissioning, or dismantling and where any construction work involves a risk of a person falling;

"support work" means the temporary structure erected to support the formwork before the casting of a concrete element of a structure.

"suspended platform" means a working platform suspended from supports by means of one or more separate ropes from each support;

"temporary works" means any falsework, formwork, support work, scaffold, shoring or other temporary structure designed to provide support or means of access during construction work;

"the Act" means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);

"tunnelling" means the construction of any tunnel beneath the natural surface of the earth for a purpose other than the searching for or winning of a mineral.

Reference should be made to the following documentation in conjunction with this Safety Specification (including existing surveys, drawings, and reports):

- Tender documents
- Drawings

IMPORTANT NOTE:
This Health and Safety Specification has been prepared to comply with the requirements of the Construction Regulations 2014.

1.2 BACKGROUND TO THE HEALTH AND SAFETY SPECIFICATION

Historically, the Construction Industry has had a poor health and safety record. Due to the complex and potentially dangerous operations being undertaken, there is a high risk of incidents, accidents, and injuries. In many instances poor adherence to the Act and Regulations has resulted in severe consequences for Health and Safety performance. The Client is determined that the highest Health and Safety standards will prevail throughout the Contract and that there will be full commitment from all parties involved.

To achieve this goal the Client has arranged for the preparation of this Health and Safety Specification. The Health and Safety Specification sets out guidelines and minimum levels of awareness and guidance for Health and Safety requirements for the project. Contractual responsibility for adhering to these requirements rests with the Contractors. All employees are encouraged to be pro-active in compliance.

The Client is committed to ensuring the highest Health and Safety standards for all work undertaken within the Contract.

Contractors as employers are fully responsible and accountable for compliance with all Health and Safety requirements.

IMPORTANT NOTE:

Compliance with the Occupational Health and Safety Act and Regulations shall not be limited to this Health and Safety Specification and definitions contained in this document.

Contractors shall be conversant with the requirements and effects of Health and Safety legislation upon their activities, in particular the Construction Regulations, 2014, and the Occupational Health and Safety Act, 1993, and to have made adequate resource in their tender submission to comply with all legislative requirements.

Failure to comply with the requirements of this Safety Specification will result in severe sanction and the severity of the sanction will depend on the severity of the noncompliance.

The Contractor's personnel will be responsible for the auditing of the implementation of the Health and Safety Specification and maintaining the document control and record systems associated with the Health and Safety Specification. The Client will arrange for Health and Safety audits to be conducted on site on their behalf to monitor health and safety compliance by contractors.

1.3 PURPOSE OF THE HEALTH AND SAFETY SPECIFICATION

The purpose of this site-specific Health and Safety Specification is to comply with legal requirements and to provide health and safety information about specific project risks known by the Client, Designer and Safety Agent to be applicable to this project. This document also provides minimum health and safety requirements, standards, and expectations that the contractor must adhere to.

The Contractor must take into account all information in this specification and ensure that their tenders include adequate resource and competence to deal with the matters detailed herein so that all relevant contents are dealt with in a way which is in compliance with legislation and the ethical concerns for the safeguarding of employees, contractors and other persons affected by the construction activities. Please note that a detailed OHS bill of quantities must be provided by the contractor on all Construction Work Permit projects. The Bill of Quantities will form part of the Construction Work Permit appellation presented to Department of Labour for approval.

The Health and Safety Specification will be implemented during construction of the works and any construction activity that the Client has control over.

This will also assist in ensuring that all the costs related to the compliance with Occupational Health Act 85 of 1993 and the Construction Regulations 2014, as well as this Health and Safety Specification, are taken into consideration at Tender stage.

No advice, approval of any document required by the Health and Safety Specification such as hazard identification and risk assessment action plans or any other form shall be construed as an acceptance by the Client of any obligation that absolves the Contractor from achieving the required level of performance and compliance with legal requirements.

Further, there is no acceptance of liability by the Client which may result from the Contractor failing to comply with the Health and Safety Specification unless the Client has issued an instruction to any requirement, i.e. the Contractor remains responsible for achieving the required performance levels.

1.4 IMPLEMENTATION OF THE HEALTH AND SAFETY SPECIFICATION

This Health and Safety Specification forms an integral part of the Contract, and Contractors shall make it an integral part of their Contracts with other Contractors and Suppliers. Contractors employed by the Client are to ensure that the provisions of the Health and Safety Specification are applied both on the site and in respect of all off site activities relating to the project, in particular in transport activities and project dedicated off site fabrication works.

The Contractor shall enforce the provisions of the Health and Safety Specification amongst all Contractors and suppliers for the project.

The Contractor shall sign the acknowledgment on the last page of this safety specification that he/she has familiarized him/herself with the content of the Health and Safety Specification and shall comply with all obligations in respect thereof.
The successful Contractor will be required to compile a Health and Safety Plan based on the requirements of the Occupational Health Act 85 of 1993 and these Specifications, which will need to be approved by Client (or their appointed safety agent) prior to commencement with construction work.

1.4.1 Client Duties

In terms of the Construction Regulations 2014 the Client (or their Agent, where appointed) has legal duties. Where an Agent (refer to "definitions" section of this document) is appointed in terms of this project, these Health and Safety duties assigned will also apply.

All references to "Client" will apply to their appointed "Safety Agent", where so appointed, in this Health and Safety Specification.

The Client must:

- Prepare a baseline risk assessment for the construction work
- Prepare a suitable, sufficiently documented, and coherent site specific Health and Safety specification for the intended construction work, based on the baseline risk assessment
- Include the health and safety specification in the tender documents
- Ensure that potential principal contractors submitting tenders have made adequate provision for the cost of health and safety measures
- Ensure that the principal contractor to be appointed has the necessary competencies and resources to carry out the construction work safely
- Take reasonable steps to ensure co-operation between all contractors appointed by the Client to enable each of those contractors to comply with the regulations
- Ensure, before work commences, that every principal contractor is registered and in good standing with the compensation fund, or with a licensed compensation insurer as contemplated in the Compensation for Occupational injuries and Diseases Act, 1993 (Act no 130 of 1993)
- Appoint each principal contractor in writing for the project, or part thereof
- Discuss and negotiate with the principal contractor the contents of the principal contractor's safety plan and thereafter finally approve that plan for implementation
- Ensure that a copy of the principal contractor's health and safety plan is implemented and maintained
- Ensure that periodic health and safety audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days
- Ensure that a copy of the health and safety audit report is provided to the principal contractor within 7 days after the audit
- Stop any contractor from executing a construction activity which poses a threat to the health and safety of persons which is not in accordance with the principal contractor's health and safety plan for site
- Where changes are brought about to the design or construction work, make sufficient health and safety information and appropriate resources available to the principal contractor to execute the work safely
- Ensure that the health and safety file is kept and maintained by the principal contractor.
- Where the Client requires additional work to be performed as a result of a design change or error in construction due to the actions of the Client, the Client must ensure that sufficient safety information and appropriate additional resources are available to execute the required work safely.
- Where more than one principal contractor is appointed, the Client must take reasonable steps to ensure co-operation between all principal contractors and contractors to ensure compliance with the Regulations
- Where the Client has appointed a Safety Agent for the project, their details for this project are contained in the Project Directory section of this health and safety specification.

1.4.2 Designer Duties

It must be noted that the Designer also has Health and Safety duties assigned in terms of the Construction Regulations. Where the contractor fulfils a design function in terms of this project (refer to "definitions" section of this document), these duties will also apply. Please refer to Regulation 6 of the Construction Regulations 2014.

Please note that the designer of temporary works must ensure that:

- all temporary works are adequately designed so that it will be capable of supporting all anticipated vertical and lateral loads that may be applied;
- the designs of temporary works are done with close reference to the structural design drawings issued by the contractor, and in the event of any uncertainty consult the contractor;
- all drawings and calculations pertaining to the design of temporary works are kept at the office of the temporary works designer and are made available on request by an inspector; and
- the loads caused by the temporary works and any imposed loads are clearly indicated in the design.

1.5 PROJECT DIRECTORY		
Project Client **Contact Person**	Langeberg Municipality Maynard Johnson	**Tel:** 023 615 8000 **Email:** mjohnson@langeberg.gov.za
Project Manager **Contact Person**	Neil Lyners & Associates RF (Pty) Ltd Carel Davids	**Tel:** 021 914 0300 **Cell:** 072 433 7262 **e-mail:** carel@lyners.co.za
Civil Engineer **Contact Person**	Neil Lyners & Associates RF (Pty) Ltd Carel Davids	**Tel:** 021 914 0300 **Cell:** 072 433 7262 **e-mail:** carel@lyners.co.za
Structural Engineer **Contact Person**	Neil Lyners & Associates RF (Pty) Ltd Lucas Bosch	**Tel:** 021 914 0300 **Cell:** 083 626 2298 **e-mail:** lucas@lyners.co.za
Mechanical Engineer **Contact Person**	MNE Oak Telez Augustyn	**Cell:** 082 339 8188 **e-mail:** telez@mne-oak.co.za
Electrical Engineer **Contact Person**	MNE Oak Andries Steenkamp	**Cell:** 072 255 4543 **e-mail:** andries@mne-oak.co.za
Construction Safety Agent **Contact Person**	Safe Working Practice (Cape Town) Pty Ltd Mark Winter	**Tel:** 021 701 0470 **Cell:** 071 603 2213 **e-mail:** markw@safepractice.co.za

OTHER PARTIES DIRECTORY	
Department of Labour for submission of Annexure 2: Notification of Construction Work WESTERN CAPE – Fezeka Ngalo	**Tel:** 021 441 8158 **e-mail:** fezeka.ngalo@labour.gov.za **Cell:** 083 365 0681
Telecommunications, Water, Gas and Electricity Contractor to apply for and refer to wayleave information from service providers for the nature and location of services. Refer all queries Project Manager.	
COVID-19 Hotlines **National Coronavirus Hotline** **Provincial Coronavirus Hotline**	 **Tel:** 0800 029 999 **Tel:** 021 928 4102

1.6 PROJECT DETAILS

Description of Works

Construction of a 3 ml Reservoir, including,

- Construction of new reservoir with access ladder and step irons
- Fencing
- Civils works and installation of services (new rising main)
- Construction of new pump station
- Partial refurbishment of pump station
- Removal of existing asbestos cement roof from existing pump station and replacement with new roof
- Demolition works inside existing pump station
- Mechanical and electrical works
- Installation of mini subs
- Construction of new MCC housing

This description of the works is not necessarily complete and shall not limit the work to be carried out by the Contractor under this Contract.

Anticipated Construction Duration
10 months.

Provisional Start Date
15 January 2022

Provisional Completion Date
End November 2022

Construction Work Permit Required for the Project?
No

1.7 EXISTING ENVIRONMENT

Hazards particular to this project by virtue of location:

- Existing underground asbestos containing water pipes present in the area of works.
- The route of the works goes through existing residential and commercial areas – members of public and vehicular traffic present. There may be community facilities present along the route of works.
- Live services (underground, ground and overhead services will be present in the area of the works.
- There may be security risks in areas of the works.
- The ground conditions are known to be rocky.

Overhead, Above Ground and Underground Services crossing the site:

Overhead: Principal Contractor to protect against damage and risks to safety of workforce and public – electrical services present.

Underground: There are several asbestos containing water services along the pipeline route. Other underground services present are electricity, sewer, fibre, stormwater.

Ground level: Yes, street lighting present.

Service Drawings available: No.

Wayleaves required: Yes

Permits required: Yes

Isolations required: Yes

Existing structures on site and surrounding land use (with a significant impact on Health & Safety):

The existing area consists of residential properties and roads. There may be community facilities present too.
There is an existing reservoir present as well as existing pump stations.

Existing ground conditions and ground survey report:

- Geotechnical report available.
- No health/safety issues known regarding quality of ground water.
- Geotechnical queries to be referred to project manager.
- Soil conditions known to be rocky with sand overlay (1.4m).

Existing Traffic Systems

Condition: Existing two way surfaced roads for the most part.

Restrictions to access: None known.

Speed restrictions: Usual urban speed limits apply.

1.8 AVAILABLE DRAWINGS

Refer to tender documentation.

1.9 PROJECT HEALTH AND SAFETY REQUIREMENTS

Significant health and safety hazards identified by Client, Designer and Safety Agent:

Use of delivery or support trucks used for the delivery and removal of material and equipment on open roadways – plant must be effectively separated from members of public and unauthorised personnel. Flag persons wearing high visibility clothing to be in place as required. Exclusion zone to be in operation when the support vehicles are in use next to the roadways.

Any **plant** that will be moving in or around the road must be made visible at all times. Parking of this plant must be strictly monitored by the contractor at all times. Use flag persons as applicable. Plant must be effectively separated from members of public and unauthorised personnel.

Members of the public and road traffic – the site is located in an existing residential and commercial area running through Robertson to the reservoir construction site. The pipeline is in the road reserve of the road for the most part and crosses roads at various points. Sidewalks may be affected. The site works will present safety issues regarding risks to members of public and road traffic. The health and safety of members of public and road users must be a priority at all times and all necessary steps must be taken to prevent unauthorised entry to site and to protect members of the public from any dangers associated with the construction works being undertaken. Existing roads will remain open during works. This is a critical hazard to traffic/members of public and to workers in the road who must have high visibility clothing on at all times. Safety of road users and workers is crucial and must be managed by Principal Contractor. The Principal Contractor is responsible for the directional signage to divert pedestrian members of the public and road users. Where applicable - flag persons to control traffic with red flags and to have high visibility clothing on at all times. A traffic accommodation plan will be required.

Noise and Dust control: Measures to be put in place by the appointed contractor to minimize the dust and noise on site. Contractor must take sufficient steps to reduce the production of noise and dust.

Warning Notices: Construction warning signage must be prominently displayed to avoid access to site areas by unauthorised persons.

Electrical work may only be undertaken after the requisite isolations and permits have been obtained and all required safety measures are in place. All required personal protective equipment must be worn. Live commissioning may only be undertaken by trained and competent contractor's personnel who are authorised and supervised by competent personnel provided by the contractor, and, if so identified, the project client and professional team.

Risk of fires caused by construction works and / or Smoking – ensure correct measures are in place for fire control to ensure no fires will break out. Fire extinguishing equipment to be readily available at all times especially during high risk activities. The smoking of cigarettes is also to be monitored and adequate smoking areas and smoking control measures to be put in place

Live services – services and moving machinery present in the works areas (including pump stations). All necessary precautions must be taken to prevent accidental contact with these services. All services to be treated as live.

Use of hazardous – MSDS to be available. Contractor must exercise caution as there is always a potential for fires. Suitable fire extinguisher to be in place at all times. Gloves and suitable respiratory protection must be provided and worn as well as other appropriate personal protective equipment (PPE) required by risk assessments.

Presence of Asbestos – There are several existing water services along the proposed pipeline route. These include existing asbestos cement pipeline. Works with asbestos must be done in strict accordance with the Asbestos Abatement Regulations of 2020. An asbestos cement roof will also be removed from an existing pump station.

Lifting Operations – all operators must provide copies of their up to date competency and medical certificates and driver's license. Loads must be slung by person with appropriate training and competence. Daily plant inspection registers to be completed and records kept in the safety file. Valid load test certificates and record of inspections by competent personnel must be available and maintained throughout the project. Rotating amber lights and reverse alarms to be active when operating all plant on site. Plant must be effectively separated from members of public and unauthorised personnel. Use trained flag persons as applicable. Exclusion zone under lifting operations to be enforced as applicable. Particular attention must be paid to lifting operations in windy conditions.

Excavations – max depth of 2.5m - sloping and/or shoring to be used – method statement to be in place. All workers must receive induction prior to commencement of works. Excavations must sloped to a safe repose. If sloping is not possible, it must be adequately supported, braced and maintained by a competent person (shored) so that they are capable of supporting all anticipated vertical and lateral loads that may be applied to them. Support mechanisms to be of sufficient design, durability and strength to prevent any excavation edges from collapsing. **Excavations must be backfilled by end of each shift as far as is reasonably practicable**. If this cannot be done then appropriate safety measures must be put in place by the contractor to prevent unauthorised entry to excavations, including barriers and warning signage. Ensure there is a safe distance between employees and plant when digging excavations.

- ALL EXCAVATIONS MUST HAVE A MINIMUM OF ORANGE PLASTIC BARRIER MESH IN PLACE.
- Red & white danger tape is not permitted for securing excavated areas.
- Excavated soil is to be placed at a sufficiently safe distance from the excavation itself.
- As applicable, water seepage / water table management into excavated areas due to high subsurface water table is to be management by the Principal Contractor.
- **PLEASE NOTE THAT THE PRINCIPAL CONTRACTOR WILL BE REQUIRED TO PROTECT EXCAVATIONS IN PUBLIC ACCESSED AREAS WITH 2.1M HIGH FENCING PANELS TO EXCLUDE UNAUTHORISED PERSONS (PARTICULARLY CHILDREN) FROM ACCESS TO THE EXCAVATIONS.**

Working at Height: a Fall Protection Plan and Rescue Plan will be required for approval prior to commencement of any activities. All workers must have a medical certificate of fitness for working at heights. All workers must have fall protection plan training in the form of a toolbox talk with a signed register of attendance. Edge protection and fall protection systems will be required where reasonably practicable. Scaffolding must be in full compliance with SANS 10085 with competent scaffold supervisors, erectors and inspectors.

Temporary works: Wear personal protective equipment such as gloves and goggles hard hats as required. Formwork and support work must be built by trained personnel under the supervision of a competent temporary works supervisor. Designers must be appointed in writing and must ensure that inspections and approvals are carried out as specified in Construction Regulation 12. Access into areas where striking and stripping activities are taking place must be restricted and completely blocked off where possible. The relevant signage must be in place to warn personnel of the related dangers.

Use of mobile cranes: All operators must provide copies of their competency and medical certificates and driver's license. Loads must be slung by person with appropriate training and competence. Daily plant inspection registers to be completed and records kept in the safety file. Rotating amber lights to be active when operating on site. Plant must be effectively separated from members of public and unauthorised personnel. Use trained flag persons as applicable. Exclusion zones to be in operation as applicable. Valid load test certificates and inspections by competent personnel must be available and maintained throughout the project.

Confined spaces (inside pump station – particularly during demolition works) – confined space work must be monitored by a competent appointed person. Prior to entry, ensure that confined space is sufficiently ventilated. Oxygen levels to be tested in confined space to ensure that it is safe for entry. Personal protective equipment to be worn (such as proper masks) if air supply insufficient or not of sufficient quality. Emergency procedures to be in place. Sufficient training must take place in use of equipment prior to any works commencing in such confined space. Permit system to be in place to declare confined space safe for entry.

Demolition (including inside pump station) – must be undertaken by competent workers under supervision. A method statement will be required for the works. Dust and noise will be an important factor. PPE to be worn.

Use of Explosives – Blasting may be required due to rocky ground conditions. Note that requirements of the Explosives Act must be strictly complied with, including requirements for licencing, permits, exclusion zones, etc.

Risk of criminal activities (and protest action) – area of the works may carry the risk of crime with potential risk (and protest action) to contractors. The safety of the workers must be taken into consideration. Emergency procedures must form part of induction training. Contractor must ensure safe entry into the area and vacate the area immediately in event of incidents and notify professional team.

COVID-19 – The Principal Contractor is to review and implement measures for the safety management, hygiene & health procedures, protocols and practices, informing employees, monitoring and compliance with all Governmental Decrees regarding the management of the COVID-19 situation.

The Principal Contractor is to review at least the following, but not limited to, information.

- What is COVID-19?
- How does COVID-19 spread?
- What are the symptoms of COVID-19?
- When should testing for COVID-19 occur?
- How can COVID-19 infection be prevented?
- COVID-19 and Stigma's or false information – What is true and what is false?

The below national and international information sources are recommended for review.

World Health Organization
https://www.who.int/emergencies/diseases/novel-coronavirus-2019

The Department of Health (Republic of South Africa)

http://www.health.gov.za/index.php/outbreaks/145-corona-virus-outbreak/465-corona-virus-outbreak

The National Institute for Communicable Diseases (Republic of South Africa)
http://www.nicd.ac.za/diseases-a-z-index/covid-19/frequently-asked-questions/

The Principal Contractor is recommended to be able to demonstrate/implement the below:

- Workplace safe work procedure and risk assessments.
- Hygiene protocols:
  - Washing of hands – How, why and when.
  - The use of hand sanitizers – How, why and when.
  - Disinfecting of surfaces and workplace cleanliness – How, why and when.
- Social distancing within the workplace – How, why and when.
- Communication with employees:
  - Employee and external contractor inductions.
  - Awareness training.
- Safety signage in at least 3 languages – English, Afrikaans & Xhosa.
- Additional control measures:
  - Employee thermometer testing.
  - Provision of PPE – gloves, masks, etc…
  - Handwashing sessions – company wide.
  - Employee health monitoring.

Strict COVID 19 control measures by the Principal Contractor is to be implemented.

Other construction hazards that the contractor can reasonably expect are as follows:

Bricklaying
Compacting and Filling
Compactor Operations
Cutting Off Disc
Electric Tools and Electrical Installations
Flammable Liquids / Gas
Hazardous Substances
Hot Works
Hand tools
Manual Handling of General Items
Plant/Vehicle and Equipment Operation
Site Strip
Steel Fixing
Temporary Works
Troxler Use

NOTE: Please refer to end of this Health and Safety Specification for the baseline risk assessment for these hazards and risks.

ACTIVITIES REQUIRING APPROVED METHOD STATEMENTS (FOR HEALTH AND SAFETY & COVID-19)

Pre-Construction Phase Method Statements

- Site establishment

Construction Phase Method Statements

- The detection and protection of existing services.
- Traffic Management Plan
- Work with Asbestos
- Blasting

ACTIVITIES REQUIRING PERMITS (FOR HEALTH AND SAFETY PURPOSES)

Permit to Dig: Where applicable, Principal Contractor to approach service providers.

Permit to Enter Excavations: The Principal Contractor is to formally manage all excavation work.

Road Works Permit: The Principal Contractor to liaise with the professional team.

Permit to Work with Electricity: Where applicable, Principal Contractor to approach service providers.

Confined Space Permit: The Principal Contractor is to formally manage all confined space work.

Hot Works Permit: The Principal Contractor is to formally manage all hot work.

Permit to Work under Power Lines: The Principal Contractor is to formally manage all works under power lines, as applicable.

Blasting: The Principal Contractor is to formally manage all blasting operations.

Temporary Works: The Principal Contractor is to formally manage all temporary work.

COVID 19 (Travel Permit): None foreseen (As per government regulations).

CONTRACTOR SAFETY OFFICER PROVISION

Records of safety audits undertaken by the Contractor's Safety Officer must be kept on site in the safety file and nonconformances reported by the Safety Officer to the Contractor's management team. All nonconformances identified by the Safety Officer and client's safety agent must be investigated and corrective action taken by the Contractor to prevent re-occurrence.

Please note that as from 7th August 2018 the safety officer must be professionally registered with the SACPCMP. Proof of registration with the SACPCMP must be provided.

If registered as a Candidate proof of mentorship and weekly visits by mentor must be available on site.

The requirement for this site is that a part time Safety Officer be appointed by the Contractor for the duration of the project, conducting at least fortnightly safety audits.

MEDICAL CERTIFICATE OF FITNESS (ANNEXURE 3)

The contractor must ensure that their employees on site have a valid medical certificate of fitness, specific to the construction work being performed, issued by an occupational health practitioner in the form of an Annexure 3 template.

MANAGEMENT AND SUPERVISION OF CONSTRUCTION WORK

A principal contractor must, in writing, appoint one full-time competent person as the construction manager with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance, and in the absence of the construction manager an alternate competent person must be appointed by the principal contractor. Proof of an all-inclusive assessment by the Principal Contractor of the Construction Manager's Competency in construction management and health and safety competency must be available in the Safety File.

The Construction Manager, Alternate Construction Managers, Assistant Construction Managers, and designated construction supervisor/s must, as a minimum, have training in Legal Liability, Construction Regulation 2014 and the OHS Act and Regulations.

TRAFFIC ACCOMMODATION

The Traffic Accommodation Plan will be prepared by the Principal Contractor and be approved by the Project Manager and, as required, the Traffic Chief as per the National Road Traffic Act, No. 93 of 1996. Where provided the Traffic Safety Officer (TSO) must have training as per Unit Standard 14561 or similar.

- The principal contractor is to implement the Plan before the start of works.
- Note that new jersey barriers may need to be provided for works in the road and usual trench barricading where the works are within the sidewalks or verges.
- Please note that at least one road lane should be open during business hours. At no time should the entire road be closed off without permission from the professional team.

ENVIRONMENTAL CONDITIONS

Contractor must take into account adverse weather conditions on site activities and implement control measures to mitigate risk. This includes risk of exposure to excessive heat, cold, rain, lightning and wind.
The open nature of the site works will not preclude any of the above.

ARRANGEMENTS FOR ACCESS, PARKING, DELIVERIES, ETC.

Off existing roads. Residents must have access to their properties at all times as well as emergency vehicles.

All service providers must sign a 37.2 Mandatory Agreement and must be inducted before they can be allowed on site.

ARRANGEMENTS FOR SITE CAMP, ABLUTIONS AND YARD, INCLUDING FOR COVID-19

Site camp location and set up

- **Restrictions / requirements:**
- **Storage areas:**
- **Security:**

} Contractor to advise in consultation with Engineer / Professional Team

Ablutions and Welfare Arrangements
Contractor to supply ablutions and facilities in line with the Construction Regulations 2014, refer to section 2.31 of this health and safety specification regarding the below. Toilets should be provided with built in facilities for hand washing. Please note further that COVID-19 control measures form an important part of ablutions provision on site ref soap and water/hand sanitiser, signage, etc:

- **Toilets:**
- **Washing facilities:**
- **Drinking Water:**
- **Shelter:**
- **Showers:**

} Contractor to provide as per Regulations

} Contractor to provide as per Regulations

Mobile site facilities requirements:

A camping toilet/mobile toilet will be required for sites that cannot facilitate a permanent location for ablution units and must be available for each gender per location.

The use of a camping toilet must be prepared and setup correctly with additional anchors and available toiletries prior to each working day and to be first priority when changing location of works along a set working path.

Teams are to ensure that the toilets are cleaned correctly and suitable for easy and hygienic uses and recorded on a daily register.

PROTECTION OF SITE AGAINST UNAUTHORISED ACCESS BY PUBLIC (INCLUDING FOR COVID 19)

Excavation Fencing: Note that excavations accessible to public, or adjacent to public roads / thoroughfares, must have (1) barrier / fence of at least 1m in height, and (2) warning illuminants at night or when visibility is poor, or have other suitable precautionary measures if of both these are not practicable.

- Orange plastic barrier mesh fencing is to be used at the minimum during excavation.
- Excavations are to be sufficiently fenced off if they are to be left open. Wherever possible, all excavations are to be backfilled at the end of each shift.
- Excavations are to be conducted in no more than 100m sections – this is to limit unnecessary risk with unsupervised excavations.
- Note requirements regarding protection of excavations in and alongside public roads. **PLEASE NOTE THAT THE PRINCIPAL CONTRACTOR WILL BE REQUIRED TO PROTECT EXCAVATIONS IN PUBLIC ACCESSED AREAS WITH 2.1M HIGH FENCING PANELS TO EXCLUDE UNAUTHORISED PERSONS (PARTICULARLY CHILDREN) FROM ACCESS TO THE EXCAVATIONS.**

General Fencing of Site: Note that construction sites in built up areas adjacent to public walkway must be fenced off and have controlled access points with the correct signs to indicate the site office for any relevant enquiries.

- Site camp / site yard is to be fenced off with 1.8m fence panels and be access controlled.
- Work areas to be fenced off with orange plastic barrier mesh fencing.

- Please note requirements of the traffic accommodation plan with respect to barricading of site.

Warning Notices: Construction warning signage must be prominently displayed to avoid unauthorised access to site and to warn of dangers associated with construction works.

Look Outs: TBA

PERSONAL PROTECTIVE EQUIPMENT (PPE)

The Client requires the Contractor to ensure that employees (and others under his/her control) wear the following minimum PPE:

Overalls: Yes.

Safety Harnesses: Yes.

Hard Hats: Yes, as per risk assessment.

Reflective Vests: Yes.

Goggles / gloves / ear defenders / respiratory protection: Yes, as per risk assessment.

Safety Footwear: Yes.

Specialist Equipment (e.g. for confined Spaces): Yes, work with asbestos and confined space working

COVID-19 PPE:

Disposable Gloves: As per COVID 19 Risk Assessment.

Disposable Overall: As per COVID 19 Risk Assessment.

Respiratory Protection (i.e. any face mask endorsed by Department of Labour): As per COVID 19 Risk Assessment and/or Government Regulations.

Eye Protection (i.e. goggles or face shield that fully covers the front and side of the face): As per COVID 19 Risk Assessment and/or Government Regulations.

HAZARDOUS SUBSTANCES

The following materials and substances have, or may have, to be used in the works and are identified as potentially posing special health and / or safety hazards during the project. Appropriate measures will need to be specified for their control:

Cement – Fuels (Petrol & Diesel) – Oils

1.10 INTERFACE AND RESTRICTIONS BY CLIENT

Contractor must note that the following Client activities will continue during construction:

- The surrounding area remains accessible to the general public.
- Client's personnel may require access to the reservoirs during the works for maintenance or inspection purposes.
- The pump station will remain operational during the works.

The following Client safety rules and/or requirements are to be observed:
All workers are to receive induction prior to commencement of work on site.
Other safety rules and requirements to be advised at induction.
Please also refer to tender document.

The following were highlighted by the client:

- PPE to be worn at all times.
- Public safety to be a priority at all times.
- Toilets to be utilized for urinating. Not against poles, structures, in bushes etc. (Fines to be issued for non-compliance)

Restrictions on times, access or other restrictions by Client
Please refer to tender document.
Other restrictions may be advised at induction.

The following were highlighted by the client:

- Work hours are as per tender.
- Road closures only allowed as per traffic accommodation plan and only allowed by prior permission of the Professional Team.
- No work to occur on Saturdays, Sundays or Public holidays. Permission is to be sought otherwise from the Professional Team.

1.11 Project Close Out

The Health and Safety files for the Principal Contractors and all Contractors require closure and handover to the Client at the completion of the project in the form of a consolidated safety file. The following list is an example of what should be included but is not exhaustive. The Safety Agent or the Client may require further information at the time of completion and the Principal Contractor is to ensure that all instructions are responded to. Documentation would include all health and safety related records from the start of the project. All records to be in hard copy or electronic format and submitted to the Safety Agent for approval in adequately formatted lists and folders. Layout should be logical and in the same order as in the site files.

Consolidated Health and Safety close out file requirements include:

- Health and safety specification (most recent version)
- Principal Contractor's health and safety plan/s
- Site safety organograms
- Legal appointments
- Notification to Department of Labour of commencement of work / Construction Work Permit
- Workman's Compensation Letters of Good Standing for the project
- Full safety files for all contractors as well as their close out reports
- List of all contractors who worked on site
- Letters of safety plan approval of contractors by the Principal Contractor
- Mandatory agreements (section 37.2 agreements)
- Incident and accident records / Occupational Disease records
- Contractor Nonconformance records
- Safety agent's audit reports
- Safety Officer reports
- Method Statements
- Risk assessments
- Safe work procedures
- Medical surveillance certificates of fitness. Medical records are to be kept according to the Occupational Health and Safety Act, as amended.
- All temporary works drawings (suspended beams/scaffolds, etc.)

- Copies of test results, policies, and procedures for environmental monitoring (silica, noise, dusts, etc.)
- Detailed registers of all material used
- Copies of all Checklists completed

1.12 SAFETY FILE RETURN TO CLIENT

The consolidated Health and Safety Files for the Project is to be handed over by the Principal Contractor to the Client upon Project Completion in either hard copy or electronic format.

2.0 FURTHER REQUIREMENTS

2.1 Duties of Principal Contractor / Contractor in terms of Construction Regulations 2014

A Principal Contractor must:

- provide and demonstrate to the Client a suitable, sufficiently documented and coherent site specific health and safety plan, based on the Client's documented health and safety specifications, *which* plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the principal contractor as work progresses;

- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, which must be made available on request to an inspector, the Client, the Client's Safety Agent, or a Contractor; and

- on appointing any other contractor, in order to ensure compliance with the provisions of the Act –

    - provide contractors who are tendering to perform construction work for the principal contractor, with the relevant sections of the health and safety specifications pertaining to the construction work which has to be performed;

    - ensure that potential contractors submitting tenders have made sufficient provision for health and safety measures during the construction process;

    - ensure that no contractor is appointed to perform construction work unless the principal contractor is reasonably satisfied that the contractor that he or she intends to appoint, has the necessary competencies and resources to perform the construction work safely;

    - ensure prior to work commencing on the site that every contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993;

    - appoint each contractor in writing for the part of the project on the construction site

    - take reasonable steps to ensure that each contractor's health and safety plan is implemented and maintained on the construction site;

    - ensure that the periodic site audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days;

    - stop any contractor from executing construction work which is not in accordance with the Client's health and safety specifications and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons;

- where changes are brought about to the design and construction, make available sufficient health and safety information and appropriate resources to the contractor to execute the work safely;

- discuss and negotiate with the contractor the contents of their health and safety plan and finally approve that plan for implementation;

- ensure that a copy of both the principal contractor and contractor's health and safety plan is available on request to an employee, an inspector, a contractor, the Client, or the Client's Safety Agent;

- hand over a consolidated health and safety file to the Client upon completion of the construction work, to include a record of all drawings, designs, materials used and other similar information concerning the completed structure;

- in addition to the documentation required in the health and safety file include and make available a comprehensive and updated list of all the contractors on site accountable to the principal contractor, the agreements between the parties and the type of work being done;

- ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3.

A contractor must prior to performing any construction work-

- provide and demonstrate to the principal contractor a suitable and sufficiently documented health and safety plan, based on the relevant sections of the Client's health and safety specification and provided by the principal contractor, which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the contractor as work progresses;

- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, and which must be made available on request to an inspector, the Client, the Client's Safety Agent or the principal contractor;

- before appointing another contractor to perform construction work be reasonably satisfied that the contractor that he or she intends to appoint has the necessary competencies and resources to perform the construction work safely;

- co-operate with the principal contractor as far as is necessary to enable each of them to comply with the provisions of the Act;

- as far as is reasonably practicable, promptly provide the principal contractor with any information which might affect the health and safety of any person at work carrying out construction work on the site, any person who might be affected by the work of such a person at work, or which might justify a review of the health and safety plan.

Where a contractor appoints another contractor to perform construction work, the duties that apply to the principal contractor will apply to the contractor as if he or she were the principal contractor.

A principal contractor must take reasonable steps to ensure co-operation between all contractors appointed by the principal contractor to enable each of those contractors to comply with these Regulations.

No contractor may allow or permit any employee or person to enter any site unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.

A contractor must ensure that all visitors to a construction site undergo health and safety induction pertaining to the hazards prevalent on the site and must ensure that such visitors have the necessary personal protective equipment.

A contractor must at all times keep on his or her construction site records of the health and safety induction training and such records must be made available on request to an inspector, the Client, the Client's Safety Agent or the Principal Contractor.

A contractor must ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3 (a template of which can be found in the Construction Regulations, 2014).

2.2 Management and Supervision of Construction Work

A principal contractor must, in writing, appoint one full-time competent person as the construction manager with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance, and in the absence of the construction manager an alternate must be appointed by the principal contractor. Proof of all-inclusive assessment of the Construction Manager's Competency in construction management and H & S competency must be available in the Safety File. The Construction Manager must, as a minimum, have a Construction Regulation course. No contractors may be left unsupervised on site by the principal contractor.

A principal contractor must upon having considered the size of the project, in writing appoint one or more assistant construction managers for different sections thereof: Provided that the designation of any such person does not relieve the construction manager of any personal accountability for failing in his or her management duties in terms of this regulation.

Where the construction manager has not appointed assistant construction managers, or, in the opinion of an inspector, a sufficient number of such assistant construction managers have not been appointed, that inspector must direct the construction manager in writing to appoint the number of assistant construction managers indicated by the inspector, and those assistant construction managers must be regarded as having been appointed.

No construction manager appointed in terms of the Regulations may manage any construction work on or in any construction site other than the site in respect of which he or she has been appointed.

A contractor must, after consultation with the Client and having considered the size of the project, the degree of danger likely to be encountered or the accumulation of hazards or risks on the site, appoint a full-time or part-time construction health and safety officer in writing to assist in the control of all health and safety related aspects on the site: Provided that, where the question arises as to whether a construction health and safety officer is necessary, the decision of an inspector is decisive.

No contractor may appoint a construction health and safety officer to assist in the control of health and safety related aspects on the site unless he or she is reasonably satisfied that the construction health and safety officer that he or she intends to appoint is registered with a statutory body approved by the Chief Inspector and has necessary competencies and resources to assist the contractor

A construction manager must in writing appoint construction supervisors responsible for construction activities and ensuring occupational health and safety compliance on the construction site. Proof of all-inclusive assessment of the Construction Supervisor's competency in construction supervision and H&S competency must be available in the Safety File. The Construction Supervisor must, as a minimum, have a supervision course as per Unit Standard 262845 (Civil Engineering), 119080 (Building Construction) and 262884 (Civil Engineering).

A contractor must, upon having considered the size of the project, in writing appoint one or more competent employees for different sections thereof to assist the construction supervisor, and every such employee has, to the extent clearly defined by the contractor in the letter of appointment, the same duties as the construction supervisor: Provided that the designation of such employee does not relieve the construction supervisor of any personal accountability for failing in his or her supervisory duties.

Where the contractor has not appointed such an employee, or, in the opinion of an inspector, a sufficient number of such employees have not been appointed, that inspector must instruct the employer to appoint the number of employees indicated by the inspector.

No construction supervisor appointed may supervise any construction work on or in any construction site other than the site in respect of which he or she has been appointed: Provided that if a sufficient number of competent employees have been appropriately designated on all the relevant construction sites, the appointed construction supervisor may supervise more than one site.

2.3 Notification of Intention to Commence Construction Work

The Contractor shall notify the Provincial Director of the Department of Labour of the intention to commence construction work at least 7 days prior to the works commencing if the intended construction work will:

- Include excavation work
- Include work at height where there is a risk of falling
- Include the demolition of a structure, or
- Include the use of explosives to perform construction work.

If the construction work involves construction of a single storey dwelling for a Client, and such Client will be residing in such dwelling upon completion, the Contractor must also notify the Provincial Director of the Department of Labour at least 7 days before the works commence.

This must be done on a form similar to an Annexure 2 (template of which can be found in the Construction Regulations, 2014). A copy of the notification letter to the Provincial Director shall be forwarded to the Client for record purposes.

2.4 Construction Work Permit

Not thought to be applicable to this project.

2.5 Assignment of Contractor's Responsible Persons to Manage Health and Safety on Site

The Contractor shall submit management and supervisory appointments as well as any relevant appointments in writing (as stipulated by the Construction Regulations 2014 and the Occupational Safety and Health Act 1993), prior to commencement of work (refer to **Annexure B** at the end of this Health and Safety Specification).

2.6 Competency for Contractor's Responsible Persons

The Contractor's responsible persons shall be competent in health and safety and be familiar with the Occupational Health and Safety Act 1993, and applicable regulations. Valid proof of pertinent health and safety courses attended by such persons will be required to be presented to the Client.

2.7 Compensation of Occupational Injuries and Diseases Act 130 of 1993 (COIDA)

The successful Contractor shall submit to the Client a valid letter of good standing with the Compensation Insurer prior to appointment.

2.8 Occupational Health and Safety Policy

The Contractor shall submit their Health and Safety Policy, prior to construction commencement, signed by the Chief Executive Officer. The Policy must outline objectives and how they will be achieved and implemented within the company operations. The Policy must be communicated to all employees and proof thereof must be available in the Safety File.

2.9 Health and Safety Organogram

The Contractor shall submit an organogram, prior to construction commencement, outlining the Health and Safety Site Team that will be assigned to the project, if successful with the tender. In cases where appointments have not been made, the organogram shall reflect the position. The organogram shall be updated when there is a change in the site team.

2.10 Risk Assessments

Baseline Risk Assessment

The Client shall cause a baseline risk assessment to be conducted by a competent person before the design process and tender process commence, and the assessed risks shall form part of the health and safety specifications.

The Contractor must, before commencement of any construction work, and during construction work, have risk assessments performed by a competent person appointed in writing, which risk assessments form part of the health and safety plan to be applied on the site and must include:

- The identification of the risks and hazards to which persons may be exposed to;
- An analysis and evaluation of the risks and hazards identified; based on a documented method
- A documented plan and applicable safe work procedures to mitigate, reduce or control the risks and hazards that have been identified;
- A monitoring plan; and
- A review plan

The Contractor must ensure that, as far as is reasonably practicable, ergonomic related hazards are analysed, evaluated, and addressed in a risk assessment.

The Contractor must ensure that all employees under his control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures and/or control measures **before any work commences** and thereafter **at the times determined in the risk assessment monitoring and review plan of the relevant site.**

The Principal Contractor must ensure that all contractors are informed regarding any hazard that is stipulated in the risk assessment **before any work commences** and thereafter **at the times determined in the risk assessment monitoring and review plan of the relevant site.**

The Contractor must consult with the health and safety committee or with a representative trade union or representative group of employees if no health and safety committee exists, on the monitoring and review of the risk assessments for the site.

The Contractor must ensure that copies of risk assessment for this site are available on site for inspection purposes by interested parties (inspector, the Client, Client's Safety Agent, any contractor, any employee, a representative trade union, a health and safety representative or safety committee member.

A Contractor must review the relevant risk assessment where changes are effected to the design and/or construction that result in a change to the risk profile, or when an incident has occurred.

Preventative measures must first address the elimination of the hazard or risk. Should PPE be required to reduce risk, the equipment or clothing to be used must be SABS approved.

In general, the Contractor must ensure that the Risk Assessment involves identifying the hazards present in a work activity on site. This is followed by an evaluation of the extent of the risk involved taking into account those precautions already being taken.
The following general principle should be followed when conducting a risk assessment:

- All relevant risks and/or hazards should be systematically addressed;
- The risk assessment should address what actually happens in the workplace during the work activity;
- All employees and those who may be affected must be considered, including maintenance staff, security guards, visitors, and Contractors;
- The risk assessment should highlight those groups and individuals who may be required to work alone or who have disabilities;
- The risk assessment process should take into account the existing safety measures and controls.
- The level of detail on a risk assessment should be appropriate to the level of risk.

2.11 Health and Safety Representative(s)

The Contractor shall ensure that Health and Safety Representative(s) is/are elected and trained to carry out his / her functions. The Safety Representative(s) must be democratically nominated, elected, and appointed in writing. The Health and Safety Representative(s) shall carry out regular inspections, keep records and report to the supervisor to take appropriate action. The Safety Representative(s) shall attend Health and Safety Committee Meetings. The Health and Safety Representative shall be part of the team that will investigate incidents, accidents, and non-conformances. The Safety Representative(s) must be (a) full time employee(s) who is/are acquainted with conditions and activities at that workplace or section thereof. The Safety Representatives must have Safety Representative training and must be capable of performing their duties.

2.12 Health and Safety Committee

Where two or more health and safety representatives have been appointed on site, the Contractor shall ensure that monthly health and safety meetings are held with such representatives and minutes are kept on record. Meetings must be organized and chaired by the Contractor's Health and Safety Committee Chairperson. Minutes of these meetings must be available for the employees of the contractor to refer to.

PLEASE NOTE THAT THE SAFETY AGENT MAY REQUIRE THAT THE PRINCIPAL CONTRACTOR CONVENES A SAFETY COMMITTEE MEETING ON SITE IN THE INTERESTS OF HEALTH AND SAFETY ON SITE. SUCH COMMITTEE MEETING MAY REQUIRE ATTENDANCE OF CONTRACTORS SAFETY OFFICERS/SAFETY REPRESENTATIVES, CONSTRUCTION SUPERVISION AND THE SAFETY AGENT.

2.13 Medical Certificate of Fitness

The contractor must ensure that their employees on site have a valid medical certificate of fitness, specific to the construction work being performed, issued by an occupational health practitioner in the form of an Annexure 3 template (refer to the Construction Regulations 2014 on the Department of Labour website for a sample of this form).

Employees required to perform work at heights or from fall risk position must be medically fit to perform such work, such employee's medicals must specify "Fall Risk" or "Working at heights" in the exposure section of the annexure 3 template.

2.14 Health and Safety Training

The Contractor shall quarterly conduct a training needs analysis to ascertain what health and safety training is required. A plan of action should be devised and forwarded to the Client for records. Once the identified people have attended the training, the Contractor must provide the Client with copies of certificates obtained.

2.14.1 Induction

No Contractor may allow or permit any employee or person to enter site unless they have undergone health and safety induction training pertaining to the hazards prevalent on site at the time of entry. This includes visitors to site. The Contractor must ensure that visitors to site have the necessary protective equipment (PPE). A copy of attendance registers of all employees who attend inductions shall be kept.

2.14.2 Awareness

The Contractor shall conduct periodic toolbox talks on site, weekly or before any hazardous work takes place. The talks shall cover the relevant activity and an attendance register must be signed by all attendees. This record of who attended and the content of the topic will be kept on the site health a safety file as evidence of training.

2.15 Competency

After the Contractor has identified the training to be conducted as part of the competency requirement, and based on Risk Assessment, he shall send the relevant persons on appropriate courses and keep certificates of training for reference. Familiarity with the Health and Safety Act and Regulations is an integral part of the definition of competence. All training must be conducted by an accredited training provider and the certificates must display the applicable unit standards and the expiry dates thereof.

2.16 General Record Keeping

The Contractor shall keep and maintain Health and Safety records to demonstrate compliance with the Health and Safety Specification and the Occupational Health and Safety Act. The contractor shall ensure that all records of incidents, spot fines, training, etc. are kept on site. All documents shall be available for inspection by the Client, or the Department of Labour's Inspectors.

2.17 General Inspection, Monitoring and Reporting

The Contractor shall carry out inspections as required by this Health and Safety Specification, as well as by health and safety legislation.

2.18 Emergency Procedures

The Contractor shall submit a detailed Emergency Procedure for approval by the Client prior to commencement on site. The procedure shall detail the response plan including the following:

- List of key personnel;
- Details of emergency services;
- Actions or steps to be taken in the event of the emergency; and
- Information on hazardous materials / situations, including each material's hazardous potential impact or risk on the environment or human and measures to be taken in the event of an accident.

Emergency procedure(s) shall include, but shall not be limited to, fire, spills, accidents to employees, use of hazardous substances, dangers as a result of riot / service delivery protests / intimidation, etc. The Contractor shall advise the Client in writing of any on-site emergencies, together with a record of action

taken, within 24 hours of the emergency occurring. A contact list of all service providers (Fire Department, Ambulance, Police, Medical and Hospital, etc.) must be maintained and available to site personnel.

2.19 First Aid Box and First Aid Equipment

The Contractor shall provide first aid box/es and appoint, in writing, First Aider(s) for this project in line with the results of the Contractor's risk assessment for the project, this health and safety specification as well as the provisions of the General Safety Regulations. The appointed First Aider(s) are to be sent for accredited first aid training before starting on site. Valid certificates are to be kept on site.

- First Aid box/es must be adequately stocked at all times, accessible and be controlled by a qualified First Aider.
- Perishables to be checked and replaced when expired.
- Stock per content list as per the General Safety Regulations Annexure.
- Signage to be in place.
- To be numbered and sealed with name of first aider on or above the First aid box.
- Dressing logbook to be available in the first aid box.
- If more than 5 employees are present, there must be a first aid box available.
- Register to be checked by a Competent person.

If required by the Client, the Contractor shall have a stretcher on site to be used in case of a serious incident.

2.20 Accident / Incident Reporting and Investigation

The Contractor shall, in addition to the prescribed requirements of the Occupational Health and Safety Act and General Safety Regulations, investigate, record, and report all Section 24 reportable incidents to the Client within 24 hours of the incident occurring. Incident investigations shall be conducted by the Contractor's appointed Accident Investigator – this Investigator must be a competent person or persons who have sufficient knowledge to carry out an investigation.

In the event of a fatality or a permanent disabling injury the Contractor must submit proof of reporting of incident to Department of Labour as well as proof of preventative measures to the Client. The Client reserves the right to conduct investigations into any incidents that they deem fit and the Contractor is required to provide full co-operation in this regard.

2.21 Hazards and Potential Situations

The Contractor shall immediately notify other Contractors of any hazardous or potentially hazardous situations, which may arise during performance of the activities.

2.22 Occupational Health and Safety Signage

The Contractor shall ascertain and provide adequate on site health and safety signage. This signage shall include, but shall not be limited to, Hard Hat / Helmet Area; Safety Shoes to be worn on site; Dust Masks to be worn in areas where there might be exposure to excessive dust; Ear Plugs / Muffs to be worn where there might be noise exposure over 85 dB; Gloves; Safety Goggles; Safety Harness, Workers in Excavation, traffic management, etc. The Contractor shall be responsible to maintain the quality and replacement of signage. Signage must comply with the requirements of SABS.

2.23 Management of Contractors by Principal Contractor

The Principal Contractor shall ensure that all contractors under his control are complying with the respective Health and Safety Plans, as well as Health and Safety Legislation.

2.24 Stacking of Materials

In addition to the provisions for the stacking of articles in the General Safety Regulations, 2003, the contractor must ensure that –

- a competent person is appointed in writing with the duty of supervising all stacking and storage on a construction site;
- adequate storage areas are provided;
- there are demarcated storage areas; and
- storage areas are kept neat and under control.

2.25 Housekeeping and General Safeguarding on Construction Sites

A contractor must, in addition to compliance with the Environmental Regulations for Workplaces, 1987, promulgated by Government Notice No. R. 2281 of 16 October 1987, ensure that suitable housekeeping is continuously implemented on each construction site, including-

- the proper storage of materials and equipment;
- the removal of scrap, waste and debris at appropriate intervals;
- ensuring that materials required for use, are not placed on the site so as to obstruct means of access to and egress from workplaces and passageways;
- ensuring that materials which are no longer required for use, do not accumulate on and are removed from the site at appropriate intervals;
- ensuring that waste and debris are not disposed of from a high place with a chute, unless the chute complies with the requirements set out in the regulations;
- ensuring that construction sites in built-up areas adjacent to a public way are suitably and sufficiently fenced off and provided with controlled access points to prevent the entry of unauthorized persons; and
- ensuring that a catch platform or net is erected above an entrance or passageway or above a place where persons work or pass under or fencing off the danger area if work is being performed above such entrance, passageway, or place so as to ensure that all persons are kept safe in the case of danger or possibility of persons being struck by falling objects.

2.26 Construction Vehicles and Mobile Plant

A contractor must ensure that all construction vehicles and mobile plant-

- are of an acceptable design and construction;
- are maintained in a good working order;
- are used in accordance with their design and the intention for which they were designed, having due regard to safety and health;
- are operated by a person who-
  - has received appropriate training, is certified competent and in possession of proof of competency and is authorised in writing to operate those construction vehicles and mobile plant;
  - has a medical certificate of fitness to operate those construction vehicles and mobile plant, issued by an occupational health practitioner in the form of Annexure 3.
- have safe and suitable means of access and egress;
- are properly organized and controlled in any work situation by providing adequate signalling or other control arrangements to guard against the dangers relating to the movement of vehicles and plant, in order to ensure their continued safe operation;
- are prevented from falling into excavations, water, or any other area lower than the working surface by installing adequate edge protection, which may include guard-rails and crash barriers;
- are fitted with structures designed to protect the operator from falling material or from being crushed should the vehicle or mobile plant overturn;
- are equipped with an acoustic warning device which can be activated by the operator;

- are equipped with an automatic acoustic reversing alarm;
- are equipped with fire extinguishers (2.5 – 4.5 kg); and
- are inspected by the authorised operator or driver on a daily basis using a relevant checklist prior to use and that the findings of such inspection are recorded in a register kept in the construction vehicle or mobile plant.

A contractor must ensure that-

- no person rides or is required or permitted to ride on a construction vehicle or mobile plant otherwise than in a safe place provided thereon for that purpose;
- every construction site is organized in such a way that, as far as is reasonably practicable, pedestrians and vehicles can move safely and without risks to health;
- the traffic routes are suitable for the persons, construction vehicles or mobile plant using them, are sufficient in number, in suitable positions and of sufficient size;
- every traffic route is, where necessary, indicated by suitable signs;
- all construction vehicles and mobile plant left unattended at night, adjacent to a public road in normal use or adjacent to construction areas where work is in progress, have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, in order to identify the location of the vehicles or plant;
- all construction vehicles or mobile plant when not in use, have buckets, booms, or similar appendages, fully lowered, or blocked, controls in a neutral position, motors stopped, wheels chocked, brakes set, and ignition secured;
- whenever visibility conditions warrant additional lighting, all mobile plant are equipped with at least two headlights and two taillights when in operation;
- tools, material, and equipment are secured and separated by means of a physical barrier in order to prevent movement when transported in the same compartment with employees;
- vehicles used to transport employees have seats firmly secured and adequate for the number of employees to be carried; and
- all construction vehicles or mobile plant travelling, working, or operating on public roads comply with the requirements of the National Road Traffic Act, 1996.
- all plant and vehicles are be fitted with amber rotating beacons and reverse alarms.
- ALL construction site vehicles must be inspected daily especially if it has dangerous "items" (fuel, explosives, etc.) on vehicle, completed inspection registers must also be available for inspection.
- the vehicles must resemble the original manufacturer's product. Levers, alarms, and amber lights to be fitted to construction vehicle for notification of vehicle.
- fire extinguishers, signage, and licence disc to be correctly mounted and displayed.
- when the vehicle is stationary no key to be left in or on vehicle or plant.
- Drip tray must be present when stationary.

2.27 Electrical Installations and Machinery on Construction Sites

A contractor must, in addition to compliance with the Electrical Installation Regulations and the Electrical Machinery Regulations, ensure that –

- before construction commences and during the progress thereof, adequate steps are taken to ascertain the presence of and guard against danger to workers from any electrical cable or apparatus which is under, over or on the site;
- all parts of electrical installations and machinery are of adequate strength to withstand the working conditions on construction sites;
- the control of all temporary electrical installations on the construction site is designated to a competent person who has been appointed in writing for that purpose;
- all temporary electrical installations used by the contractor are inspected at least once a week by a competent person and the inspection findings are recorded in a register kept on the construction site; and
- all electrical machinery is inspected by the authorized operator or user on a daily basis using a relevant checklist prior to use and the inspection findings are recorded in a register kept on the construction site.

2.28 Use and Temporary Storage of Flammable Liquids on Construction Sites

A contactor must, in addition to compliance with the provisions for the use and storage of flammable liquids in the General Safety Regulations, 2003, ensure that –

- where flammable liquids are being used, applied, or stored at the workplace concerned, it is done in a manner that does not cause a fire or explosion hazard, and that the workplace is effectively ventilated;
- no person smokes in any place in which flammable liquid is used or stored, and the contractor must affix a suitable and conspicuous notice at all entrances to any such areas prohibiting such smoking;
- an adequate amount of efficient fire-fighting equipment is installed in suitable locations around the flammable liquids store with the recognized symbolic signs;
- only the quantity of flammable liquid needed for work on one day is taken out of the store for use;
- all containers holding flammable liquids are kept tightly closed when not in actual use and, after their contents have been used up, are removed from the construction site and safely disposed of;
- where flammable liquids are decanted, the metal containers are bonded and earthed; and
- no flammable material, including cotton waste, paper, cleaning rags or similar material is stored together with flammable liquids
- proper containers are to be used for fuel. Marked and labelled as per the content.
- diesel on site; more than 800 litres must have a certificate, fire safe certificate. Locked in a ventilated, secure area with a drip tray and have a designated, responsible person to use it.

2.29 Water environments

Not thought to be applicable to this project.

2.30 Fire precautions on Construction Sites

A contractor must, in addition to compliance with the Environmental Regulations for Workplaces, 1987, ensure that –

- all appropriate measures are taken to avoid the risk of fire;
- sufficient and suitable storage is provided for flammable liquids, solids, and gases;
- smoking is prohibited and notices in this regard are prominently displayed in all places containing readily combustible or flammable materials;
- in confined spaces and other places in which flammable gases, vapours or dust can cause danger-
  - only suitably protected electrical installations and equipment, including portable lights, are used;
  - there are no flames or similar means of ignition;
  - there are conspicuous notices prohibiting smoking;
  - oily rags, waste, and other substances liable to ignite are without delay removed to a safe place; and
  - adequate ventilation is provided;
- combustible materials do not accumulate on the construction site;
- welding, flame cutting, and other hot work are done only after appropriate precautions have been taken to reduce the risk of fire;
- suitable and sufficient fire-extinguishing equipment is placed at strategic locations or as may be recommended by the Fire Chief or local authority concerned, and that such equipment is maintained in a good working order;
- the fire equipment contemplated above is inspected by a competent person, who has been appointed in writing for that purpose, in the manner indicated by the manufacturer thereof;
- a sufficient number of workers are trained in the use of fire-extinguishing equipment;
- where appropriate, suitable visual signs are provided to clearly indicate the escape routes in the case of a fire;
- the means of escape is kept clear at all times;

- there is an effective evacuation plan providing for all -
  - persons to be evacuated speedily without panic;
  - persons to be accounted for; and
  - plant and processes to be shut down; and
- a siren is installed and sounded in the event of a fire.

2.31 Construction Employees' Facilities

A contractor must, in terms of the Construction Regulations 2014, provide:

- Shower facilities after consultation with the employees or employees' representatives, or at least one shower facility for every 15 persons;
- at least one sanitary facility for each sex and for every 30 workers;
- Toilets to be within walking distance
- Hygiene registers to be completed
- Proof of safe disposal of effulgent waste disposal certificates to be obtained
- changing facilities for each sex;
- and sheltered/shaded eating area.
- Protection from the Elements and raised off the ground.
- Every employer shall provide sanitary facilities at the workplace in accordance with the provisions of Parts F, P and Q of the National Building Regulations.
- Sufficient clean water for all employees. 500ml to each employee every hour.

A contractor must provide reasonable and suitable living accommodation for the workers at construction sites who are far removed from their homes and where adequate transportation between the site and their homes, or other suitable living accommodation, is not available.

2.32 Fall protection

The Contractor must:

- designate a competent person to be responsible for the preparation of a fall protection plan
- ensure that the fall protection plan contemplated above is implemented, amended where and when necessary and maintained as required; and
- take steps to ensure continued adherence to the fall protection plan.

A fall protection plan contemplated above must include-

- a risk assessment of all work carried out from a fall risk position and the procedures and methods used to address all the risks identified per location;
- the processes for the evaluation of the employees' medical fitness necessary to work at a fall risk position and the records thereof;
- a programme for the training of employees working from a fall risk position and the records thereof;
- the procedure addressing the inspection, testing, and maintenance of all fall protection equipment; and
- a rescue plan detailing the necessary procedure, personnel and suitable equipment required to affect a rescue of a person in the event of a fall incident to ensure that the rescue procedure is implemented immediately following the incident.

A contractor must ensure that a construction manager appointed under regulation 8(1) is in possession of the most recently updated version of the fall protection plan.

A contractor must ensure that all unprotected openings in floors, edges, slabs, hatchways, and stairways are adequately guarded, fenced, or barricaded or that similar means are used to safeguard any person from falling through such openings;

Also that no person is required to work in a fall risk position, unless such work is performed safely as contemplated in above and fall prevention and fall arrest equipment are approved as suitable and of

sufficient strength for the purpose for which they are being used, having regard to the work being carried out and the load, including any person, they are intended to bear; and securely attached to a structure or plant, and the structure of plant and the means of attachment thereto are suitable and of sufficient strength and stability for the purpose of safely supporting the equipment and person who could fall, and fall arrest equipment is used only where it is not reasonably practicable to use fall prevention equipment.

2.33 Temporary works

A contractor must appoint a temporary works designer in writing to design, inspect and approve the erected temporary works on site before use.

A contractor must ensure that all temporary works operations are carried out under the supervision of a competent person who has been appointed in writing for that purpose.

A contractor must ensure that-

- all temporary works structures are adequately erected, supported, braced and maintained by a competent person so that they are capable of supporting all anticipated vertical and lateral loads that may be applied to them, and that no loads are imposed onto the structure that the structure is not designed to withstand;
- all temporary works structures are done with close reference to the structural design drawings, and where any uncertainty exists the structural designer should be consulted;
- detailed activity specific drawings pertaining to the design of temporary works structures are kept on the site and are available on request to an inspector, other contractors, the Client, the Client's Safety Agent, or any employee;
- all persons required to erect, move, or dismantle temporary works structures are provided with adequate training and instruction to perform those operations safely;
- all equipment used in temporary works structure are carefully examined and checked for suitability by a competent person, before being used;
- all temporary works structures are inspected by a competent person immediately before, during and after the placement of concrete, after inclement weather or any other imposed load and at least on a daily basis until the temporary works structure has been removed and the results have been recorded in a register and made available on site;
- no person may cast concrete, until authorization in writing has been given by the competent person contemplated above*;*
- if, after erection, any temporary works structure is found to be damaged or weakened to such a degree that its integrity is affected, it is safely removed or reinforced immediately;
- adequate precautionary measures are taken in order to-
  - secure any deck panels against displacement; and
  - prevent any person from slipping on temporary works due to the application of release agents;
- as far as is reasonably practicable, the health of any person is not affected through the use of solvents or oils or any other similar substances;
- upon casting concrete, the temporary works structure is left in place until the concrete has acquired sufficient strength to safely support its own weight and any imposed load, and is not removed until authorization in writing has been given by the competent person
- the foundation conditions are suitable to withstand the loads caused by the temporary works structure and any imposed load in accordance with the temporary works design.
- provision is made for safe access by means of secured ladders or staircases for all work to be carried out above the foundation bearing level;
- a temporary works drawing, or any other relevant document includes construction sequences and methods statements;
- the temporary works designer has been issued with the latest revision of any relevant structural design drawing;
- a temporary works design and drawing is used only for its intended purpose and for a specific portion of a construction site; and
- the temporary works drawings are approved by the temporary works designer before the erection of any temporary works.

No contractor may use a temporary works design and drawing for any work other than its intended purpose.

2.34 Excavation

A contractor must-

- ensure that all excavation work is carried out under the supervision of a competent person who has been appointed in writing for that purpose; and
- evaluate, as far as is reasonably practicable, the stability of the ground before excavation work begins.

A contractor who performs excavation work-

- must take reasonable and sufficient steps in order to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material in an excavation;
- may not require or permit any person to work in an excavation which has not been adequately shored or braced: Provided that shoring and bracing may not be necessary where-
  - the sides of the excavation are sloped to at least the maximum angle of repose measured relative to the horizontal plane; or
  - such an excavation is in stable material: Provided that-
    - permission has been given in writing by the appointed competent person contemplated above upon evaluation by him or her of the site conditions; and
    - where any uncertainty pertaining to the stability of the soil still exists, the decision from a professional engineer or a professional technologist competent in excavations is decisive and such a decision must be noted in writing and signed by both the competent person and the professional engineer or technologist, as the case may be;
- must take steps to ensure that the shoring or bracing contemplated above is designed and constructed in a manner that renders it strong enough to support the sides of the excavation in question;
- must ensure that no load, material, plant or equipment is placed or moved near the edge of any excavation where it may cause its collapse and consequently endangers the safety of any person, unless precautions such as the provision of sufficient and suitable shoring or bracing are taken to prevent the sides from collapsing;
- must ensure that where the stability of an adjoining building, structure or road is likely to be affected by the making of an excavation, steps are taken to ensure the stability of such building, structure or road and the safety of persons;
- must cause convenient and safe means of access to be provided to every excavation in which persons are required to work, and such access may not be further than six metres from the point where any worker within the excavation is working;
- must ascertain, as far as is reasonably practicable, the location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed, and must before the commencement of excavation work that may affect any such service, take the steps that are necessary to render the circumstances safe for all persons involved;
- must ensure that every excavation, including all bracing and shoring, is inspected-
  - daily, prior to the commencement of each shift;
  - after every blasting operation;
  - after an unexpected fall of ground;
  - after damage to supports; and
  - after rain,

  by the competent person, in order to ensure the safety of the excavation and of persons, and those results must be recorded in a register kept on site and made available on request to an inspector, the Client, the Client's Safety Agent, any other contractor or any employee;
- must cause every 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, to be –

  - adequately protected by a barrier or fence of at least one metre in height and as close to the excavation as is practicable; and
  - provided with warning illuminants or any other clearly visible boundary indicators at night or when visibility is poor, or have resort to any other suitable and sufficient precautionary measure where this is not practicable;
- must ensure that all precautionary measures stipulated for confined spaces as determined in the General Safety Regulations, 2003, are complied with by any person entering any excavation;
- must, where the excavation work involves the use of explosives, appoint a competent person in the use of explosives for excavation, and must ensure that a method statement is developed by that person in accordance with the applicable explosive's legislation; and
- must cause warning signs to be positioned next to an excavation within which or where persons are working or carrying out inspections or tests.

2.35 Demolition Work

A contractor must appoint a competent person in writing to supervise and control all demolition work on site.

A contractor must ensure that before any demolition work is carried out, and in order to ascertain the method of demolition to be used, a detailed structural engineering survey of the structure to be demolished is carried out by a competent person and that a method statement on the procedure to be followed in demolishing the structure is developed by that person.

During a demolition, the competent person contemplated in above must check the structural integrity of the structure at intervals determined in the method statement contemplated in above, in order to avoid any premature collapses.

A contractor who performs demolition work must with regard to a structure being demolished, take steps to ensure that-

- no floor, roof or other part of the structure is overloaded with debris or material in a manner which would render it unsafe;
- all reasonably practicable precautions are taken to avoid the danger of the structure collapsing when any part of the framing of a framed or partly framed building is removed, or when reinforced concrete is cut; and
- precautions are taken in the form of adequate shoring or other means that may be necessary to prevent the accidental collapse of any part of the structure or adjoining structure;
- ensure that no person works under overhanging material or a structure which has not been adequately supported, shored, or braced;
- ensure that any support, shoring, or bracing contemplated above, is designed and constructed so that it is strong enough to support the overhanging material;
- where the stability of an adjoining building, structure or road is likely to be affected by demolition work on a structure, take steps to ensure the stability of such structure or road and the safety of persons;
- ascertain as far as is reasonably practicable the location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed, and must before the commencement of demolition work that may affect any such service, take the steps that are necessary to render circumstances safe for all persons involved;
- cause every stairwell used and every floor where work is being performed in a building being demolished, to be adequately illuminated by either natural or artificial means;
- cause convenient and safe means of access to be provided to every part of the demolition site in which persons are required to work; and
- erect a catch platform or net above an entrance or passageway or above a place where persons work or pass under or fence off the danger areas if work is being performed above such entrance, passageway, or place so as to ensure that all persons are kept safe where there is a danger or possibility of persons being struck by falling objects.

A contractor must ensure that no material is dropped to any point, which falls outside the exterior walls of the structure, unless the area is effectively protected.

No person may dispose of waste and debris from a high place by a chute unless the chute-

- is adequately constructed and rigidly fastened;
- if inclined at an angle of more than 45 degrees to the horizontal, is enclosed on its four sides;
- if of the open type, is inclined at an angle of less than 45 degrees to the horizontal;
- where necessary, is fitted with a gate at the bottom end to control the flow of material; and discharges into a container or an enclosed area surrounded by barriers.

A contractor must ensure that every chute used to dispose of rubble is designed in such a manner that rubble does not free-fall and that the chute is strong enough to withstand the force of the debris travelling along the chute.

A contractor must ensure that no equipment is used on floors or working surfaces unless such floors or surfaces are of sufficient strength to support the imposed loads.

Where a risk assessment indicates the presence of asbestos, a contractor must ensure that all asbestos related work is conducted in accordance with the Asbestos Abatement Regulations, 2020.

Where a risk assessment indicates the presence of lead, a contractor must ensure that all lead related work is conducted in accordance with the Lead Regulations, 2001.

Where the demolition work involves the use of explosives, a method statement must be developed in accordance with the applicable explosives legislation, by an appointed person who is competent in the use of explosives for demolition work and all persons involved in the demolition works must adhere to demolition procedures issued by the appointed person.

A contractor must ensure that all waste and debris are as soon as reasonably practicable removed and disposed of from the site in accordance with the applicable legislation.

2.36 Tunnelling

Not thought to be applicable to this project.

2.37 Scaffolding

A contractor must appoint a competent person in writing who must ensure that all scaffolding work operations are carried out under his or her supervision and that all scaffold erectors, team leaders and inspectors are competent to carry out their work as per the SANS 10085 of 2004.

A contractor using access scaffolding must ensure that such scaffolding, when in use, complies with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act and SANS 10085. Scaffold must be;

- Level and balanced upon the correct footing such as base jacks, U-Jacks, and mobile wheels
- Have the correct Ledgers and bracing methods to secure the frames and Standards
- To be fully boarded with the correct edge protection on both the 0.500m and 1 metre height per working platforms.
- Working platforms to be in accordance with the Tables 4 and 5 of the SANS 10085 for weight restrictions
- Have the correct access that is fitted within the scaffold and grants access to the working platforms and must be fitted with a trap door system.
- Secured with fastening methods such Reveal and fixed ties according to table 7 of SANS 10085. Buttresses to be used when required.
- signage must be displayed to indicate if the scaffold is safe or unsafe to use.

- Trestles to be built in accordance to section 10.16.1 of the SANS 10085 and safety requirements to be met by the scaffolding inspector and scaffold supervisors on site.

2.38 Bulk mixing plant

Not thought to be applicable to this project, contractor to advise safety agent if this is not correct.

2.39 Rope Access Work

Not thought to be applicable to this project.

2.40 Hazardous Chemical Substances (HCS)

In addition to the requirements in the HCS Regulations, the principal contractor must provide proof in the Health and Safety Plan that:

- Material Safety Data Sheets (MSDS's) of the relevant materials / hazardous chemical substances are available prior to use by the contractor. All MSDS's shall be available for inspection by the agent at all times.
- Risk assessments are done at least once every 6 months.
- Exposure monitoring is done according to OESSM and by an Approved Inspection Authority (AIA) and that the medical surveillance programme is based on the outcomes of the exposure monitoring.
- How the relevant HCS's are being/going to be controlled by referring to:
  - Limiting the amount of HCS
  - Limiting the number of employees
  - Limiting the period of exposure
  - Substituting the HCS
  - Using engineering controls
  - Using appropriate written work procedures
- The correct PPE is being used.
- HCS are stored and transported according to SABS 072 and 0228.
- Training with regards to these regulations was given.

The Health and Safety plan should make reference to the disposal of hazardous waste on classified sites and the location thereof (where applicable).

The First Aider must be made aware of the MSDS and trained in how to treat HCS incidents appropriately.

2.41 Noise Induced Hearing Loss

Where noise is identified as a hazard the requirements of the NIHL regulations must be complied with and the following must be included / referred to in the Health and Safety Plan:

- Proof of training with regards to these regulations.
- Risk assessment done within 1 month of commencement of work.
- That monitoring carried out by an AIA and done according to SABS 083.
- Medical surveillance programme established and maintained for the necessary employees.
- Control of noise by referring to:
- Engineering methods considered
- Admin control (number of employees exposed) considered
- Personal protective equipment considered/decided on
- Describe how records are going to be kept for 40 years.

2.42 Explosives and Blasting

The Contractor shall ensure that the use of explosives and blasting (where required) be undertaken by a specialist contractor or a Contractor with proven track record in the type of work to be performed.

The Contractor may only use explosives for work purposes where the following conditions in place:

- Explosives Regulations to be complied with in all respects.
- Contractor must be in possession of a Blasting Licence
- Blasting permit to be obtained
- Permit to transport explosives to be obtained
- Method statement to be drawn up and approved by professional team
- Municipal authorities may require advance notice of planned use of explosives
- Contractor must notify Provincial Director of Department of Labour on Annexure 2 at least 7 days prior to blasting taking place
- Contractor must have Workman's Compensation and appropriate insurances in place

2.43 Personal Protective Equipment (PPE)

The Contractor shall carry out PPE or clothing needs analysis in accordance with his risk assessment, to determine the necessary PPE or clothing to be used during construction. The Contractor shall make provision to keep adequate quantities of appropriate, SABS approved PPE or clothing on site at all times.

The Contractor must ensure that personnel are trained in the correct use of PPE to be used.

The Contractor must ensure that lost, stolen, worn out or damaged PPE is replaced as required and receipt signed for by employees on site.

2.44 Asbestos

The Contractor shall ensure that all asbestos work is done only by registered "Asbestos Contractor" as prescribed by the Asbestos Abatement Regulations, 2020. The Contractor shall submit an Asbestos Certificate from Department of Labour which refer to the prescribed requirements. The Contractor shall notify The Client if there are any asbestos materials to be used on site.

"asbestos clearance certificate" means a written document verifying that the regulated asbestos fibre concentration in the air meets the clearance indicator;

"type 1 asbestos work" means:
(a) painting of asbestos cement products in a manner that does not require surface preparation and does not cause the release of asbestos fibres; or

(b) the removal of less than 10 square metres of asbestos cement products or equivalent gutters and piping or asbestos insulating board, where removal work may not be repeated on the same site within a period of six months; and does not require registration as a registered asbestos contractor with the chief inspector;

"type 2 asbestos work" means:
(a) the repair or encapsulation of asbestos cement products in a manner that does not require surface preparation; or

(b) the removal of asbestos cement products or asbestos insulating board; and, requires registration as a type 2 registered asbestos contractor with the chief inspector;

"type 3 asbestos work" means:
(a) the removal, repair or encapsulation of any asbestos and asbestos-containing material; and, requires registration as a type 3 registered asbestos contractor with the chief inspector;

Besides the requirements listed above, should asbestos be identified as a hazard at the workplace, the contractor must, as per AAR 2020, include the following in the health and safety plan/file and must be implemented on site:

- An asbestos risk assessment must be carried out, as far as is reasonably practicable, immediately by a competent person and thereafter at intervals not exceeding 24 months.
- If asbestos-containing materials are identified a written asbestos management plan for the workplace must be prepared by a competent person.
- Train Employees, visitors and persons who may have incidental asbestos exposure to asbestos.
- The Chief Director: Provincial Operations must be notified as per the Annexure 2 when asbestos work will be done, at least seven days prior to commencement of work.
- The contractor may only undertake the type of asbestos work for which they are registered by the chief inspector.
- Must appoint an occupational health and safety representative as contemplated in section 17 of the Act.
- Submit the approved plan of work to the Chief Director: Provincial Operations at least seven days prior to commencement of asbestos work.
- Appoint an asbestos removal supervisor for each asbestos work site.
- Adhere to the repair or removal methodology and associated control measures provided in the plan of work approved for that specific asbestos work.
- Ensure that the employee medical and training records are available on site for inspection and validation.
- Keep employee information for a minimum period of 50 years.
- For type 2 and type 3 asbestos work, ensure that air monitoring is in place.
- All asbestos contractor employees must be put under medical surveillance.
- Close off all asbestos containing or affected areas.
- The contractor must provide the required PPE, washing facilities and decontamination facilities as per the type of asbestos work.
- A document must be obtained from the asbestos disposal site for all asbestos waste removed from the workplace; all asbestos waste is disposed of only on sites specifically designated for this purpose
- When all asbestos is removed an inspection must be done by and approved inspection authority and an asbestos clearance certificate issued.
- Comply with the Prohibitions in regulation 24.

2.45 Pressure Vessels (Including Gas Bottles)

The Contractor shall comply with Pressure Vessel Regulations, including:

- Providing competency and awareness training to the operators;
- Providing PPE or clothing;
- Providing and maintain appropriate signage in areas where pressure vessels are used, as applicable;
- Inspect equipment regularly and keep records of inspections;
- Providing appropriate firefighting equipment (Fire Extinguishers).
- Under pressure vessels to have the following in place;
  - Service date
  - Seals on valves with no leaks and not broken
  - flash arrestors
  - Should be stored and chained together
  - Oxygen / Acetylene bottles to have clips
  - Signage to be visible
  - Gauges in working condition and be visible
  - Permits for use

- Pressure equip Regs 6. (1) The user shall ensure that the pressure equipment is operated and maintained within its design and operating parameters.

2.46 Fire Extinguishers and Fire Fighting Equipment

The Contractor shall provide adequate, regularly serviced fire extinguishers located at strategic points on site. The Contractor shall keep spare serviced portable fire extinguishers. The Contractor shall have adequate persons trained or competent to use the Fire Fighting Equipment.

Safety signage shall be posted up in all areas where fire extinguishers are located.

2.47 Lifting Machinery and Tackle

The Contractor shall ensure that lifting machinery and tackle is inspected before use and on a monthly basis. The Contractor shall have lifting machinery and tackle inspector who will inspect the equipment at intervals required by the Driven Machinery Regulations, taking into account that:

- All lifting machinery and tackle have a safe working load clearly indicated
- Regular inspection and servicing is carried out
- Records are kept of inspections and of service certificates
- Thorough examinations are carried out by competent personnel at the frequencies required by legislation
- There is proper supervision in terms of guiding the loads which includes a trained banks man to direct and check lifting tackle if it is safe for use
- Forklift to be inspected every year and lift plan every 2 years
- Load test certificate to be no older than 6 months
- Sufficient props to be used and max weight to be displayed
- Slings to be checked with regard to integrity, chains, serial numbers, checked for tears, cuts links and all other materials
- Hooks to be oiled, not in a fixed position and closed to prevent materials from slipping/falling off
- Lifting equipment must be used for the scope of work carried out

2.48 Ladders and Ladder work

The Contractor shall ensure that all ladders are numbered and inspected regularly keeping record of inspections. It should be noted that Aluminium ladders are preferred to wooden ladders.

2.49 General Machinery

The Contractor shall comply with the Driven Machinery Regulations, which include inspecting machinery regularly, appointing a competent person to inspect and ensure maintenance, issuing PPE or clothing and training those that use machinery and enforce compliance.

2.50 Portable Electrical Tools

The Contractor shall ensure that use and storage of all explosive actuating fastening devices and portable electrical tools are in compliance with relevant legislation.

The Contractor shall consider that:

- A competent person undertakes routine inspections;
- Only authorised persons use the tools;
- There are safe working procedures applied;
- Awareness training is carried out and compliance is enforced at all times; and
- PPE and clothing is provided and maintained.

2.51 High Voltage Electrical Equipment

The Contractor shall ensure that, where the work is under, on or near high-voltage electrical equipment the Electrical Installation Regulations, together with safety instructions (Regulations of the Owner of the Equipment) are complied with. Such equipment includes:

- Eskom and the Local Authority equipment
- The Contractor's own power supply; and
- Electrical equipment being installed but not yet taken over from a Contractor by The Client.

2.52 Public Health and Safety

The Contractor shall ensure that each person working on or visiting a site, and the surrounding community, shall be made aware of the dangers likely to arise from onsite activities and the precautions to be observed to avoid or minimize those dangers. Appropriate health and safety signage shall be posted at all times.

2.53 Night Work

The Contractor shall not undertake any night work without prior arrangement and a written permit from the Client. The Contractor shall ensure that adequate lighting is provided for all night work and failure to do so shall result in work being stopped.

2.54 Environmental Conditions and Flora and Fauna

The Contractor must be mindful of adverse weather conditions upon the health and safety of the workforce. This includes inclement weather, strong wind, heat stress, extreme cold, etc. The Contractor's risk assessment process must take into account the risks associated with such weather conditions. The same is true when working in an environment where there is a risk to employees' health and safety from presence of poisonous flora, or wildlife (including bees, snakes, etc). The Contractor's risk assessment process must take these risks into account.

2.55 Occupational Health

Exposure of workers to occupational health hazards and risks are quite common in any work environment, especially in construction. Occupational health hazards and risks exposure is a major problem and all Contractors are to ensure that proper health and hygiene measures are put in place to prevent exposure to these hazards and risks.

The occupational hazards and risks may enter the body in three ways:

- Inhalation through breathing e.g. cement dust;
- Ingestion through swallowing maybe through food intake;
- Absorption through the skin (pores) e.g. painting or use of thinners.

The contractor is required to ensure that all his personnel are medically fit prior to being allowed onto the work site.

All Contractors should ensure that Occupational Hygiene surveys are conducted as per the Occupational Health and Safety Act to ensure employees are not exposed to hazards. Risk Assessments should identify areas where surveys are to be conducted.

2.56 Suspended Platforms

Not thought to be applicable to this project.

2.57 Material Hoists

Not thought to be applicable to this project.

2.58 Explosive Actuated Fastening Device

No contractor may use or permit any person to use an explosive actuated fastening device, unless-

- the user is provided with and uses suitable protective equipment;
- the user is trained in the operation, maintenance and use of such a device
- the explosive actuated fastening device is provided with a protective guard around the muzzle end, which effectively confines any flying fragments or particles; and
- the firing mechanism is so designed that the explosive actuated fastening device, will not function unless-
  - it is held against the surface with a force of at least twice its weight; and
  - the angle of inclination of the barrel to the work surface is not more than 15 degrees from a right angle.

A contractor must ensure that-

- only cartridges suited for the relevant explosive actuated fastening device, and the work to be performed, are used;
- an explosive actuated fastening device is cleaned and examined daily before use and as often as may be necessary for its safe operation by a competent person who has been appointed for that purpose;
- the safety devices of an explosive actuated fastening device are in good working order prior to use;
- when not in use, an explosive actuated fastening device and its cartridges are locked up in a safe place, which is inaccessible to unauthorized persons;
- an explosive actuated fastening device is not stored in a loaded condition;
- a warning notice is displayed in a conspicuous manner in the immediate vicinity wherever an explosive actuated fastening device is used; and
- the issuing and collection of cartridges and nails or studs of an explosive actuated fastening device are-
  - controlled and done in writing by a person having been appointed in writing for that purpose; and
  - recorded in a register by a competent person and that the recipient has accordingly signed for the receipt thereof as well as the returning of any spent and unspent cartridges.

2.59 Confined Spaces

Confined space work must be closely monitored by a competent person appointed by the contractor, to include, but not restricted to, ensuring that the confined space is sufficiently ventilated prior to entry. Oxygen levels to be tested in confined space to ensure that it is safe for entry. Permit system to be in place to declare confined space safe for entry prior to entry. PPE must be worn (such as proper masks) if air supply is insufficient or not of sufficient quality.

Sufficient training must take place in use of all confined space monitoring and access equipment prior to any works commencing in such confined space. It is strongly recommended that a tripod and winch system be in place to afford easy access and egress and for emergency evacuation from the confined space (manholes and chambers). Please also refer to GSR5 on safety requirements for Work in Confined Spaces.

General safety Regulations 5.
(1) An employer or a user of machinery shall take steps to ensure that a confined space is entered by an employee or other person only after the air therein has been tested and evaluated by a person who is competent to pronounce on the safety thereof, and who has certified in writing that the confined space is safe and will remain safe while any person is in the confined space, taking into account the nature and duration of the work to be performed therein.

(2) Where the provisions of sub regulation (1) cannot be complied with the employer or user of machinery, as the case may be, shall take steps to ensure that any confined space in which there exists or is likely to exist a hazardous gas, vapour, dust or fumes, or which has or is likely to have, an oxygen content of less than 20 per cent by volume, is entered by an employee or other person only when-- (a) subject to the provisions of sub regulation (3), the confined space is purged and ventilated to provide a safe atmosphere therein and measures necessary to maintain a safe atmosphere therein have been taken; and (b) the confined space has been isolated from all pipes, ducts and other communicating openings by means of effective blanking other than the shutting or locking of a valve or a cock, or, if this is not practicable, only when all valves and cocks which are a potential source of danger have been locked and securely fastened by means of chains and padlocks.
(3) Where the provisions of sub regulation (2)(a) cannot be complied with, the employer or user of machinery shall take steps to ensure that the confined space in question is entered only when the employee or person entering is using breathing apparatus of a type approved by the chief inspector and, further, that—
(a) the provisions of sub regulation (2) (b) are complied with;
(b) any employee or person entering the confined space is using a safety harness or other similar equipment, to which a rope is securely attached which reaches beyond the access to the confined space, and the free end of which is attended to by a person referred to in paragraph (c);
(c) at least one other person trained in resuscitation is and remains in attendance immediately outside the entrance of the confined space in order to assist or remove any or persons from the confined space, if necessary; and
(d) effective apparatus for breathing and resuscitation of a type approved by the chief inspector is available immediately outside the confined space.

(4) An employer or user of machinery shall take steps to ensure that all persons vacate a confined space on completion of any work therein.

(5) Where the hazardous gas, vapour, dust or fumes contemplated in sub regulation (2) are of an explosive or flammable nature, an employer or user of machinery shall further take steps to ensure that such a confined space is entered only if –
(a) the concentration of the gas, vapour, dust or fumes does not exceed 25 per cent of the lower explosive limit of the gas, vapour, dust or fumes concerned where the work to be performed is of such a nature that it does not create a source of ignition; or
(b) such concentration does not exceed 10 per cent of the lower explosive limit of the gas, vapour, dust or fumes where other work is performed.

2.60 Alcohol and drugs (GSR 2)

1. A contractor shall not permit any person who is or who appears to be under the influence of intoxicating liquor or drugs, to enter or remain at a site.

2. No employee shall be under the influence of or have in his or her possession or partake of or offer any other person intoxicating liquor or drugs.

3. An employer or a user, as the case may be, shall, in the case where a person is taking medicines, only allow such person to perform duties at the site if the side effects of such medicine do not constitute a threat to the health or safety of the person concerned or other persons at such site.

2.61 COVID-19 (PLEASE NOTE THAT THIS SECTION IS CONSTANTLY UNDER REVIEW)

This section is based on the requirements of Government Gazette No 43257 dated 29th April 2020, and the latest Disaster Management Act 2002.

The importance of the management and control of this virus by contractors on site is paramount.

For this reason no work is permitted on site until the contractor has submitted proposals in their safety plan to the safety agent and professional team on how the risk of COVID-19 transmission on site will be managed by the contractor (monitoring and implementation of control measures through administrative, physical and other control measure).

DEFINITIONS *(Disaster management Act of 2002)*

'adequate space' means not more than one person per one and a half metres of floor space;

'Alert Level' means the determination made under sub regulation 3(2);

'clinical case' means a patient that presents with clinical signs and symptoms of COVID-19;

'COVID -19' means the Novel Coronavirus (2019- nCov2) which is an infectious disease caused by a virus that has previously not been scientifically identified in humans, which emerged during 2019 and was declared a global pandemic by the WHO in 2020;

'Criminal Procedure Act' means the Criminal Procedure Act, 1977 (Act No 51 of 1977);

'enforcement officer' includes a member of the South African Police Service, the South African National Defence Force. metro police. traffic officers, immigration inspectors; and a peace officer as defined in section 1 of the Criminal Procedure Act;

'essential services' means the services listed in Annexure D;

'face mask' means a cloth face mask or homemade item that covers the nose and mouth, or another appropriate item to cover the nose and mouth;

'gathering' means any assembly, concourse or procession in or on -
(a) any public road, as defined in the National Road Traffic Act, 1996 (Act No. 93 of 1996); or
(b) any other building, place or premises. including wholly or partly in the open air, and including, but not limited to, any premises or place used for any sporting, entertainment, funeral, recreational, religious, or cultural purposes; but excludes a workplace and a place of residence for those persons ordinarily residing at the residence;

'health protocols' means the COVID-19 health protocols determined by the Director General of Health;

'head of an institution' means the accounting officer of a public institution and the chief executive officer or the equivalent of a chief executive officer of a private institution;

'institution' means any public or private institution, including a sole practitioner and any other business owned and operated by a single person, that is engaged in the supply or distribution of a good or service as set out in the Table 1, or which regulates such supply or distribution, including professional regulatory bodies designated in directions made in terms of regulation 4 of the Regulations;

'isolation' means separating a sick individual with a contagious disease from healthy individuals that are not infected with such disease in a manner that aims to prevent the spreading of infection or contamination;

'national state of disaster' means the national state of disaster declared by Government Notice No. R. 313 of 15 March 2020;

'quarantine' means the restriction of activities or separation of a person, who was or may potentially have been exposed, to COVID-19 and who could potentially spread the disease to other non -exposed persons, to prevent the possible spread of infection or contamination to healthy individuals;

'the Act' means the Disaster Management Act, 2002 (Act No. 57 of 2002); and
'WHO' means the World Health Organisation.

Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several Coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered Coronavirus causes Coronavirus disease COVID-19.

COVID 19 is a viral pandemic that has and is causing a great deal of damage to human health, countries' economies and health systems and has led to lock downs, work stoppages and restriction of movement that threatens the existence of many jobs, as well as the way we conduct our normal working and social lives.

In response to the pandemic the government has passed legislation and guidance for employers and employees in the work environment.

People can catch COVID-19 from others who have the virus. The disease can spread from person to person through small droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales. These droplets land on objects and surfaces around the person. Other people then catch COVID-19 by touching these objects or surfaces, then touching their eyes, nose or mouth. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets. This is why it is important to stay more than one meter away from a person who is sick.

Please refer to Annexure A for details on the criteria that must be considered in the contractor's safety plan response.

2.62 General Practices when Working at Heights

- No Homemade structures or ladders will be permitted on the project.
- Trestle tables are not to be fully extended and must be fully boarded, no drums to be used.
- Surroundings to be clear of rubble.
- Fall protection, fall prevention, and fall rescue plans to be in place and communicated to site employees.
- Ladders to be structurally sound and not broken and in accordance to GSR 13A.
- Only competent persons may be allowed to work at heights
- Correct personal protective equipment to be used (safety harness and lanyard) and edge protection / life lines to be used.
- Anchor points to be in place and determined by an engineer. Anchor points must be pull tested prior to use.
- GSR (6) 6. No employer shall require or permit any person to work in an elevated position and no person shall work in an elevated position, unless such work is performed safely from a ladder or scaffolding, or from a position where such person has been made as safe as if they were working from scaffolding.

- Construction regulation 10 of 2014 to be implemented when working at heights and to prevent any person from falling from heights.
- Employees required to perform work at heights or from fall risk position must be medically fit to perform such work, such employee's medicals must specify "Fall Risk" or "Working at heights" in the exposure section of the annexure 3 template.

2.63 Traffic Management

All traffic signs must be displayed as per the traffic management plan drawings.
Size of signs used must be as per the traffic management drawings and all signs to be visible and in good condition.

- Traffic management Plan issued per Road and Traffic act (chapter 13). Must be approved by the Traffic Chief and professional team.
- Plans for signage deployment must be in order and must be placed correctly.
- Traffic management plan must be submitted and must be suitable for the tasks being performed.
- Traffic plan must be implemented and controlled by the sites Traffic safety officer and flag persons.
- Jersey barriers, where used, to be linked.
- No signs to be obstructed.
- STOP/GO structures must be protected against being struck by vehicles (e.g. new jersey barriers)
- Road marking buggies/vehicles must be protected by escort vehicles front and rear.
- Displayed traffic signs must be maintained in a daily register to be checked morning and evenings after works have been finalised.

Size of signs used must be as per the traffic management drawings and all signs to be visible and in good condition.

- Traffic accommodation Plan issued must be approved by the professional team.
- Plans for signage deployment must be in order and must be placed correctly.
- Traffic accommodation plan must be submitted and must be suitable for the tasks being performed.
- Traffic plan must be implemented and controlled by the sites Responsible Person and flag persons.
- As applicable, road marking buggies/vehicles must be protected by escort vehicles front and rear.

2.64 **Ventilation and Lighting in the Work Place**

Every employer shall cause every workplace in his undertaking to be lighted in accordance with the illuminance values specified in the Schedule to the General Safety Regulations:

Provided that where specialised lighting is necessary for the performance of any particular type of work, irrespective of whether that type of work is listed in the Schedule or not, the employer of those employees who perform such work shall ensure that such specialised lighting is available to and is used by such employees.

The Contractor must ensure that:
- the average illuminance at any floor level in a workplace within five meters of a task is not less than one fifth of the average illuminance on that task;
- glare in any workplace is reduced to a level that does not impair vision;
- lighting on rotating machinery in such that the hazard of stroboscopic effects is eliminated; and
- luminaires and lamps are kept clean and, when defective, are replaced or repaired forthwith.

With a view to the emergency evacuation of indoor workplaces without natural lighting or in which persons habitually work at night, every employer shall, in such workplaces, provide emergency sources of lighting which are such that, when activated, an illuminance of not less than 0.3 lux is obtained at floor level to enable employees to evacuate such workplaces: Provided that where it is necessary to stop machinery or shut down plant or processes before evacuating the workplace, or where dangerous materials are present or dangerous processes are carried out, the illuminance shall be not less than 20 lux.

The contractor must ensure that the emergency sources of lighting prescribed above:
- are capable of being activated within 15 seconds of the failure of the lighting prescribed by subregulation (1);
- will last long enough to ensure the safe evacuation of all indoor workplaces;
- are kept in good working order and tested for efficient operation at intervals of not more than three months; and
- where directional luminaires are installed, these are mounted at a height of not less than two meters above floor level and are not aimed between 10° above and 45° below the horizontal line on which they are installed.

The contractor must ensure that all rooms, stairways, passageways, gangways, basements, and other places where danger may exist through lack of natural light, to be lighted such that it will be safe.

The contractor must ensure that every workplace in his undertaking is ventilated either by natural or mechanical means in such a way that –

- the air breathed by employees does not endanger their safety;
- the time-weighted average concentration of carbon dioxide therein, taken over an eight-hour period, does not exceed one half per cent by volume of air;
- the carbon dioxide content thereof does not at any time exceed three per cent by volume of air;
- the prescribed exposure limits for airborne substances therein are not exceeded; and
- the concentration therein of any explosive or flammable gas, vapour or dust does not exceed the lower explosive limit of that gas, vapour, or dust.

2.65 Nuclear Density Gauge (Troxler)

The use of a Troxler on site must be in line with the SANS 3001 of March 2014. The SANS consists of 5 sections

The in-situ density of road construction materials is only determined in civil engineering using indirect methods such as the nuclear density gauge and sand replacement methods.
This method forms part of a set of methods used to operate nuclear gauges, and includes the following:
a) administration, handling, and maintenance (see SANS 3001-NG1);
b) validation of standard calibration blocks (see SANS 3001-NG2);
c) calibration of a nuclear gauge (see SANS 3001-NG3);
d) verification of a nuclear gauge (see SANS 3001-NG4):
e) in situ density determination using a nuclear gauge (see SANS 3001-NG5)

When used Troxlers must be:

- Stored in a dedicated, lockable area and must have a warning signage displayed.
- Must only be transported in a dedicated vehicle with the required signage displayed and by an authorised employee that has been appointed in writing.
- Must have a Troxler Calibration Certificate in place.
- Must have a Troxler Technician Appointment on file and signed and proof of competency within the safety file.

2.66 Ergonomics Regulation of 2019

"competent person" in relation to ergonomics, means a person who– *(a)* has in respect of the work or task to be performed the required knowledge, training and experience in ergonomics and, where applicable, qualifications specific to ergonomics: provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualifications Framework Act, 2008 (Act No. 67 of 2008), those qualifications and that training must be regarded as the required qualifications and training; and *(b)* is familiar with the Act and the applicable regulations made under the Act;

"ergonomic risk" means a characteristic or action in the workplace, workplace conditions, or a combination thereof that may impair overall system performance and human well-being;

"ergonomic risk assessment" means a programme, process, or investigation to identify, analyse, valuate and prioritise any risk from exposure to ergonomic risks associated with the workplace;

"ergonomics" means the scientific discipline concerned with the fundamental understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance;

The ergonomics regulations will apply to any employer or self-employed person who carries out work at the workplace who may expose any person to an ergonomic risk in the work place and any designer, manufacturer, importer or supplier of machinery, plant, or work systems for the work place.

An employer must, before the commencement of any work that may expose employees to ergonomic risks, have an ergonomic risk assessment performed by a competent person.

The ergonomic risk assessment must be done at intervals not exceeding two years and must include the following;

- a complete hazard identification and all persons who may be affected by the ergonomic risk.
- how employees may be affected by the ergonomic risks;
- the analysis and evaluation of the ergonomic risks;
- the prioritisation of ergonomic risks.

An employer must review the relevant ergonomic risk assessment if:

- such assessment is no longer valid;
- control measures are no longer effective;
- technological or scientific advances allow for more effective control methods;
- there has been a change in –
  - the work methods;
  - the type of work carried out; or
  - the type of equipment used to control the exposure; and
  - an incident occurs or medical surveillance reveals an adverse health effect, where ergonomic risks are identified as a contributing factor.

An employer must ensure that an employee is placed under medical surveillance, which is overseen by an occupational medicine practitioner, if–

- the ergonomic risk assessment referred to in regulation 6 indicates the need for the employee to be placed under medical surveillance; or
- an occupational health practitioner recommends that relevant employees must be under Medical surveillance, in which case the employer may call upon an occupational medicine practitioner to ratify the appropriateness of such recommendation.

An employer must ensure that the medical surveillance consists of–

- in the case of a new employee, an initial health examination before the employee commences employment or within 30 days of commencement of such employment;
- a periodic health examination informed by the ergonomic risk assessment, at intervals specified by an occupational medicine practitioner, but not exceeding two years; and
- an exit health examination informed by the ergonomic risk assessment.

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Both the Client and the Contractor have a duty in terms of health and safety legislation to do all that is reasonably practicable to make members of the public and others being affected by the construction processes aware of possible risks and put preventative measures in place to mitigate the risks. The public and/or visitors shall go through a brief health and safety induction detailing hazards and risks they may be exposed to and what measures are in place to control these hazards and risks.

OTHER HEALTH AND SAFETY SPECIFICATION REQUIREMENTS

The contractor must be aware of the following additional requirements:

What	When	Output
Awareness training (Toolbox Talks)	At least weekly and before hazardous work is carried out	Attendance Register
Health and Safety Committee Meetings	Monthly	Minutes signed by the employer (Contractor) covering: a) Health and Safety Representative Checklist b) Safety report from Safety Officer and Safety Agent
Health and Safety Reports	Monthly	Report covering: a) Incidents/Accidents and Investigations b) Non-conformance c) Health and Safety Training d) HIRA Updates e) Internal and External Audits
General Inspections	As per Health and Safety Specification and OHSA	Report on Health and Safety Specification and OHSA compliance: a) Scaffolding b) Lifting Machinery c) Excavation
General Inspections	Monthly	Covering: a) Firefighting Equipment b) Portable Electrical Equipment c) Ladders
Record keeping	Ongoing	Covering: a) General complaints b) Fines c) General incidents d) MSDS e) Surveillance Medicals f) Inspection Register g) Dept of Labour Notices
Permits	Before commencement with certain activities	As stipulated by the Health and Safety Specification and the OHSA / Construction Regulations

Key:

OHSA – Occupational Health and Safety Act, 1993

ANNEXURE A – REQUIREMENTS FOR THE SAFETY PLAN ASSESSMENT (INCLUDING COVID 19 REQUIREMENTS)

The Contractor must note that the information below is pertinent to the compilation of their safety plan response to this site-specific safety specification and it would be preferred if the Safety Plan is written in the order of the assessment documented below.

No	Item	Notes
1	**Project Directory**	Please state details of Project Client, Project Manager/Principal Agent, Safety Agent, Consulting Engineer, etc. (Name, address, contact details).
2	**Contractors Directory**	Please indicate if you will be using Contractors on this project, if yes, include their details, trade, and FEM details.
3	**Other Parties Directory**	Please indicate contact details for any services applicable (electricity, water, etc.) as well as Department of Labour and Emergency Services.
4	**Project Safety Statement**	The Project Safety Statement must be included in the Safety Plan.
5	**Health and Safety standards for the project (OHS Act, construction regulations, basic conditions of employment, etc.)**	Health and Safety standards must be included in the Safety Plan.
6	**Project Particulars**	Scope of works must be included in the Safety Plan. This is critical.
7	**Existing environment – Structures and Surroundings, Services (Electrical, Water, Sewerage, etc.), Traffic Arrangements, Parking, Access to Site, Storage of Plant and Materials**	Please include these items in the plan. The items must be Site Specific, the location of services and services that will be affected must be mentioned.
8	**Management Structure for safety on the Project**	A structured organogram with names of the responsible people must be included.
9	**Appointed Persons, Supervision**	The required appointments must be identified. A list of the appointed persons must be included in the Safety Plan.
10	**Security Procedures**	Please indicate if a security company will be appointed and include the contact information in the Safety Plan.
11	**Registers list and inspection frequency**	A list of the Inspection Registers that will be on file must be included in the Safety Plan.
12	**Design Co-ordination**	Please indicate your procedure for implementation of design changes by designer on the project, and the procedures for liaison and implementation of temporary works design on the project.
13	**Contractor Co-ordination**	Mention must be made of how Contractors will be co-ordinated on site to ensure that they work together and not adversely affected health and safety.

No	Item	Notes
14	**Housekeeping, stacking and storage**	Housekeeping policies and procedures must be included in the Safety Plan.
15	**Waste Disposal Arrangements**	Waste disposal arrangements procedures must be included in the Safety Plan.
16	**Noise and dust control**	Please indicate if any noisy operations (more than 85 decibels) will be carried out and what measures will be used to reduce noise exposure to workforce.
17	**Training Requirements**	Training requirements must be identified and recorded.
18	**Plant and Equipment**	A list of plant and equipment to be used on site must be included in the Safety Plan.
19	**Safety Monitoring Arrangements**	The name, contact details and SACPCMP registration status of the Safety Officer must be included in the Safety Plan. State how often the Safety officer will be on site (note safety specification requirement in section 1.7).
20	**Information for Contractors**	State how information will be given to Contractors on site.
21	**Consultation/communication arrangements with Employees**	State how information will be given to employees e.g. notice board.
22	**Selection of Contractors Procedures**	Principal contractor must state what health and safety procedures they will use to assess the competence and resources of their contractors on site.
23	**Activities with risk to Health and Safety (Risk Assessment)**	A Baseline Risk Assessment must be included in the Safety Plan, it must address the Risks identified in the Safety Specification as well as the risk of any other hazards that the Principal Contractor is aware of that are relevant to the site.
24	**Hazardous Substances**	Must be listed in the Safety Plan and addressed in the Risk Assessment.
25	**First Aid and Medical Procedures**	Please indicate name of first aider, position of first aid box, location of nearest medical facility and emergency numbers.
26	**Fire and Emergency Procedures**	List of emergency telephone numbers must be drawn up and included in the Safety Plan. The position of Fire Extinguishers, Assembly Point location, fire drill frequencies, numbers of fire marshals, etc.
27	**Accident and Incident Reporting and investigation**	State the Accident and Incident Reporting and investigation procedures of your company.
28	**Welfare and Site Facilities**	Elaborate on toilets and eating areas, water provision, COVID-19 ablution provision, how will workers be protected during wet weather conditions etc.
29	**Site Rules**	The Site Rules must be included in the Safety Plan.
30	**Personal Protective Equipment**	The necessity must be identified by Risk Assessments, the required PPE for site risks and COVID-19 control measures.
31	**Health & Safety File arrangements**	Please indicate arrangements for the return of the Health and Safety File to the safety agent at the end of the project.

No	Item	Notes
32	**Method Statements/Safe System of Works**	A list of Method Statements/Safe System of Works must be included in Safety Plan for all High-risk activities. **PLEASE NOTE THAT THIS IS PARTICULARLY RELEVANT FOR COVID-19. NO WORK MAY COMMENCE UNLESS COVID-19 RISKS AND CONTROL MEASURES HAVE BEEN APPROVED BY THE PROFESSIONAL TEAM. REFER TO SECTION 2.61 OF THIS SAFETY SPECIFICATION.**
33	**Permits and wayleaves**	List of activities that Principal Contractor anticipates will require permits and wayleaves (including those stated in the safety specification) to be included.
34	**Fall Prevention and Protection Plan and Fall Rescue Plan**	A copy of the Fall Prevention and Protection Plan, fall rescue plan and fall risk assessment must be included in the Safety Plan.
35	**Demolition method statement**	A copy of the Demolition Method Statement must be included in the Safety Plan.
36	**Confined spaces**	The Principal Contractors' procedures for managing access, egress and work in confined spaces must be specified in the Safety Plan. Includes permit procedures, air monitoring, PPE, etc.
37	**Safety Representatives and Safety Committees**	When a project has more than 20 employees a designated employee must be chosen by the labourers to represent them. A safety committee must be established if 2 or more safety representatives are appointed. Please note Safety Specification requirements regarding this section (section 2.12).
38	**Have the significant hazards from the safety specification been addressed?**	See section 1.9 of the Specifications and ensure practical measures have been detailed in the safety plan.
39	**Safety File - Safety Policies in File and Signed by 16(1) CEO.**	Safety Policies must be signed and explained to employees.
40	**Safety File - A copy of the valid Letter of Good standing from FEM / Workman's Compensation must be on file.**	A copy of the valid Letter of Good standing from FEM / Workman's Compensation must be on file.
41	**Safety File - Signed copy of the 37.2 Mandatary Agreement**	A 37.2 Mandatary Agreement needs to be signed between the Client and the Principal Contractor.
42	**Safety File - Appointment letter from Client (as well as 5.1.K)**	The Client must appoint the Principal Contractor in writing.
43	**Safety File – Notification / Permit**	A copy of the Annexure 2 Notification (and proof of submission) to Department of Labour must be available. This can be in the form of a Department stamp, email, or copy of Construction Work Permit.

CONTROL MEASURES THAT MUST BE INCLUDED FOR SAFETY PLAN SUBMISSION PURPOSES:

Issues that must be included by the contractor in their COVID-19 safety plan response should include arrangements for the following (please note that reference to contractors' employees / staff / workers / personnel on site must include control of their (sub)contractors, visitors and suppliers):

Workplace Plan - A plan must be developed by the contractor for the phased in return of employees to site. Please refer to the latest regulations and amendments, all persons who are able to work from home should do so.

Coordination on Site Relating to COVID-19 matters - The Employer must appoint a manager as a COVID-19 Compliance Officer (required of all industries, businesses, entities, both private and in the public sector). This compliance officer is responsible for overseeing the following:

- implementation of the workplace plan; and adherence to the standards of hygiene and health protocols relating to COVID-19 at the workplace;
- developing a plan for the phased in return of their employees to the workplace, prior to reopening the workplace for business, which plan must correspond with Annexure E of the Disaster Management Act 2002 (as amended April 2020) and be retained for inspection and contain the following information:
  - which employees are permitted to work;
  - what the plans for the phased-in return of their employees to the workplace are;
  - what health protocols are in place to protect employees from COVID-19; and
  - the details of the COVID-19 compliance officer;
  - phase in the return of their employees to work to manage the return of employees from other provinces, metropolitan and district areas; and
  - develop measures to ensure that the workplace meets the standards of health protocols, adequate space for employees and social distancing measures for the public and service providers, as required.

Transportation to Site - Procedures for Transportation of Workers to Site – employees should be advised that if using transport, passengers must wear a cloth mask to be allowed entry into the vehicle. Hand sanitisers must be made available, and all passengers must sanitise their hands before entering. Public transport vehicles must be sanitised on a daily basis. Please note that the government mandated limit on passengers per vehicle must be strictly adhered to.

Site access - Entry to site may only be through pre-arranged security controlled access points. Contractor must detail how will members of public be prevented from accessing site (risk of cross contamination between persons working on site and members of public).

Provision of Visitors Book for signing in and out of site. Records of all personnel entering site and their contact details must be kept.

Screening on Site - Contractor to advise how will personnel on site be screened on a daily basis for symptoms of COVID-19, including a symptom check as well as temperature assessment (digital thermometer). The contractor must describe their procedure for employees on site, suspected of having COVID-19 symptoms, refusing to undergo **medical** examination, prophylaxis, treatment, isolation, and quarantine. Sites with more than 500 employees must have testing facilities.

Risk assessment and safety procedure - Contractor must provide a written policy concerning the protection of it staff from COVID-19. Contractor must compile a COVID-19 risk assessment and safety procedures for the site. The Policy must include how will it be communicated to all on site and records kept thereof. The Risk Assessments must include the identification of exposure levels, identification of "high contact" activities, the identification of vulnerable workers and special measures for their protection, including protection against unfair discrimination or victimization. The COVID-19 risk

assessment and COVID-19 OHS policy must be submitted to DoEL if employer have more than 50 employees.

Safety Signage and Hotline Number - Contractor to implement placement of COVID-19 safety signage and hotline number at site entrance and on site, warning of hazards and advising control measures (see samples in Annexure to this document). Please note that signage must representative of the local languages.

Communication Procedures - Contractor to describe comprehensive induction and toolbox talk procedures to include COVID-19. Toolbox talks should be conducted weekly on COVID-19 control measures and risks on site, include personal hygiene - manner of controlling coughing and sneezing on site - in elbow.

Emergency Procedure - Contractor must describe communication of COVID-19 symptoms and protocol that must be followed if person demonstrates symptoms, or is thought to have COVID-19 - symptoms of COVID-19 include cough, sore throat, shortness of breath or fever/chills (or ≥ 38°C measured temperature), redness of eyes, also additional symptoms – body aches, loss of smell or loss of taste, nausea, vomiting, diarrhoea, fatigue, weakness or tiredness. Contractor must advise personnel on site of the symptom reporting procedure to site management of COVID-19 symptoms, and referral protocol for screening or testing if showing symptoms.

Emergency COVID-19 protocol that must be put in place by Principal Contractor must include:

- Sick workers may not enter workplace.
- If sick worker already on site then worker must be isolated in designated area for isolation on site, provided with FFP1 surgical mask and transported for self-isolation or for medical examination or testing at identified testing site.
- Worker placed on sick leave.
- On receiving their results, the employee and/or health professional supporting the employee should notify their workplace so that the employee is managed accordingly. The workplace should proactively take steps to obtain this information to avoid any delays in reporting.
- Assess the risk of transmission, disinfect area and workers workstation, refer exposed workers for screening, etc.
- Lodge claim with Workman's Compensation if infection occupationally acquired.
- Worker may only return to work after undergoing a medical evaluation confirming worker has tested negative for COVID-19.
- Worker must be closely monitored for symptoms on return to work.
- If worker has been diagnosed with COVID-19 the employer must notify Dept of Health and Dept of Employment and Labour

NOTE THAT: personnel on site, or presenting themselves to site who appear sick, or have symptoms associated with COVID-19 may not be allowed on site.

Welfare and Washing Facilities, Sanitising and Disinfection - Contractor must describe provision of soap and clean running water and sanitisers at site entrance and at other locations on site. Correct manner of washing / disinfecting hands, 20 second rule. Use of paper towels only. Disinfection of work surfaces and equipment control procedures required - carried out before work begins, regularly during day and after work ends. Toilets, common areas, door handles, shared electronic equipment and any other shared equipment must be regularly cleaned and disinfected, biometric systems disabled or made COVID-19 safe.

Hand sanitiser must contain 70% alcohol.

Employees working away from home should be provided with hand sanitiser by the employer.

COVID-19 PPE on Site - Contractor must describe controls for wearing of PPE on site, including wearing of cloth masks on site - people working and visiting site must be instructed on the correct way of

wearing cloth masks, procedure for maintenance and replacement of cloth masks. Surgical masks and N95 masks should only be worn by frontline health workers, not site staff. Note that some surgical masks should be kept on site to give to persons exhibiting COVID-19 symptoms prior to being taken away for testing.
Employer is required to provide each employee with at least 2 cloth masks.

Supervision and Monitoring on Site - Monitoring systems must be in place by Contractor to ensure compliance with safety protocols and identify infections among employees - supervision monitoring and enforcement - how will it be done by the contractor?

Ventilation on Site - How will ventilation and air quality be made safe on site.

Waste Management - Sufficient refuse bins must be on site for disposal of tissues, used PPE. Procedure for safe removal of contents of bins; used PPE, other detritus should be made in contractors safety plan.

Social Distancing Measures - Contractor must describe, so far as practicable how can numbers of workers be minimised on site at any one time (e.g.: through staff rotation, staggered working hours, shift systems, remote working arrangements or similar to achieve social distancing? (1.5m). Note that contractor must minimise contact between workers themselves and workers and public.

Depending on what is reasonably practicable, site must be arranged so that there is distance of at least 1.5m between workers and members of public or put physical barriers in place or provide workers with face shields or visors.

COVID-19 Investigation procedure - Contractor must describe how will they investigate the cause of COVID-19 infection (including control failure and risk assessment review, checking of PPE requirements, admin support to contact tracing implemented by Dept of Health).

Important notes:

If more than 50 employees in contractors employ the employer must submit this risk assessment and written policy re health and safety of employees from COVID-19 to Safety Committee and Department of Employment and Labour.

Monitoring by the Safety Agent will be strict - noncompliance with COVID-19 control measures will be reported immediately to the principal contractor for action purposes. If necessary, transgressors will be removed from site for re-induction, or a recommendation for permanent barring from site will be made.

As this is an ongoing medical crisis it is likely that control measures to prevent the spread of the virus will be updated by the government on a regular basis. Hence the measures in this section of the safety specification will be reviewed on an ongoing basis, as we receive updated information from the government.

ANNEXURE B – LEGAL APPOINTMENTS The contractor shall make the following appointments, as required:
Chief Executive Officer (OSH Act 16(1)
Contract Director/Manager (OSH Act 16(2)
Construction Manager (CR 8(1)
Construction Supervisor (CR 8(7)
Assistant Construction Supervisor (CR 8(8)
Construction Safety Officer (CR 8(5)
Traffic Safety Officer
Safety Representative (where > 20 employees on site)
Temporary work Designer (CR 12(1)
Temporary work Supervisor (CR12(2)
Construction risk assessor (CR 9(1))
Excavation Supervisor (CR13(1)(a)
Demolition Supervisor (CR14(1)
Scaffold Supervisor (CR16(1)
Suspended Platform Supervisor (CR17(1)
Material Hoist Inspector (CR19(8)(a)
Material Hoist Operator (CR19(6)
Bulk Mixing Plant Supervisor (CR20(1)
Bulk Mixing Plant Operator (CR20(2)
Controller of Explosive Actuated Fastening Devices Nails, Cartridges or Studs Issue and Collection (CR21(2)(g)(1)
Construction Vehicle and Mobile Plant Operator (CR23(1)(d)(i)
Controller of Temporary Electrical Installations (CR24(c)
Stacking Supervisor (CR28(a)
Fire Extinguishing Equipment Inspector (CR29(h)
Fall Protection Plan Developer (CR 10(1)(a)
Incident Investigator (OSH Act 9(2)
Competent Person – Confined Spaces (GAR 5(1)
COVID 19 – Compliance Officer and COVID 19 – Manager (to address employees concerns and keep them informed re COVID-19)

ANNEXURE C - BASELINE RISK ASSESSMENT FOR PROJECT

Irrespective of the risk presented on site, it will be ensured that sufficient supervision is in place on site, that personnel are trained in accordance with legislation, including the requirement for site specific inductions on site to inform personnel on site of the risks and hazards applicable to the site. Site supervision is responsible for ensuring that the control measures required below are implemented on site.

	HAZARD	RISK	MINIMUM CONTROL MEASURES
1.	Asbestos Cement Pipes and asbestos cement roof	Release of asbestos fibres	• Ensure safe access and egress is provided • Erect physical barriers to prevent entry by unauthorised persons, as applicable • damp down exposed area to contain fibre release • Personnel involved to wear asbestos respiratory protection • Exclusion zone may be required • Only Department of Labour registered asbestos contractors may work with asbestos, and strictly in accordance with the requirements of the Asbestos Abatement Regulations.
2.	Asphalting	Fire Burns to skin Skin disease	• Suitable fire extinguisher to be in place prior to commencement of works • Ensure competent personnel using materials and competent and trained machinery/equipment operators • Ensure there is a safe place of work at all times • Ensure all personnel wear suitable and sufficient personal protective equipment (PPE) including safety boots, reflective vests and gloves • Health and Safety data sheet required
3.	Bricklaying	Caustic contamination with mortar Contact with sharp bladed tools	• Use only trained personnel • Safe means of access to be provided • Safe/Suitable working platform required where working at height • PPE for mortar to include gloves where practicable and goggles/ masks where there is a risk of contamination
4.	Compacting and Filling	Contact with tipping materials Contact with moving plant Vehicles/personnel falling into excavations Contact with underground services	• Trained banksman to control vehicles movement • Only trained personnel use plant • Personal Protective Equipment to be worn • Personnel to stand clear as materials are being tipped • Use stop blocks and signs to warn vehicles of excavations, where applicable • Stand clear of plant whilst materials are being compacted • Establish position of underground services and protect services from damage
5.	Compactor Operations	Crushing of feet	• Only trained and competent personnel to use the machine • Ensure operative wears steel toe cap shoes or boots at all times
6.	Concrete Pumping	Sprains and strains Hit by pump Concrete burns Collapse/bursting of structure	• Personnel to be in clear vision of pump operator • Trained pump operator • Personnel working with the concrete to wear the appropriate personal protective equipment to protect against cement burns • Design of structure being loaded to be approved by competent designer and inspected before, during and after loading • Pump to be well maintained

	HAZARD	RISK	MINIMUM CONTROL MEASURES
7.	Confined Spaces	Suffocation Fumes	• Ensure that confined space is sufficiently ventilated • Wear personal protective equipment such as proper masks if air supply insufficient or not of sufficient quality • Test oxygen levels in confined space to ensure that is safe for entry • Ensure that emergency procedures in place
8.	Cutting Kerbs	Saw slipping, Blade disintegrating, Noise, and Dust	• Only trained operators to use saw and change blades. • Personal Protective Equipment must be worn. Gloves, goggles, dust mask and hearing protection. • People to be kept away from the work area. • Work to cease if people have to pass. • Sparks, etc. to be directed away from people and any flammable material.
9.	Cutting Off Disc	Noise Cuts from machine Fire (particularly at refuelling) Flying debris Blade shattering Contamination by fume created or exhaust fume	• Use competent personnel. • Hot works control- fire extinguisher, fire watchman. (Permit may be required) • PPE to include gloves, eye protection, hearing protection • Solid working position. • Clear working area • Correct grade of blade must be used. • Good ventilation to be provided (forced if necessary). • Changing of wheels to be by competent persons only • Cut off discs must not be used for grinding (grinding disc thicker) • Bystanders to wear hearing protection, as applicable
10.	Demolition	Falling materials Premature collapse of structure	• Ensure there is a current method statement in place • Ensure all emergency procedures are in place and all details are displayed • Ensure that structural demolition has been approved by the designer and site management • Personnel must be competent • Ensure at all times there is a safe means of access and egress • All personnel must wear suitable and sufficient Personal Protective Equipment, including head, eye and skin protection
11.	Electrical Commissioning	Electric shock	• Personnel to comply with permits to work issued by Client • Personal protective equipment to be worn by employees to prevent electric shock • First aid treatment to be readily available • Only competent and trained persons may decommission or commission electrical equipment
12.	Electric Tools and Electrical Installations	Electric shock Fire	• Electric tools and installations to be in good condition • Inspect electric tools before use • Do not use electric tools in wet/damp conditions • Use personal protective equipment such as insulated gloves • Electrical installations register to be maintained, inspected by competent person

	HAZARD	RISK	MINIMUM CONTROL MEASURES
13.	Excavations (Working in and around)	Toxic fumes Collapse of trench walls/trapping Falling into excavation Collapse of adjacent structures	• Deep excavations / monitor air for toxic fumes • Prevent collapse by battering back sides to a safe angle or install temporary support • Protect vehicles from falling into excavations – provide barriers, signage, etc. as necessary • Beware of undermining of other structures (e.g. buildings, scaffolds) • Record excavation inspections by competent person on daily basis • Provide suitable means of access/egress in case of emergency. • Excavations formed by explosives must be accompanied by method statement approved by Client
14.	Explosive Actuated Fastening Devices	Noise Being struck by cartridge or fixing	• Operators to be trained, competent and wear appropriate protective equipment, e.g. goggles, gloves, ear defenders, head protection. • Cartridge gun to be in good condition, inspected for damage and faults regularly and results entered into register • Used and unused cartridges and cartridge gun should be kept in secure place when not in use, maintain register for return and issue.
15.	Explosive use	Injuries to personnel, passers-by by blast Property damage	• Blaster must have all relevant permits, permissions, and licences in place before blasting. • Method statement must be approved. • Maintain exclusion zone around perimeter of blasting, warn persons away, erect warning signage and barriers. • Obtain permission from local authority and police. • Blaster must be competent in blasting • Ensure that blasting does not affect stability of adjacent structures/buildings
16.	Fire	Injuries to workers, pedestrians, residents, road users, damage to property through fire	• No littering on site which could become fire hazard, maintain site in clean condition. • No fires to be lit on site. Have a working fire extinguisher at hand at all times. • No smoking or naked flame near flammable substances or in unauthorised areas • Ensure proper storage/use of Petrol/diesel/flammable substances – post warning notices
17.	Flammable Liquids and Gases (Use of)	Fire Explosion	• No littering on site which could become fire hazard, maintain site in clean condition. • Have a working fire extinguisher at hand at all times. • No smoking or naked flame near flammable substances or in unauthorised areas • Ensure proper storage/use of Petrol/diesel/flammable substances – post warning notices • Equipment must be in good condition, maintained • Personnel using substances must be trained in safe use and risks
18.	Hand tools	Injuries caused by use of hand tool Impact with the tool Falls due to access problems Contamination with substance being worked	• Ensure: • Tool is correct for job • Tool is in good order and suitably sharp • Personnel must be competent/instructed in tool usage and tool safely • Lighting is sufficient • Access is safe, working platform is secure, leading edge is guarded • Operative is wearing all necessary PPE

	HAZARD	RISK	MINIMUM CONTROL MEASURES
19.	Hazardous Substances	Injuries to workers through use of hazardous substances, e.g. injuries to eyes, skin, etc.	• Use substances in accordance with data sheet, particularly reference protective clothing required (example: gloves, goggles, etc.) • Know what First Aid measures are • Have welfare facilities available for washing of hands, etc.
20.	Hot Works	Burns to eyes or other parts of the body	• Personal Protective Equipment to include eye, skin, and hearing protection • Respirator maybe be required where cutting galvanized steel or anywhere else toxic fumes and gases arise. Dust can also be a problem and forced ventilation may be required.
21.	Kerb Laying	Nips at joints Crushing by kerbs Caustic burns	• Impervious gloves and barrier cream to be used to protect hands. • Personnel should be aware of safe manual handling techniques when handling kerbs.
22.	Lifting Operations	Falling material Crushing by materials Hand injuries to the slinger Toppling crane	• Check test certificate • Check examination certificate • Check inspection have been carried out • Check certificates for lifting equipment (chains, slings, shackles, etc.) • Ensure lifting gear is rated to carry load (SWL) • Ensure materials being lifted are properly packaged and slung. • Be aware that there should be a minimum clearance of 600mm between any slewing parts of a crane and any fixed installation to prevent being trapped. • Access to the work area during lifting operations is to be restricted to those involved with and trained in the work in hand. Do not allow members of the public to gain access to the area. • Only trained banksmen to be used. • The crane driver and the banksman are to ensure that the signals given are clearly understood.
23.	Live Services	Striking of live services	• Make all necessary enquiries to establish what services are in the area. Consult drawings and advice from service provider (e.g. Municipality or ESKOM) when planning work. • Assume all service to be live (Unless confirmation is received to confirm that services are isolated or otherwise made safe). Do not work near live services without authorisation from site management. • Comply with the requirements of the safe system of work for underground services. • Where available, locate services with a locator • Hand dig around services
24.	Manhole Rings and Pipes Storage	Rolling of rings Collapse of pipes Crushing of persons Stock pile collapse	• Manhole rings must be stored flat to prevent them being rolled. • Banks of pipe stock piles are not to be broken until they are ready for use. • Personnel must stand to the side when breaking bands so as not to be hit by falling pipes. • Pipes must be wedged to prevent rolling

	HAZARD	RISK	MINIMUM CONTROL MEASURES
25.	Manual Handling of General Items	Muscular skeletal injuries if the load is too heavy or awkward Operative falling/ tripping Contamination from the substance being carried Fall of material being carried	• Personnel should be aware of safe manual handling techniques • Personnel to wear Personal Protective Equipment when carrying items, e.g. safety footwear and gloves. • Ensure good housekeeping against tripping/fall hazards. • Operative to get assistance if load too heavy- team lift if necessary. • Utilise mechanical lifting and carrying aids where possible. • Personnel to ensure access equipment, ladders will take weight of operative and load being carried. • Personnel to ensure item being carried is properly bonded or is not be liable to break apart whilst being manually handled.
26.	Members of Public – Protection of	Injury to member of public and road users from site works	• Barriers and signage to be in place • Workers must warn away any members of public from the works • Footpaths and bridges which are open to public must be closed off if in area of works or otherwise made safe so that no injury occurs to members of public • Traffic turning into site – traffic management and signage as required. • Signage to be on road at site entrance warning motorists that construction traffic turning into/out of site access. Keep roads free of mud where possible • Refer to plant risk assessment for details on plant safety precautions • NOTE: SIGNAGE TO BE POSTED ON SITE TO WARN OF CONSTRUCTION TRAFFIC MOVEMENTS. SAFE MEANS OF ACCESS FOR BOTH CONSTRUCTION TRAFFIC TO SITE AND PRIVATE HOMEOWNERS MUST BE AGREED.
27.	Mobile Crane Erection and Dismantling and Use	Collapse of structure Overturning of structure Falling materials	• Ensure emergency procedures are in place and all operative are aware of the details • Only use trained and competent operators for the erection and dismantling and use of cranes • Ensure crane driver is trained and holds certification as proof. Must have valid medical certificate of fitness. • Ensure there is safe means of access available at all times • Ensure the mobile crane driver has 360° vision if not ensure a fully trained banksman is used • Banksman to wear reflector vest to identify himself to the crane driver • Ensure all personnel wear suitable and sufficient personal protective equipment • Consider creating exclusion areas
28.	Noise and Dust	Breathing in dust can cause long term health problems, noise can damage hearing	• Wear respiratory and hearing protection • Dampen down and minimise dust where possible.
29.	Overhead Services (Working near)	Contact with live services causing injury to personnel Damage caused to services	• Maintain safe clearance levels • Establish presence of any services via proper walk through survey of site and/or means of service drawings • Wear personal protective clothing • Ensure height of plant/vehicles does not compromise or exceed clearance levels for overhead services • Obtain information on clearance levels from service provider

	HAZARD	RISK	MINIMUM CONTROL MEASURES
30.	Painting	Contact with paint	• Refer to safety data sheet for usage instructions, hazards and precautions required. • When working at height, refer to risk assessment addressing this hazard below.
31.	Paving (Laying)	Impact injuries from tile / mallet Caustic burns Sore knees Cuts from cutter	• Impervious gloves to be worn/ barrier cream to be used • Kneelers or similar to be available • Personal protective equipment to be worn – for example if saw used to cut pavers
32.	Plant or Vehicles and Equipment Operation	Workers injured by passing traffic Road users and pedestrians at risk from plant operation Noise	• Implement traffic protection measures • Trained and competent operators must be used • Check plant and vehicles on daily basis before use and record inspections. Maintain vehicles in safe condition. • Medical certificates of fitness required for construction plant. • Crossing of road by construction vehicles or machines must be limited to the practical minimum • Plant and vehicles must be fitted with amber rotating beacons and reverse alarms. • Wear appropriate protective clothing/equipment, e.g. goggles, gloves, ear defenders, etc. as appropriate.
33.	Plastering	Falling materials Fall from height Contact with materials	• Ensure standard safety procedures are followed • Ensure there is a safe working area • Ensure safe access and egress • Ensure competent personnel are used
34.	Road Construction	Risk of being struck by vehicles	• Ensure traffic management measures in place • No construction activities to commence until adequate provision made to accommodate traffic in accordance with the South African Traffic Signs Manual. • Wear reflective waistcoats when working on or near the road or road shoulder as well as any other required personal protective clothing. • Crossing of road by personnel must be limited to the practical minimum • Use of fencing or other barriers as appropriate
35.	Road Working – working in or next to road	Injury to workers caused by passing traffic Injury to road users and pedestrians by works	• Flagmen to be used where interface with construction plant with passers-by or where hazard posed by delivery vehicles turning into/out of site. • Traffic management plan to be approved by Municipality and, if necessary, traffic department • No construction activities to commence until adequate provision made to accommodate traffic in accordance with the South African Traffic Signs Manual. • Use safety signage to warn traffic and pedestrians of construction works • Where existing walk ways/pavements affected by works, must direct pedestrian traffic away to safe walking area. • Wear reflective waistcoats when working on or near the road or road shoulder as well as any other required personal protective clothing. • Crossing of road by personnel must be limited to the practical minimum • Use of fencing or other barriers as appropriate

	HAZARD	RISK	MINIMUM CONTROL MEASURES
36.	Scaffold Erection/ Dismantling	Personnel falling from a height Items of scaffold falling onto personnel Scaffold collapsing onto those below	• Ensure • scaffold is designed to take the imposed loads • scaffolding is constructed properly • scaffold is not overloaded • scaffolders are fully trained • scaffolding is regularly checked by competent person and record of inspection retained. Written inspections to be recorded on weekly basis • scaffolders must adhere to the safe systems of work. • all fall arrest equipment to be checked and certified in good working order • that ALL understand the safe system of work
37.	Shuttering Walls, Beams, Columns	Falling from height Falling materials from height Cuts and abrasions from splinters and nails	• Ensure all personnel wear the appropriate Personal Protective Equipment • Ensure at all times there is a safe working platform • Use only trained and competent personnel • If electrical tools are being used ensure they have been tested and safe to use • Ensure timber is de-nailed after use • Ensure safety standards are followed at all times • Ensure there is a safe means of access and egress at all times
38.	Site Strip	Overturning Vehicles	• Follow standard safety procedures • Only use trained and competent personnel • Ensure there is a suitable and safe means of access and egress • Ensure banksman used when required • Ensure all personnel wear suitable reflector vests as required
39.	Snakes	Snake bite	• Qualified first aider required for site who can treat snakebite • Snake bite kit to be on hand • Check area before working • Find out nearest hospital and get emergency telephone numbers.
40.	Steel Erection	Falls from height Falling components Contact injuries from falling lifting equipment	• Adhere to all general precautions for working at height (See risk assessment below) • Barrier off / exclude area below work • All lifting appliances to be examined and inspected • Inspection register in place and up to date • All personnel to be trained and competent and wear clipped on safety harnessed when working at height • Ensure that lifting equipment (slings, chains, shackles) test certificates are current and on site. • Competent persons only to connect loads and direct plant
41.	Steel Fixing	Back injuries caused by manual handling Eye injuries from tie wire Trips / falls Falling form height	• PPE must include safety boots and goggles • Manual handling training may be required • Care to be taken when working near overhead lines • Use only trained personnel • Provide safe means of access • Maintain and regularly inspect all lifting appliances and equipment • Cap starter bars to prevent injuries where feasible • Construct scaffold walk ways to cross reinforcing mesh, as required

	HAZARD	RISK	MINIMUM CONTROL MEASURES
42.	Temporary Works	Collapse of temporary works	• Wear personal protective equipment such as gloves and goggles • Formwork must be built by trained person and also be inspected by competent person and results entered into register on site
43.	Tower (Mobile Aluminium Tower) Scaffold	Over Turning Falls	• Tower to be on firm level ground with wheels or feet properly supported. • Height not to exceed 3 times the base dimension. i.e. 2x3m Base Tower not exceed 6m. • Erection by competent person • Inspection before first use • Weekly record of inspection required • Guard rails and Toe boards as per normal scaffolds • Beware when moving of overhead obstructions, such as power lines • Never move in strong winds
44.	Troxler – use of	Radiation exposure Transportation and storage of nuclear equipment Working in road	Ensure • Training of Troxler gauge operators in basic radiation safety and correct operating procedure to satisfactory level of competence • An enclosed vehicle must be used for transport of the gauge • After use and before storing the gauge, a visual check to be carried out to confirm shutter is properly closed • Warning signage to be displayed at entrance to store indicating presence of radioactive material • Wear reflective vests when working in or near the road or road shoulder as well as any other required personal protective clothing.
45.	Underground Services	Striking of buried services	• Make all necessary enquiries to establish what services are in the area. Consult drawings and advice from service provider (e.g. Municipality or ESKOM) when planning work. • Assume all service to be live (Unless confirmation is received to confirm that services are isolated or otherwise made safe). Do not work near live services without authorisation from site management. • Comply with the requirements of the safe system of work for underground services. • Where available, locate services with a locator • Hand dig around services
46.	Working at Height	Personnel falling form height Falling debris Those beneath being injured	• All access equipment is properly constructed (inspections record must be maintained) • Only trained personnel construct, dismantle or control the access equipment • All access equipment must have full toe boards and guardrails - comply with SANS 10085 on erection, use and dismantling of scaffolding • No access equipment may be loaded above the level of the guardrail • No access equipment to be loaded above its safe working load • Where work involves leaning out on an open leading edge, then all personnel are to be fitted with full body harness. The harness must be connected at all times • All fall arrest equipment to be correctly maintained • Ensure if ladders are being used for access, they are either footed or tied. Also, the ladder must be set at the correct level of 1 in 4 or approximately 75°

ANNEXURE D - BASELINE RISK ASSESSMENT FOR PROJECT – COVID-19

It must be ensured that sufficient supervision is in place on site, that personnel are trained in accordance with legislation, including the requirement for site specific inductions on site to inform personnel on site of the COVID 19 risks and hazards applicable to the site. Site supervision is responsible for ensuring that the control measures required below are implemented on site.

No.	HAZARD	MINIMUM CONTROL MEASURES
1.	COVID-19 - Contracting COVID-19, person to person transmission	• Do not share tools / equipment, crockery/cutlery/towels/bedding or anything that can facilitate the spread of the virus. • Masks have not been proven to definitively protect against every contagion. However, masks prevent a person from unconsciously touching their eyes, nose and mouth, so they may offer a measure of protection. Masks are for single use only, not to be worn two days in a row. • Avoid touching your eyes, nose, and mouth and shaking hands with others. • Cough or sneeze into a tissue and dispose thereof safely into a bin provided. • Wash your hands frequently with soap and running water for no less than 20 seconds. If you have none available use a hand sanitiser with at least 70% alcohol. • Apply social distancing principles, stay at least 1.5m away from people/employees were possible. • Avoid crowds and gatherings. • Clean frequently touched objects/surfaces. • The following cleaning products can be used: Hypochlorite (e.g. Household Bleach) Alcohol (70%) Hydrogen Peroxide Phenolic Compounds Quaternary Ammonium Compounds

No.	ACTIVITY	HAZARD	MINIMUM CONTROL MEASURE
2.	Site Preparation	Site might be infected with COVID-19 contagion during lock down	• Inspect the site to assess conditions. Revise any policies, method statements for risks and hazards identified for review. • Decontaminate the site, in affected areas, ensure the availability of hand washing facilities and sanitizers, throughout the site, and at entrances. Ensure sanitising and hand washing facilities are available at ablution areas, common eating areas, offices, canteens, security
3.	Occupational Health	Older workers of 60+, workers with underlying auto-immune or chronic diseases are at increased risk of infection (note that workers may be symptom free but infected with COVID-19)	• All workers are to be screened and have a valid certificate of fitness on return to work. A full questionnaire to be completed daily before entry on site, and those identified as high risk, or exhibiting flu like symptoms, must be separated and refused entry to site until declared symptom free by a medical practitioner.
4.	Labour	Underlying auto-immune or chronic diseases, socio-economic status, having to use public transport to get to work	• A full questionnaire to be completed daily before entry on site, and those identified as high risk, or exhibiting flu like symptoms, must be separated and refused entry to site until declared symptom free by a medical practitioner. • Daily temperature readings to be taken on entry to site; Induction, toolbox talks to be done daily on topics relating to COVID-19, personal hygiene and PPE. Strict enforcement on use of PPE • Public traffic must comply with government guidelines ref wearing of masks and sanitising requirements.

No.	ACTIVITY	HAZARD	MINIMUM CONTROL MEASURE
5.	Transportation (Public and on Site)	Maximum allowed capacity exceeded; No facilities for sanitising vehicles and passengers; No additional protective measures available, e.g. face masks; Unlicensed drivers and operators	• Selection and provision of transport services compliant with gazetted requirements; Policy and procedures and rules for travel, where possible to limit the use of public transport, or to arrange selective methods of transport, ongoing toolbox talks and supply of cloth masks to be worn when travelling or moving on and off site. Vehicles sanitised between trips; hand sanitiser provided for passengers. Public transport services can carry 100% of their loading capacity except for long-distance services which are allowed to only carry up to 70% of their loading capacity.
6.	Social Distancing	Many construction tasks require more than 1 worker that will be required to work within the limit of 1,5m Access/Egress to and off site; Welfare facilities, Meeting areas	• Demarcation and spacing of queueing areas; segregation of queueing areas and public outside site perimeters; Meeting/eating areas large enough to maintain 1.5m distance at maximum occupancy. • Only essential workers to spend time on site, Staggered meeting/eating times, use of Zoom, Skype, Microsoft Teams for meetings where necessary. Individual, segregated facilities for safe keeping.
7.	Waste Management	Spreading of virus and contact with virus causing infection from handwashing, drying hands, cleaning equipment, disposal of contaminated waste and other related aspects	• Establish and follow protocols for disposal of potentially infected waste (receptacles). Awareness through notices (posters) regarding correct procedures of waste disposal. Competent supervision and adequate awareness training required. Provide adequate supplies of material and consumables, provision of sealable disposal containers/bags through appropriate waste removal company. Provide adequate supply of paper towels. If contractors used ensure appropriate management.
8.	Signage	Unauthorised entry to site and work areas compromising workers health (contamination). Acts and behaviour that compromises worker	• Installation of posters and signage with the site rules and protocols that need to be maintained at strategic points. Competent supervision and adequate awareness training required. Disciplinary steps to be taken against transgressors.
9.	Welfare Facilities	Spreading of virus and contact with virus causing infection	• Limiting of personnel on site to minimum number required to maintain control and management. Implement and maintain cleaning and disinfecting programme. • Site rules for social distancing to 1.5m. Use technology to avoid proximity between individuals where possible
10.	Use of Personal Protective Equipment	Risk of spread of droplet infection through coughing, sneezing when in close contact with other people	• No employee/ visitor will be allowed on site without a cloth mask. Adequate training must be provided in the correct use and disposal of these masks. Cloth masks must be washed and ironed. Where possible face shields should be used to protect mouth, nose and eyes. Regular cleaning of face shields required. • No sharing of PPE will be permitted. Adequate supervision required. COVID PPE does not replace conventional PPE.

ANNEXURE E - COVID-19 SITE SAFETY SIGNAGE





ANNEXURE F – GUIDELINES TO HEALTH AND SAFETY BILL OF QUANTITIES

Not thought to be applicable to this project.

ANNEXURE G – SAFETY SPECIFICATION AND BASELINE RISK ASSESSMENT ISSUE REGISTER

Date of Original Safety Specification Compilation	Compiled By	Issue Date
October 2021.	Mark Winter	26th October 2021.

Revision Summary	Revised By	Revision Date

Acknowledgement:

I, _____representing

_____(Contractor), have satisfied myself with the content of this Health and Safety Specification and shall ensure that our employees and contractors on site comply with the requirements of this document, our safety documentation and health and safety legislation.

_____ _____

Signature of Contractor Date

Comments:

_____

_____

_____

_____

_____

_____

C6 Drawings

The Works shall be carried out in accordance with the following drawings which are included in Part C6 : Drawings and form part of the contract documents:

Table 3.2.4.1: List of Drawings

CONSULTANT'S DRAWING NUMBER	DESCRIPTION	REVISION
21108-C-000	Localiy Plan	A
21108-C-001	Existing Services Layout	A
21108-C-004-02	New 315mm dia Rising Main from Reservoir 1 to 2	A
21108-C-004-03	Proposed Reservoir Layout and Piping	A
21108-C-004-04	Proposed Bulk Earthworks: Cut to Fil Based on FGL	A
21108-C-004-05	Proposed Bulk Earthworks: Cut Depth to Reservoir Foundation	A
21108-C-004-06	Proposed Zone Amendments at Reservoir 2	A
21108-C-004-07	Proposed Zone Amendments at Paddy Street	A
21108-C-004-10	Outlet Section at Reservoir	A
21108-C-004-11	Scour Section at Reservoir	A
21108-C-007-01	Layout at Reservoir 1	A
21108-C-007-02	Layout at Reservoir 2	A
21108-C-200	Typical Detail of Water Thrust Blocks	A
21108-C-201	200mm Diameter Water Meter Detail	A
21108-C-202	Scour Chamber Detail	A
21108-C-203	Typical Detail of Storm Water Manhole for pipes up to 600mm diam.	A
21108-C-204	Typical Detail of Gate Valve and Fire Hydrant	A
21108-C-205	Typical Detail of Air Valve	A
21108-C-207	Typical Detail of Tie In Connection	A
21108-C-208	Typical Detail of Stw Inlet-Outlet Structures	A
21108-C-209	Typical Detail of Security Fence	A
21108-C-210	Detail of Connection at Reservoir 2	A
21108-C-211	Tie In Connection at Reservoir 3	A
21108-C-212	Detail of 150mmØ Water Pipe Cranking	A
21108-C-213	Detail of 100mmØ Water Pipe Cranking	A
21108-C-214	Detail of 75mmØ Water Pipe Cranking	A
21108-C-215	Typical Detail of Premix Road Reinstatement	A
21108-S-001	Concrete Layout & Details 1	A
21108-S-002	Concrete Layout & Details 2	A

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CONTRACT DOCUMENT

FOR

CONTRACT NO: **T60/2021**

FOR

CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

(RETURNABLE DOCUMENT)

- The Form Of Offer and Acceptance (C1.1) is on C1-Page 1 of this document
- The Preferencing Schedule is on T2-Pages 35 - 37 of this document

TENDERER	
CONTACT PERSON	
TEL NO.	
FAX NO.	
TENDER AMOUNT	
COMPLETION PERIOD (WEEKS)	

VOLUME 2: RETURNABLE DOCUMENT : MECHANICAL AND ELECTRICAL WORKS

ISSUED BY:

LANGEBERG MUNICIPAL OFFICES
28 MAIN ROAD
ASHTON,
6715

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Part T2: Returnable Documents

T2.1 List of Returnable Documents

The tenderer (Mechanical & Electrical Subcontractor or JV partner) must complete the following Returnable Documents in **black ink:**

1. Returnable Schedules required for tender evaluation purposes

1: SCHEDULE OF WORK EXPERIENCE .....
2: TAX CLEARANCE CERTIFICATE, TCS SARS COMPLIANCE STATUS PIN, BARGAINING COUNCIL CERTIFICATE AND MINIMUM WAGE DECLARATION .....
3: CONFIRMATION OF CONTRACTOR ENTERPRISE REGISTRATION .....
4. DECLARATION OF "IN THE SERVICE OF THE STATE"… .....
5: DECLARATION FOR MUNICIPAL SERVICES AND PAYMENTS TO SERVICE PROVIDER .....
6: DATA SHEETS FOR MECHANICAL & ELECTRICAL EQUIPMENT .....

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SCHEDULE 1 : SCHEDULE OF WORK EXPERIENCE

The tenderer shall insert in the spaces provided below a list of similar completed civil engineering contracts awarded to him and those currently being undertaken. This information is deemed to be material to the award of the Contract.

COMPLETED CONTRACTS				
EMPLOYER (NAME, TEL No AND FAX No)	CONSULTING ENGINEER (NAME, TEL No AND FAX No)	NATURE OF WORK	VALUE OF WORK R(m)	DATE COMPLETED

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CURRENT CONTRACTS				
EMPLOYER (NAME, TEL No AND FAX No)	CONSULTING ENGINEER (NAME, TEL No AND FAX No)	NATURE OF WORK	VALUE OF WORK R(m)	ANTICIPATED COMPLETION DATE

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 2 : TAX CLEARANCE CERTIFICATE, TCS SARS COMPLIANCE STATUS PIN, BARGAINING COUNCIL CERTIFICATE AND MINIMUM WAGE DECLARATION

(A) TAX CLEARANCE CERTIFICATE

A TCS SARS compliance status pin (valid at tender closing date) from the South African Revenue Services (SARS) shall be attached to this Schedule or proof that the tenderer has made arrangements with SARS to meet his or her outstanding tax obligations.

Each party to a Consortium/Joint Venture shall submit a separate Tax Clearance Certificate, or proof that he or she has made the necessary arrangements with SARS.

Failure to submit a TCS SARS compliance status pin will result in the invalidation of the tender/bid.

(B) BARGAINING COUNCIL CERTIFICATE OF COMPLIANCE

1) Tenderers must be registered with a relevant Bargaining Council (if such be in place) and provide the applicable Certificate of Compliance in terms of the relevant Government Gazette.

Where applicable, a Certificate of Compliance issued by the relevant Bargaining Council shall be attached to this schedule. Each party to a Consortium/Joint Venture shall attach separate certificates in the above regard.

(C) DECLARATION IN RESPECT OF MINIMUM WAGE

The tenderer, by signing this schedule, declares that not less than the statutory minimum wage shall be paid to employees, as applicable.

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 3 : CONFIRMATION OF CONTRACTOR ENTERPRISE REGISTRATION

A. CENTRAL SUPPLIER DATABASE REGISTRATION

Refer to Tender Data clauses F.2.1 and F.2.23
I/We hereby confirm that I/we are registered and verified on the Langeberg Municipality Supplier Database

COMPANY NAME	REGISTRATION NUMBER

I/We attach a copy of the Company Registration on the Central Supplier Database and acknowledge that the validity of this certificate is dependent upon the validity of the tax clearance certificate attached to Schedule 1. In the case of Joint Venture Partnerships this requirement will apply to each party to the Joint Venture.

B. CIDB CONTRACTOR REGISTRATION

Refer to Tender Data clauses F.2.1.2, F.2.23.3 and F.3.13.1:
I/We hereby confirm my/our registration on the Construction Industry Development Board (CIDB) Contractor Database:

COMPANY NAME	CIDB CONTRACTOR GRADING DESIGNATION	CRS REGISTRATION NUMBER AS APPLICABLE

I/We attach a printed copy of the Active Contractor's Listing off the CIDB website www.cidb.org.za as documentary proof of the Contractor's Registration issued by the Construction Industry Development Board (CIDB) to this schedule.

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.

Failure to affix such documentation as proof of Contractor Enterprise registration as prescribed to this Schedule shall result in this tender not being further considered for the award of the Contract.

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Number of sheets, appended by the tenderer to this Schedule ..... (If nil, enter NIL).

SIGNED ON BEHALF OF TENDERER: . . . . . .

SCHEDULE 4: DECLARATION OF "IN THE SERVICE OF THE STATE"

the state, or has been in the service of the state in the previous twelve months, the following information must be completed: **(Please indicate if not applicable)**

The name of the person in the employment of the state:

……

The capacity in which that person is in service of the state:

……

Is that person an owner, director, manager, shareholder or connected to the business: Yes or No? **(If yes please specify)**

.....

The relationship to the owner, director, manager, shareholder or stakeholder of the entity:

	Spouse	**Child**	**Parent**
Owner			
Director			
Manager			
Shareholder			

"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.

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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 the Business*

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SCHEDULE 5: DECLARATION: CERTIFICATE FOR MUNICIPAL SERVICES AND PAYMENTS TO SERVICE PROVIDERS

PART A: PROPERTY OWNED BY ENTERPRISE OR DIRECTORS
Please complete the following if property is owned by the enterprise, the proprietors, directors or partners in their personal capacity, which must be confirmed by the relevant municipality **(ATTACH COPY OF MUNICIPAL ACCOUNT(S) NOT OLDER THAN 30 DAYS**:

Name of account holder: ……

Account number: ……..

Account number: ……..

FOR MUNICIPAL USE ONLY **I/we hereby certify that the municipal account details of our client as indicated above is correct.** **……..** **Name of municipal official (print name)** **……** **Signature of municipal official**	**Official date stamp of municipality**

PART B: PROPERTY LEASED BY ENTERPRISE OR DIRECTORS
Please attach a sworn affidavit or a copy of your lease agreement if the property is leased by the enterprise or the proprietors or directors in their personal capacity, for which the aforementioned is not responsible for payment of municipal rates and taxes.

PART C: WHERE PROPERTY IS NOT OWNED OR LEASED BY ENTERPRISE OR DIRECTORS
Please attach a sworn affidavit from the proprietor or director of the enterprise confirming that the enterprise does not own or lease any property and that the aforementioned is not responsible for payment of any municipal rates and taxes.

I,……., the undersigned, certify that the information furnished on this declaration form is correct and that I/we have no undisputed commitments for municipal services towards a municipality or other service provider in respect of which payment is overdue for more than 90 days.

…… **……**

Signature for and on behalf of the bidder **Date**

LANGEBERG MUNICIPALITY

……

SCHEDULE 6: DATA SHEETS FOR MECHANICAL AND ELECTRICAL EQUIPMENT
(ALL DATA SHEETS TO BE COMPLETED WITH SUBMISSION)
T2.3 : DATA SHEETS (ALL DATA SHEETS TO BE COMPLETED WITH SUBMISSION)

Mechanical & Electrical Sub-Contractor: .....

DATA SHEETS

PART A – MECHANICAL

1. DATA SHEET FOR PUMPS – BOOSTER PUMPS

1.1. Manufacturer .....

1.2. Place of manufacture .....

1.3. Delivery time ..... weeks

1.4. Model number and type .....

1.5. Number of stages .....

1.6. Impeller diameter (mm) and material .....

1.7. Characteristics:

	Shut-off head	Best efficiency	Max. power condition	Duty point
Total manometric head	.....	.....	.....	.....
Flow rate	.....	.....	.....	.....
NPSH required	.....	.....	.....	.....
Motor power (kW) / current (A) required at 400 V	...../	...../	...../	...../ .....
Pump efficiency	.....	.....	.....	.....

1.8. Suction diameter (if applicable) .....

1.9. Discharge diameter .....

1.10. Weight of pump with motor .....

1.11. Type of gland sealing .....

1.12. Pump speed .....

1.13. Solid size (mm) .....

PERFORMANCE CURVES

The Tenderer is required to submit signed performance curves with the tender indicating head, efficiency, kW and NPSH.

PUMP DRAWING

The Tenderer is required to submit a line drawing of the complete pump/motor unit showing all salient dimensions. **Note: This data sheet must be completed fully at tender stage.**

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2. DATA SHEET FOR ELECTRICAL MOTORS – BOOSTER PUMPS

2.1	Manufacturer	.....
2.2	Place of manufacture	.....
2.3	Class of insulation	.....
2.4	Type of winding over-temperature protection device	.....
2.5	Type of motor	.....
2.6	Rated output (kW)	.....
2.7	Rated full load current	.....
2.8	Voltage	.....
2.9	Power factor at full load	.....
2.10	Power factor at 3/4 load	.....
2.11	Efficiency at full load	.....
2.12	Efficiency at 3/4 load	.....
2.13	Protection class	.....
2.14	Full load speed	.....
2.15	Maximum outer diameter	.....

GUARANTEED CHARACTERISTICS – BOOSTER PUMPS

We guarantee that each pump set shall perform, in compliance with the Specification, as per the figures completed below:

i.	Minimum flow rate at the operational point:	..... L/s
i.	Minimum manometric head at the operational point:	..... m
i.	Minimum pump efficiency at the operational point:	..... %
/.	Maximum shaft power required at operational point:	..... kW
/.	Maximum current drawn at the operational point at 400V:	..... A
i.	Maximum operational speed to achieve the operational point:	..... RPM
i.	Rated motor power exceeds required shaft power by:	..... %

Note: This data sheet must be completed fully at tender stage.

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3. DATA SHEET FOR PUMPS – LIFT PUMPS 1

3.1 Manufacturer .....

3.2 Place of manufacture .....

3.3 Delivery time ..... weeks

3.4 Model number and type .....

3.5 Number of stages .....

3.6 Impeller diameter (mm) and material .....

3.7 Characteristics:

	Shut-off head	Best efficiency	Max. power condition	Duty point
Total manometric head	.....	.....	.....	.....
Flow rate	.....	.....	.....	.....
NPSH required	.....	.....	.....	.....
Motor power (kW) / current (A) required at 400 V	...../	..... /	..... /	..... / .....
Pump efficiency	.....	.....	.....	.....

3.8 Suction diameter (if applicable) .....

3.9 Discharge diameter .....

3.10 Weight of pump with motor .....

3.11 Type of gland sealing .....

3.12 Pump speed .....

3.13 Solid size (mm) .....

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PERFORMANCE CURVES

The Tenderer is required to submit signed performance curves with the tender indicating head, efficiency, kW and NPSH.

PUMP DRAWING

The Tenderer is required to submit a line drawing of the complete pump/motor unit showing all salient dimensions.

Note: This data sheet must be completed fully at tender stage.

4. DATA SHEET FOR ELECTRICAL MOTORS – LIFT PUMPS 1

4.1	Manufacturer	.....
4.2	Place of manufacture	.....
4.3	Class of insulation	.....
4.4	Type of winding over-temperature protection device	.....
4.5	Type of motor	.....
4.6	Rated output (kW)	.....
4.7	Rated full load current	.....
4.8	Voltage	.....
4.9	power factor at full load	.....
4.10	Power factor at 3/4 load	.....
4.11	Efficiency at full load	.....
4.12	Efficiency at 3/4 load	.....
4.13	Protection class	.....
4.14	Full load speed	.....
4.15	Maximum outer diameter	.....

GUARANTEED CHARACTERISTICS – LIFT PUMP STATION 1 PUMPS

We guarantee that each pump set shall perform, in compliance with the Specification, as per the figures completed below:

i.	Minimum flow rate at the operational point:	..... L/s
i.	Minimum manometric head at the operational point:	..... m
i.	Minimum pump efficiency at the operational point:	..... %
/.	Maximum shaft power required at operational point:	..... kW
/.	Maximum current drawn at the operational point at 400V:	..... A
i.	Maximum operational speed to achieve the operational point:	..... RPM
i.	Rated motor power exceeds required shaft power by:	..... %

Note: This data sheet must be completed fully at tender stage.

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5. DATA SHEET FOR PUMPS – LIFT PUMPS 2

5.1 Manufacturer .....

5.2 Place of manufacture .....

5.3 Delivery time ..... weeks

5.4 Model number and type .....

5.5 Number of stages .....

5.6 Impeller diameter (mm) and material .....

5.7 Characteristics:

	Shut-off head	Best efficiency	Max. power condition	Duty point
Total manometric head	.....	.....	.....	.....
Flow rate	.....	.....	.....	.....
NPSH required	.....	.....	.....	.....
Motor power (kW) / current (A) required at 400 V	...../	..... /	..... /	..... / .....
Pump efficiency	.....	.....	.....	.....

5.8 Suction diameter (if applicable) .....

5.9 Discharge diameter .....

5.10 Weight of pump with motor .....

5.11 Type of gland sealing .....

5.12 Pump speed .....

5.13 Solid size (mm) .....

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PERFORMANCE CURVES

The Tenderer is required to submit signed performance curves with the tender indicating head, efficiency, kW and NPSH.

PUMP DRAWING

The Tenderer is required to submit a line drawing of the complete pump/motor unit showing all salient dimensions.

Note: This data sheet must be completed fully at tender stage.

6. DATA SHEET FOR ELECTRICAL MOTORS – LIFT PUMPS 2

6.1	Manufacturer	.....
6.2	Place of manufacture	.....
6.3	Class of insulation	.....
6.4	Type of winding over-temperature protection device	.....
6.5	Type of motor	.....
6.6	Rated output (kW)	.....
6.7	Rated full load current	.....
6.8	Voltage	.....
6.9	power factor at full load	.....
6.10	Power factor at 3/4 load	.....
6.11	Efficiency at full load	.....
6.12	Efficiency at 3/4 load	.....
6.13	Protection class	.....
6.14	Full load speed	.....
6.15	Maximum outer diameter	.....

GUARANTEED CHARACTERISTICS – LIFT PUMP STATION 2 PUMPS

We guarantee that each pump set shall perform, in compliance with the Specification, as per the figures completed below:

i.	Minimum flow rate at the operational point:	..... L/s
i.	Minimum manometric head at the operational point:	..... m
i.	Minimum pump efficiency at the operational point:	..... %
/.	Maximum shaft power required at operational point:	..... kW
/.	Maximum current drawn at the operational point at 400V:	..... A
i.	Maximum operational speed to achieve the operational point:	..... RPM
i.	Rated motor power exceeds required shaft power by:	..... %

Note: This data sheet must be completed fully at tender stage.

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7. DATA SHEET FOR PUMPS – DRAINAGE PUMP

7.1 Manufacturer .....

7.2 Place of manufacture .....

7.3 Delivery time ..... weeks

7.4 Model number and type .....

8. DATA SHEET FOR VALVES AND PIPEWORK

8.1. DATA SHEET FOR PIPEWORK

Manufacturer .....

Material of piping .....

Finish .....

Maximum working pressure .....

Test pressure .....

Internal diameter .....

Couplings .....

8.2. DATA SHEET FOR NON-RETURN VALVES

Manufacturer .....

Make and model number .....

Material of body .....

Maximum working pressure .....

Test pressure .....

Nominal diameter .....

Door and shaft material .....

8.3. DATA SHEET FOR ISOLATING VALVES

Manufacturer .....

Make and model number .....

Material of body .....

Material of gate .....

Maximum working pressure .....

Nominal diameter .....

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8.4. AIR-RELEASE VALVES

Manufacturer .....

Make and model number .....

Material of body .....

Material of internals .....

Maximum working pressure .....

Nominal diameter .....

8.5. DATA SHEET FOR VENTILATION

Manufacturer .....

Make and model number .....

Motor size [kW] .....

Size of wall opening required [mm] ..... (H x W)

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SIGNED ON BEHALF OF TENDERER:	
NAME, SURNAME & POSITION	
DATE	

PART B – ELECTRICAL EQUIPMENT

1. MEDIUM VOLTAGE (11kV)

1. Specialist MV Sub-Contractor .....

2. Miniature Substation

2.1. Material and finish .....

2.2. Dimensions (l x w x h) .....

3. Ring Main Unit (RMU)

3.1. Manufacturer .....

3.2. Place of manufacture .....

3.3. Model No/Configuration

3.4. Insulation medium .....

3.5. Protection relay .....

3.6. Cable test facility .....YES / NO

3.7. Arc vent ducting included .....YES / NO

3.8. Internal arc withstand compliance with IEC 62271-200 .....YES / NO

3.9. Motorized operator .....YES / NO

3.10. Ratings:

No	Components	Unit	Offer
I1	Voltage	kV	
I2	Internal Arc Withstand (3s)	kA	
I3	Nominal current	A	
I4	Short time current r.m.s	kA	
I5	Peak withstand current	kA	
I6	Insulation level	kV	
I7	Peak lightning withstand	kV	

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4. Transformer

4.1. Manufacturer .....

4.2. Place of manufacture .....

4.3. Ratings:

4.3.1. Size (kVA) .....

4.3.2. Ratio (kV/V) .....

4.3.3. Vector Group .....

4.3.4. Winding material .....

4.3.5. Protection devices .....

4.3.6. Off-load tap-changer..... YES / NO

5. MV cable

5.1. Manufacturer .....

5.2. Place of manufacture .....

5.3. Size (mm^2) .....

5.4. Type .....

5.5. Voltage .....

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Signature ..... Date

2. DATA SHEET FOR LOW VOLTAGE

2.1. MOTOR CONTROL CENTRES (MCCs)

2.1.1. MCC dimensions (l x w x h), height to include stand height and estimated weight:

1. Booster and Lift Pump Station 1: .....
2. Lift Pump Station 2: .....
3. Raw Water Pump station: .....

2.1.2. Will MCC be in compliance to SANS 1973-1 (>10kA)? ..... YES / NO

2.1.3. State method of compliance .....

2.1.4. Name of steelwork/busbar manufacturer .....

2.1.5. Name of populator .....

2.1.6. If different entities in 1.4 and 1.5, confirm that all work carried out by 1.5 will comply strictly with the required SANS and OHS Act requirements

(Note: this is a statement of legal compliance) ..... YES / NO

2.1.7. Variable Frequency Controllers

1. Manufacturer and Model Number .....
2. Device provided with network capability? YES / NO
3. Harmonic design compliant at PCC? YES / NO

2.2. INSTRUMENTATION

2.2.1. Ultrasonic Level Sensor

1. Manufacturer .....
2. Place of manufacture .....
3. Sensor model number .....
4. Minimum of 4 relays? ..... YES / NO
5. Accuracy .....

2.2.2. Electro-Magnetic Flow Meter

1. Manufacturer .....
2. Place of manufacture .....
3. Meter model number .....
4. Nominal diameter .....
5. Accuracy .....

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2.2.3. Pressure Sensors

1. Manufacturer .....
2. Place of manufacture .....
3. Sensor model number .....
4. Measuring range .....
5. Accuracy .....

2.2.4. Pressure Probe

1. Manufacturer .....
2. Place of manufacture .....
3. Sensor model number .....
4. Measuring range .....
5. Accuracy .....

2.2.5. Pressure Switch

1. Manufacturer .....
2. Place of manufacture .....
3. Sensor model number .....
4. Measuring range .....
5. Accuracy .....

2.2.6. Float Level Switches

1. Manufacturer .....
2. Place of manufacture .....
3. Model number description .....
4. Operating voltage .....

2.2.7. Flow switches

1. Manufacturer .....
2. Place of manufacture .....
3. Model number description .....
4. Non-intrusive type? ..... YES / NO

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2.3. CABLES

2.3.1. Manufacturer .....

2.3.2. Type .....

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SIGNED ON BEHALF OF TENDERER:	
NAME, SURNAME & POSITION	
DATE	

Part C2: Pricing Data

Bid specifications may not make any reference to any particular trade mark, name, patent, design, type, specific origin or producer, unless there is no other sufficiently precise or intelligible way of describing the characteristics of the work, in which case such reference must be accompanied by the words “or equivalent”.

TENDERERS MUST NOTE THAT WHEREVER THIS DOCUMENT REFERS TO ANY PARTICULAR TRADE MARK, NAME, PATENT, DESIGN, TYPE, SPECIFIC ORIGIN OR PRODUCER, SUCH REFERENCE SHALL BE DEEMED TO BE ACCOMPANIED BY THE WORDS ‘OR EQUIVALENT”

CONTENTS

SCHEDULE D : MECHANICAL AND ELECTRICAL

The Sum of these schedules must be transferred to Item 23.1 in Schedule D : Mechanical & Electrical in Volume 1.

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C2.1 Pricing Instructions

General

The BOQ below must be completed in full and all prices must be in Rand. The prices must be firm and fixed for the duration of the project period, taking the indicated validity period and completion date into account.

The tenderer must include a price for each item indicated. If no price is inserted it will then be assumed that the item's price has been included for elsewhere.

The prices quoted below must allow for all required material, labour, handling, transport, storage, off-loading and any and all other coordination and project management requirements to fully complete a successful project in line with the documentation requirements.

It must be noted that all work carried out under the scope will be subject to a twelve (12) month defects liability period, whereby the Contractor remains responsible for equipment performance and durability.

All required site inspections, trips to and from site for the various installation teams as well as site establishment and time on site must be included as part of the tender offer.

The contingency amount as indicated will be spent at the sole discretion of the Client. No work outside the scope of works may be performed by the Contractor and no claims in this regard will be entertained without written approval.

Cables and Excavations

Note that the cable sizes and distances are provisional for pricing only.

All final cable distances must be measured on-site by the Contractor, in line with the final agreed-upon cable route. Only after the final cable route distances have been provided to the Engineer, can the final cable sizes for ordering and installation be determined.

All cable distances are therefore re-measurable and payment will only be made for final installed distances.

Note that 1m cable slack must be provided for in the final rates at each cable end and that the rates must include provision for any further wastage at these cable ends.

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Labour Costs

Rates for labour as listed below shall include all the allowances as specified in the Conditions of Contract for Construction for Building and Engineering works designed by the Employer as well as a reasonable profit.

Overtime costs attached to this contract shall be paid in the same relation as to that which the employees are actually paid.

Only the net working hours will be measured under Daywork and it will be held that the Contractor has made provision in his rates for possible interruptions and standing time. Refer to the civil introduction section for further requirements relating to specific civil pricing items.

DESCRIPTION	UNIT	RATE
Unskilled labour	hour	
Semi-skilled labour	hour	
Skilled labour	hour	
Foreman/Section leader	hour	
Engineering / Project management	hour	

Material Costs

Material costs shall be paid at the cost to the Contractor plus a mark-up of 15 % to include all other allowances as specified in the Conditions of Contract for construction for Building and Engineering works designed by the Employer as well as a reasonable profit.

The Contractor shall submit all Suppliers' invoices for material bought.

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C2.2 Bill of Quantities

CONTENTS

BILLS / SCHEDULES OF QUANTITIES

Section A	Preliminary & General
Section B1	Mechanical installation – Booster and Lift Pump Station 1
Section B2	Mechanical Installation – Lift Pump Station 2
Section C1	Electrical installation – Booster and Lift Pump Station 1
Section C2	Electrical Installation – Lift Pump Station 2
Section C3	Electrical Installation – Raw Water Pump Station
Section D	Telemetry / SCADA

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ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
1	GENERAL							
	Allow for all costs and expenses with regards to the following Preliminary & General, Contractual and Health & Safety and Project Management requirements							
1.1	Providing the required insurances	Sum	1					
1.2	Providing the required performance guarantee	Sum					Rate Only	
	Preliminary & General (including all travelling, establishment, project management, site supervision, site office, ablution, services, accommodation, etc.)							
1.3	Fixed	Sum	1					
1.4	Establishment and de-establishment	Sum	1					
1.5	Construction	Sum	1					
1.6	Contractor site security for sites and project duration	Sum	1					
1.7	Transporting of all equipment to site, including all handling (loading and offloading) required	Sum	1					
1.8	Liaison and coordination with other on-site Contractors	Sum	1					
	Project meetings							
1.9	Initial project initiation meeting	Each	1					
1.10	Site meetings (monthly)	Each	6					
	Technical meetings (ad-hoc)	Each	4					
	Health & Safety							
1.11	Cost of health and safety measures required in terms of the Construction Regulations (2014) of the Occupational Health and Safety Act	Sum	1					
1.12	Compilation and maintenance of a Health and Safety Plan, including Risk Assessments, Safe Work Procedures and Method Statements.	Sum	1					
1.13	Compilation and maintenance of the Health and Safety File.	Sum	1					
1.14	Close out of Health and Safety File at end of project	Sum	1					
	Method Statements							
	Submission of method statements for Temporary Works							
1.15	Booster Pump Station and Lift Pump Station 1	Sum	1					
1.16	Lift Pump Station 2	Sum	1					
	Submission of method statements for Installation							
1.17	Booster Pump Station and Lift Pump Station 1	Sum	1					
1.18	Lift Pump Station 2	Sum	1					
1.19	Compilation, printing and distribution of shut-down notices to the public	Each	1,500					
1.20	Hazop of switch-over procedures on pump stations with Client and Engineer	Each	2					
	Operational signage and instructions for:							
1.21	Booster Pump Station	Sum	1					
1.22	Lift Pump Station 1	Sum	1					
1.23	Lift Pump Station 2	Sum	1					
	Drawings and Manuals							
	Workshop / Construction drawings							
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
Brought Forward								
1.24	Mechanical (Pumping Equipment)	Sum	1					
1.25	Electrical MCCs	Sum	1					
	As-Built Drawings and Manuals							
1.26	Mechanical (Pumping Equipment)	Sum	1					
1.27	Electrical Control and MCCs	Sum	1					
	Training Sessions							
1.28	Mechanical (Pumping Equipment)	Each	1					
1.29	Electrical and Control	Each	1					
	Contractor Testing, Commissioning and System Optimisation							
1.30	Contractor Testing and Dry-commissioning of installation	Sum	1					
1.31	Contractor Testing, Wet-commissioning and System Optimisation	Sum	1					
1.32	Taking-Over inspections with Client and Engineer (Separate from Contractor's testing, commissioing and System Optimisation)	Sum	1					
1.33	Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works: Detail	Sum	1					
Total Carried Forward To Summary								

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
1	SECTION A : PRELIMINARY AND GENERAL	.....
	SUBTOTAL	.....
	Add 15% VAT	.....
Total Carried Forward To Summary Of Schedules		

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
2	**MECCHANICAL INSTALLATION - BOOSTER PUMP STATION & LIFT PUMP STATION 1**							
	Pumps and Motors							
	Supply and Installation of:							
2.1	New Booster pump sets : Complete centrifugal, end-suction pump set, including pump, motor, coupling and guard, installed on a common base-plate	Each	4					
2.2	New Lift pump sets : Complete centrifugal, end-suction pump set, including pump, motor, coupling and guard, installed on a common base-plate	Each	2					
2.3	Laser alignment of end-suction pump sets	Each	6					
	Pipework and accessories:							
	Supply and Installation of complete HDG + epoxy coated flanged pipework, including all pipe specials, fittings and couplings according to layout drawing and specification:							
	Complete Pipework, flanged and drilled to SANS 1123 Table 1000/3:							
2.4	Suction pipework for Booster - and Lift PS 1, complete. PN10 rated	Sum	1					
	Blanking-off of existing pipework connections:							
2.5	DN200, PN10	Each	1					
2.6	DN350, PN10	Each	1					
2.7	DN500, PN10	Each	1					
2.8	Delivery pipework for Booster PS, complete. PN10 rated	Sum	1					
2.9	Delivery pipework for Lift PS 1, complete. PN10 rated	Sum	1					
	Supply and installation of manufactured pipe supports / anchors, complete with holding down bolts etc.:							
2.10	Complete Booster PS installation	Sum	1					
2.11	Complete Lift PS 1 installation	Sum	1					
	Flange Bolt Sets and Packings:							
	Supply and installation of HDG bolt sets, and gaskets, complete for each installation:							
	Suction pipework for Booster - and Lift PS 1, complete. PN10 rated							
2.12	Delivery pipework for Booster PS, complete. PN10 rated	Sum	1					
2.13	Delivery pipework for Lift PS 1, complete. PN10 rated	Sum	1					
	Valves							
	Supply and Installation of valves:							
	Pump Suction:							
2.14	DN250 Gate Valve, PN10	Each	4					
2.15	DN350 Gate Valve, PN10	Each	2					
2.16	DN350 Gate Valve, complete with cap top, bell tobie and uPVC sleeve, PN10	Each	1					
	Pump Delivery:							
2.17	DN200 Gate Valve, PN10	Each	4					
2.18	DN300 Gate Valve, PN10	Each	3					
2.19	DN350 Gate Valve, PN10	Each	1					
2.20	DN200 Silent Closing Check Valve, PN10	Each	4					
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
Brought Forward								
2.21	DN300 Silent Closing Check Valve, PN10	Each	3					
2.22	DN350 Silent Closing Check Valve, PN10	Each	1					
2.23	DN100 Double Action Air Release - and Isolating Valve	Each	2					
	Pump Station Ancillaries							
	Supply and Installation of (including all accessories required):							
2.24	Suction and Discharge Pressures Gauges on stand, Complete with all hoses, isolating cocks, fittings, etc.	Each	6					
2.25	Additional fasteners, gaskets and Anchors, etc. for ancillary equipment	Sum	1					
	Lifting Equipment:							
2.26	1.0 ton SWL geared crawl, complete to fit I-beam	Each	3					
2.27	1.0 ton SWL chain hoist	Each	1					
2.28	Drainage Pump, including all pipework, valves and fittings	Each	2					
2.29	Extractor Fan Set, complete with all control accessories and cowl	Each	2					
	Removal of existing equipment and delivery to Municipal store, including all handling complete							
2.30	Complete Booster PS	Sum	1					
2.31	Complete Lift PS 1	Sum	1					
	Temporary Works							
	Supply, installation and removal of the following temporary works, including all material, labour and machinery required:							
	Lift PS 1							
2.32	Alterations to existing delivery pipework and relocation of existing rising main outside of building to be place outside of construction area for new building	Sum	1					
2.33	Temporary reroute of Lift PS 1 suction pipeline to the new building.	Sum	1					
2.34	Temporary work to enable the new Lift PS 1 without the new Booster equipment connected to new suction manifold.	Sum	1					
2.35	Temporary works required for switch over of the Lift PS 1	Sum	1					
2.36	Any additional temporary work the Contractor deem necessary to comply with the switch-over	Sum	1					
	Booster PS							
	Blanking of pipework (including removal) where future permanent pipework will be connected:							
2.37	DN200	Each	1					
2.38	DN250	Each	4					
2.39	DN350	Each	1					
2.40	Temporary works required for cutting into the existing suction and delivery lines of the Booster pump station.	Sum	1					
2.41	Safeguarding of equipment during building alterations (both for exiting and new equipment)	Sum	1					
2.42	Temporary works required for connecting new equipment to new suction manifold	Sum	1					
2.43	Temporary works required for switch over of the Booster Pump Station.	Sum	1					
2.44	Any additional temporary work the Contractor deem necessary to comply with the switch-over	Sum	1					
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
Brought Forward								
	Minor Civil Works							
2.45	Breakout of existing pipework in concrete walls / where new pipework are installed	Each	10					
2.46	Breakout of existing pipework in brick walls / where new pipework are installed	Each	3					
2.47	Casting in of new puddle pipework	Each	8					
2.48	Closing of openings where pipework were removed	Each	5					
2.49	Core drilling and 160Ø sleeves	Each	4					
2.50	Hand excavation of medium soil, backfill with suitable material and compaction for installation of underground pipework	m³	100					
2.51	Hand excavation of medium soil, backfill with suitable material and compaction for opening of existing services	m³	50					
2.52	Extra over for excavation of hard rock	m³	10					
2.53	Import of suitable bedding and blanket material, complete	m³	15					
2.54	All other work that the Contractor deem necessary to successfully complete the required work (specify):	Sum	1					
2.55	**Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works**	Sum	1					
Total Carried Forward To Summary								

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
2	SECTION B1 : MECHANICAL INSTALLATION - BOOSTER PUMP STATION & LIFT PUMP STATION 1	.....
Total Carried Forward To Summary Of Schedules		

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT R	AMOUNT c
3	**SECTION B2 : MECHANICAL INSTALLATION - LIFT PUMP STATION 2**							
	Pumps and Motors							
	Supply and Installation of:							
3.1	New Lift pump sets : Complete centrifugal, end-suction pump set, including pump, motor, coupling and guard, installed on a common base-plate	Each	2					
3.2	Laser alignment of end-suction pump sets	Each	2					
3.3	Refurbishment of existing pump sets	Prov Sum					150,000	00
	Pipework and accessories:							
	Supply and Installation of complete HDG + epoxy coated flanged pipework, including all pipe specials, fittings and couplings according to layout drawing and specification:							
	Complete Pipework, flanged and drilled to SANS 1123 Table 1000/3:							
3.4	Suction pipework for Lift PS 2, complete. PN10 rated	Sum	1					
3.5	Delivery pipework for Lift PS 2, complete. PN10 rated	Sum	1					
3.6	Supply and installation of manufactured pipe supports / anchors, complete with holding down bolts etc.	Sum	1					
	Flange Bolt Sets and Packings:							
	Supply and installation of HDG bolt sets, and gaskets, complete for each installation:							
3.7	Complete Lift PS 2 installation	Sum	1					
	Valves							
	Supply and Installation of valves:							
	Pump Suction:							
3.8	DN250 Gate Valve, PN10	Each	2					
	Pump Delivery:							
3.9	DN200 Gate Valve, PN10	Each	3					
3.10	DN200 Silent Closing Check Valve, PN10	Each	3					
3.11	DN100 Double Action Air Release - and Isolating Valve	Each	1					
	Pump Station Ancillaries							
	Supply and Installation of (including all accessories required):							
3.12	Suction and Discharge Pressures Gauges on stand, Complete with all hoses, isolating cocks, fittings, etc.	Each	2					
3.13	Fasteners, gaskets and Anchors, etc.	Sum	1					
3.14	1.0 ton SWL chain hoist, including 1.0 ton SWL geared crawl, complete to fit I-beam	Each	1					
3.15	Extractor Fan Set, complete with all control accessories and cowl	Each	1					
	Removal of existing equipment and delivery to Municipal store, including all handling complete							
3.16	Complete Lift PS 2	Sum	1					
	Temporary Works							
	Supply, installation and removal of the following temporary works, including all material, labour and machinery required:							
3.17	Temporary works required for switchover of the Booster PS	Sum	1					
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
Brought Forward								
3.18	Any additional temporary work the Contractor deem necessary to comply with the switch-over	Sum	1					
	Minor Civil Works							
3.19	Breakout of existing pipework in concrete walls / where new pipework are installed	Each	0					
3.20	Breakout of existing pipework in brick walls / where new pipework are installed	Each	3					
3.21	Casting in of new puddle pipework	Each	3					
3.22	Closing of openings where pipework were removed	Each	3					
3.23	Core drilling and 110Ø sleeves	Each	0					
3.24	Hand excavation of medium soil, backfill with suitable material and compaction for installation of underground pipework	m³	10					
3.25	Hand excavation of medium soil, backfill with suitable material and compaction for opening of existing services	m³	5					
3.26	Extra over for excavation of hard rock	m³	2					
3.27	Import of suitable bedding and blanket material, complete	m³	6					
	All other work that the Contractor deem necessary to successfully complete the required work (specify):							
3.28	**Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works**	Sum	1					
Total Carried Forward To Summary								

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
3	SECTION B2 : MECHANICAL INSTALLATION - LIFT PUMP STATION 2	.....
Total Carried Forward To Summary Of Schedules		

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
4	**SECTION C1 : ELECTRICAL INSTALLATION - BOOSTER PUMP AND LIFT PUMP STATION 1**							
	Bulk Electrical Supply							
	Supply and install							
	New Robertson WTW Miniature Substation							
4.1	Miniature Substation: 500kVA, 11kV/400V, DyN11, three-way RMU, Coastal Spec	Each	1					
4.2	Minisub plinth, excavations and compaction	Each	1					
4.3	Minisub earthing, including testing and report	Sum	1					
4.4	RMU relay protection settings design and programming report - with client coordination	Sum	1					
4.5	MV Cable disconnections on old M/S and connections onto new M/S	Each	4					
4.6	MV cable joint: 95mm2 PILC	Each	1					
4.7	MV cable section: 95mm2 PILC	m	10					
4.8	Removal of existing M/S and delivery to Municipal stores in Robertson	Each	1					
4.9	Removal of existing plinth	Each	1					
4.10	80A TP CB in existing M/S, including all connections and tails, for temp WTW supply	Sum	1					
	Motor Control Centres (MCCs)							
	Supply and install							
4.11	New combined MCC, for Booster and Lift Pump Stations at WTW - complete with PLC and HMI	Each	1					
	Instrumentation							
	Supply and install							
	Pressure							
	Pressure Sensors							
4.12	Booster PS	Each	1					
4.13	Lift PS	Each	1					
4.14	Town low-pressure zone	Each	1					
	Pressure Switches							
4.15	Booster PS	Each	0					
4.16	Lift PS	Each	2					
	Level							
	Ultrasonic Level Sensor							
4.17	Final WTW Reservoir, common for both pump stations	Each	1					
	Float Level Switches							
4.18	Final WTW Reservoir, common for both pump stations	Each	2					
4.19	Emergency shunt-trip	Each	2					
	Flow							
	Electromagnetic Flow Meter							
4.20	Booster PS	Each	1					
4.21	Lift PS	Each	1					
	Non-Intrusive No-Flow Switches							
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
Brought Forward								
4.22	Booster PS	Each	4					
4.23	Lift PS	Each	0					
	Cables							
	Supply and install							
	Power Supply Cable From Minisub To:							
4.24	Main MCC: 2 x 150mm2 x 4 Cu SWA (total length)	m	40					
4.25	Main MCC: 95mm2 BCEC	m	20					
4.26	Existing WTW: 70mm2 x 4 Cu SWA	m	30					
4.27	Existing WTW: 50mm2 BCEC	m	30					
4.28	Existing WTW: 70mm2 x 4 Cu SWA Joint	Each	1					
	Power Supply Cable From Main MCC To:							
4.29	Extraction fan: 1.5mm2 x 4 Cu Cabtyre	m	25					
4.30	Local DB: 6mm2 x 4 Cu SWA + 4mm2 BCEC	m	25					
4.31	Small lighting and power - refer section 9 below	m	0					
	Motor Cables							
4.32	Booster Pumps: 25mm2 x 4 Cu	m	100					
4.33	Lift Pumps: 120mm2 x 4 Cu	m	40					
4.34	Drainage Pumps: 2.5mm2 x 4 Cu	m	50					
	Control Cables							
	Float Level Switches: 1.5mm2 x 7							
4.35	Main WTW Reservoir	m	30					
4.36	Shunt trips	m	40					
	Local Control Stations: 1.5mm2 x 4							
4.37	Booster PS	m	100					
4.38	Lift PS	m	40					
	Pump overheat: 1.5mm2 x 3							
4.39	Booster PS	m	100					
4.40	Lift PS	m	40					
	Pump pressure switch: 1.5mm2 x 3							
4.41	Booster PS	m	0					
4.42	Lift PS	m	40					
	Pump no-flow switch: 1.5mm2 x 3							
4.43	Booster PS	m	100					
4.44	Lift PS	m	0					
	Instrumentation Cables							
	Pressure Sensor: 1.5TP screened							
4.45	Booster PS	m	20					
4.46	Lift PS	m	20					
	Flow Meter: 1.5TP screened and armoured							
4.47	Booster PS	m	35					
4.48	Lift PS	m	35					
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT R	AMOUNT c
Brought Forward								
	Ultrasonic Level Sensor: 1.5TP screened and armoured							
4.49	Common to both	m	35					
	Connections							
	Power / Motor Cables							
4.50	150 x 4	Each	6					
4.51	120 x 4	Each	8					
4.52	70 x 4	Each	1					
4.53	35 x 4	Each	2					
4.54	25 x 4	Each	8					
4.55	6/4 x 4	Each	12					
4.56	2.5/1.5	Each	8					
	Earth cables							
4.57	95	Each	2					
4.58	50	Each	1					
4.59	6/4/2.5	Each	8					
	Control cables							
4.60	1.5	Each	45					
	Instrumentation cables							
4.61	1.5 x 1 TP	Each	11					
	General Electrical Work, Cable Installation and Ancillaries							
	Supply, install and connect							
4.62	Local Control Station: Floor-standing, Green Start and Red Mushroom E-Stop	Each	6					
4.63	IP67 junction boxes for floats	Each	1					
	Cable Tray HDG							
	Supply and install, complete with mounting, spacing and suspension ancillaries							
4.64	100mm	m	40					
4.65	300mm	m	10					
4.66	100mm with HDG cover with stainless steel bandit straps	m	5					
4.67	300mm with HDG cover with stainless steel bandit straps	m	5					
4.68	Bosal for final sections	m	20					
4.69	Extraction fan lockable indoor isolator	Each	2					
4.70	Sump pump lockable indoor isolator	Each	2					
4.71	Removal of existing equipment and delivery to Client stores in Robertson, against a signed delivery receipt	Sum	1					
4.72	12000BTU Industrial Inverter split-aircon, complete with ducting, mounting and power supply (MCC rooms)	Sum	1					
4.73	Pipework changes at low-pressure zone in town, for pressure sensor mounting and remote monitoring	PC Sum					30,000	00
4.74	Ancillaries such as draw-boxes, spacers, expanding foam, etc. for a fully compliant and neat installation	Sum	1					
	Earthing							
	Supply, install and connect							
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT R	AMOUNT c
Brought Forward								
4.75	Issuing of COC - In compliance to latest SANS 10142-1	Each	1					
4.76	General bonding and earthing of equipment and relevant structures, including all ancillaries required	Sum	1					
	Excavations							
	New LV (750mm)							
4.77	Pickable soil	m	30					
4.78	Intermediate soil	m³	3					
4.79	Hard rock	m³	1					
4.80	Bedding and disposal	m³	8					
4.81	Danger tape	m	60					
4.82	Cable markers	Each	3					
	Building Lighting and Power							
	Standard cost per outlet point for the complete supply and installation of recessed outlets including all required material and labour (bosal conduit, conductors, draw-wire, terminations etc…)							
	Booster and Lift PS							
4.83	Local DB	Each	1					
	Switched socket outlets - IP67							
4.84	Industrial 16A (2-way, 1400 AFFL)	Each	2					
	Light Switches							
4.85	Industrial one way - indoor	Each	4					
4.86	Industrial one way - outdoor	Each	1					
	Luminaires							
4.87	Building Indoor: 45W LED	Each	14					
4.88	Building Bulkhead: 20W LED	Each	6					
4.89	Building Floodlight: 60W LED	Each	2					
4.90	Photocell	Each	1					
	Outlet points							
4.91	Socket outlets	Each	2					
4.92	Switches	Each	5					
4.93	Lights	Each	23					
4.94	**Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works**	Sum						
Total Carried Forward To Summary								

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
4	SECTION C1 : ELECTRICAL INSTALLATION - BOOSTER PUMP AND LIFT PUMP STATION 1	.....
Total Carried Forward To Summary Of Schedules		

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
5	**SECTION C2 : ELECTRICAL INSTALLATION - LIFT PUMP STATION 2**							
	Bulk Electrical Supply							
	Supply and install							
5.1	Relocation of existing metering kiosk to new building (excluding cable work)	Sum	1					
	Motor Control Centres (MCCs)							
	Supply and install							
5.2	New MCC for Lift Pump Station 2 - complete with PLC and HMI	Each	1					
	Instrumentation							
	Supply and install							
	Pressure							
	Pressure Sensors							
5.3	Lift PS	Each	1					
	Pressure Switches							
5.4	Lift PS	Each	2					
	Level							
	Ultrasonic Level Sensor							
5.5	On-Site Reservoir	Each	1					
	Float Level Switches							
5.6	On-Site Reservoir	Each	2					
5.7	Remote Main Reservoirs	Each	4					
	Level Probes							
5.8	Remote Main Reservoirs	Each	2					
	Flow							
	Electromagnetic Flow Meter							
5.9	Lift PS	Each	1					
	Cables							
	Supply and install							
	Power Supply Cable (Existing):							
5.10	Main MCC: 70mm2 x 4 Cu SWA	m	25					
5.11	Main MCC: 50mm2 x 4 Cu BCEC	m	25					
5.12	Existing Cable: 70mm2 x 4 Cu SWA Joint	Each	1					
	Power Supply Cable From Main MCC To:							
5.13	Extraction fan: 1.5mm2 x 4 Cu Cabtyre	m	10					
5.14	Local DB: 6mm2 x 4 Cu SWA + 4mm2 BCEC	m	0					
5.15	Small lighting and power - refer section 9 below	m	0					
	Motor Cables							
5.16	Lift Pumps: 25mm2 x 4 Cu	m	30					
	Control Cables							
	Float Level Switches: 1.5mm2 x 7							
5.17	On-Site Reservoir	m	50					
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
Brought Forward								
	Local Control Stations: 1.5mm2 x 4							
5.18	Lift PS	m	30					
	Pump overheat: 1.5mm2 x 3							
5.19	Lift PS	m	30					
	Pump pressure switch: 1.5mm2 x 3							
5.20	Lift PS	m	30					
	Instrumentation Cables							
	Pressure Sensor: 1.5TP screened							
5.21	Lift PS	m	15					
	Flow Meter: 1.5TP screened							
5.22	Lift PS	m	15					
	Ultrasonic Level Sensor: 1.5TP screened and armoured							
5.23	On-site reservoir	m	50					
	Connections							
	Power / Motor Cables							
5.24	70 x 4	Each	6					
5.25	25 x 4	Each	4					
5.26	2.5/1.5	Each	6					
	Earth cables							
5.27	50	Each	1					
5.28	6/4/2.5	Each	8					
	Control cables							
5.29	1.5	Each	19					
	Instrumentation cables							
5.30	1.5 x 1 TP	Each	7					
	General Electrical Work, Cable Installation and Ancillaries							
	Supply, install and connect							
5.31	Local Control Station: Floor-standing, Green Start and Red Mushroom E-Stop	Each	2					
5.32	IP67 junction boxes for floats	Each	1					
	Cable Tray HDG							
	Supply and install, complete with mounting, spacing and suspension ancillaries							
5.33	100mm	m	15					
5.34	300mm	m	3					
5.35	100mm with HDG cover with stainless steel bandit straps	m	5					
5.36	Bosal for final sections	m	10					
5.37	Extraction fan lockable indoor isolator	Each	1					
5.38	Removal of existing equipment and delivery to Client stores in Robertson, against a signed delivery receipt	Sum	1					
5.39	Ancillaries such as draw-boxes, spacers, expanding foam, etc. for a fully compliant and neat installation	Sum	1					
	Earthing							
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT R	AMOUNT c
Brought Forward								
	Supply, install and connect							
5.40	Issuing of COC - In compliance to latest SANS 10142-1	Each	1					
5.41	General bonding and earthing of equipment and relevant structures, including all ancillaries required	Sum	1					
	Excavations							
	New LV (750mm)							
5.42	Pickable soil	m	70					
5.43	Intermediate soil	m^3	10					
5.44	Hard rock	m^3	1					
5.45	Bedding and disposal	m^3	18					
5.46	Danger tape	m	140					
5.47	Cable markers	Each	4					
	Building Lighting and Power							
	Standard cost per outlet point for the complete supply and installation of recessed outlets including all required material and labour (bosal conduit, conductors, draw-wire, terminations etc…)							
	Lift PS 2							
5.48	Local DB	Each	0					
	Switched socket outlets - IP67							
5.49	Industrial 16A (2-way, 1400 AFFL)	Each	0					
	Light Switches							
5.50	Industrial one way - indoor	Each	2					
5.51	Industrial one way - outdoor	Each	0					
	Luminaires							
5.52	Building Indoor: 45W LED	Each	4					
5.53	Building Bulkhead: 20W LED	Each	4					
5.54	Building Floodlight: 60W LED	Each	1					
5.55	Photocell	Each	1					
	Outlet points							
5.56	Socket outlets	Each	0					
5.57	Switches	Each	2					
5.58	Lights	Each	10					
5.59	**Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works**	Sum	1					
Total Carried Forward To Summary								

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
5	SECTION C2 : ELECTRICAL INSTALLATION - LIFT PUMP STATION 2	.....
Total Carried Forward To Summary Of Schedules		

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT	
							R	c
6	**SECTION C3 : ELECTRICAL INSTALLATION - RAW WATER PUMP STATION**							
	Bulk Electrical Supply							
	Supply and install							
6.1	Re-connect existing main supply cable	Sum	1					
	Motor Control Centres (MCCs)							
	Supply and install							
6.2	New MCC for Raw Water Pump Station	Each	1					
	Instrumentation							
	Supply and install							
	Level							
6.3	Raw water dam measurement	Prov Sum					45,000	00
	Flow							
	Non-Intrusive Flow Switches							
6.4	Existing Lift Pumps	Each	3					
	Cables							
	Supply and install							
	Power Supply Cable (Existing)							
6.5	Re-use existing	m	0					
	Power Supply Cable From Main MCC To:							
6.6	Re-use existing	m	0					
	Motor Cables							
6.7	Lift Pumps: Re-use existing	m	0					
	Control Cables							
	Pump overheat: 1.5mm2 x 3							
6.8	Re-use existing	m	0					
	Pump no-flow: 1.5mm2 x 3							
6.9	Lift PS	m	30					
	Instrumentation Cables							
	Level: 1.5TP screened and armoured							
6.10	Raw Water Dam	m	50					
	Connections							
	Power / Motor Cables							
6.11	70 x 4	Each	2					
6.12	25 x 4	Each	6					
6.13	2.5/1.5	Each	8					
	Earth cables							
6.14	50	Each	2					
6.15	6/4/2.5	Each	6					
	Control cables							
6.16	1.5	Each	9					
Total Carried Forward								

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT R	AMOUNT c
Brought Forward								
	Instrumentation cables							
6.17	1.5 x 1 TP	Each	2					
	General Electrical Work, Cable Installation and Ancillaries							
	Supply, install and connect							
6.18	Local Control Station: Floor-standing, Green Start and Red Mushroom E-Stop	Each	0					
6.19	IP67 junction boxes for floats	Each	1					
	Cable Tray HDG							
	Supply and install, complete with mounting, spacing and suspension ancillaries							
6.20	100mm	m	5					
6.21	300mm	m	0					
6.22	100mm with HDG cover with stainless steel bandit straps	m	0					
6.23	Bosal for final sections	m	10					
6.24	Extraction fan lockable indoor isolator	Each	0					
6.25	Removal of existing equipment and delivery to Client stores in Robertson, against a signed delivery receipt	Sum	1					
6.26	Ancillaries such as draw-boxes, spacers, expanding foam, etc. for a fully compliant and neat installation	Sum	1					
	Earthing							
	Supply, install and connect							
6.27	Issuing of COC - In compliance to latest SANS 10142-1	Each	1					
6.28	General bonding and earthing of equipment and relevant structures, including all ancillaries required	Sum	2					
	Excavations							
	New LV (750mm)							
6.29	Pickable soil	m	30					
6.30	Intermediate soil	m^3	5					
6.31	Hard rock	m^3	1					
6.32	Bedding and disposal	m^3	8					
6.33	Danger tape	m	60					
6.34	Cable markers	Each	1					
6.35	**Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works**	Sum	1					
Total Carried Forward To Summary								

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
6	SECTION C3 : ELECTRICAL INSTALLATION - RAW WATER PUMP STATION	.....
Total Carried Forward To Summary Of Schedules		

ITEM NO	DESCRIPTION	UNIT	QTY	MATERIAL RATE	LABOUR RATE	TOTAL RATE	AMOUNT R	AMOUNT c
7	**SECTION D : TELEMETRY - SCADA**							
	Central SCADA							
	Supply and install							
7.1	New SCADA hardware and configuration - Main Offices	Prov Sum					60,000	00
7.2	New SCADA hardware and configuration - WTW	Prov Sum					60,000	00
7.3	New SCADA software, licensing, page setup, water balance, dashboard and coordination	Prov Sum					100,000	00
7.4	Installation of additional on-site back-up server, complete with hardware and software for water system database	Prov Sum					85,000	00
7.5	SMS-alarm system, complete within licensed VPN and all setup coordination	Prov Sum					40,000	00
7.6	IT Configuration and backbone	Prov Sum					100,000	00
7.7	Main Central Monitoring Site Integration	Prov Sum					100,000	00
	Telemetry Outstations							
	Supply, install and connect							
	New outstation (complete)							
7.8	Booster / Lift PS 1	Prov Sum					85,000	00
7.9	WTW Main	Prov Sum					85,000	00
7.10	Lift PS2	Prov Sum					85,000	00
7.11	Reservoirs	Prov Sum					100,000	00
7.12	Main Office	Prov Sum					85,000	00
7.13	Raw Water Pump Station	Prov Sum					85,000	00
7.14	Southern Water Pump Station	Prov Sum					85,000	00
7.15	Southern Reservoir	Prov Sum					100,000	00
7.16	Town Low-Pressure Zone	Prov Sum					85,000	00
7.17	**Testing and Commissioning**	Prov Sum					75,000	00
7.18	**Taking-over**	Prov Sum					75,000	00
7.19	**Any other expenses deemed to be incurred in complying with the full requirements of the Scope of Works**	Sum	1					
	Total Carried Forward To Summary							

SUMMARY OF SECTIONS

SECTION	DESCRIPTION	AMOUNT (RAND)
7	SECTION D : TELEMETRY - SCADA	.....
Total Carried Forward To Summary Of Schedules		

CONTRACT NO.: T60.2021

The Construction of 3 ML Reservoir,
Pipelines and Related Pump Work
BILL OF QUANTITIES

SUMMARY OF SCHEDULE OF QUANTITIES MECHANICAL & ELECTRICAL

SECTION	DESCRIPTION	AMOUNT R
A	PRELIMINARY AND GENERAL	
B1	MECHANICAL INSTALLATION – BOOSTER AND LIFT PUMP STATION 1	
B2	MECHANICAL INSTALLATION – LIFT PUMP STATION 2	
C1	ELECTRICAL INSTALLATION – BOOSTER AND LIFT PUMP STATION 1	
C2	ELECTRICAL INSTALLATION – LIFT PUMP STATION 2	
C3	ELECTRICAL INSTALLATION – RAW WATER PUMP STATION	
D	TELEMETRY / SCADA	

TOTAL CARRIED FORWARD TO CONTRACT PRICE _____

CALCULATION OF CONTRACT PRICE

E : TOTAL OF SCHEDULE(S) A + B1 + B2 + C1 + C2 + C3 + D

= R . . . . . .

SCHEDULE D: MECHANICAL AND ELECTRICAL (E) **R** .....

TOTAL CARRIED FORWARD TO ITEM 23.1 IN SECTION D IN VOLUME 1 **R** .....

I/We, the undersigned, do hereby declare that these are the properly priced Bill / Schedules of Quantities forming part of this Contract Document containing Pages in consecutive order upon which my/our Tender for **Contract No.: T60/2021 : CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK** has been based.

SIGNED ON BEHALF OF TENDERER:	
NAME, SURNAME & POSITION	
DATE	

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Part C3: Scope of Work

ITEM	DESCRIPTION	PAGE NO
SECTION 1:	GENERAL	.....
SECTION 2:	MECHANICAL	.....
SECTION 3:	ELECTRICAL, CONTROL AND INSTRUMENTATION	.....
SECTION 4:	DRAWING LIST	.....

Status

Should any requirement or provision in the parts of the Scope of Work conflict with any requirement of any Standardised Specification, particular specification or any drawings, the order of precedence, unless otherwise specified, is:

- Scope of Work
- Particular Specifications
- SANS Standardised Specifications
- Drawings

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SECTION 1: GENERAL

1. OVERVIEW

1.1 GENERAL REQUIREMENTS

The following scope of works pertains to the design, procurement, installation, testing, commissioning, taking-over and closing-out of a holistic and complete project of works by the Contractor and associated sub-contractors.

All material and labour items required to ensure a complete, functional and compliant project must be provided as part of the tender offer.

1.2 BROAD PROJECT SCOPE

Potable water is distributed from the Robertson Water Treatment Work to the town via boosted and gravity networks. Under this project, the existing booster pump station and two lift pump stations shall be refurbished / upgraded to suit the future demand.

The existing booster pump station is situated at the WTW drawing water from Reservoir 1. The new mechanical and electrical equipment will be installed in the existing pump station, after alterations were made to the building to house the new equipment.

Water is also pumped from the WTW's potable water Reservoir (1) to Reservoir 2 and again from Reservoir 2 to Reservoir 3 with two lift pump stations. Lift Pump Station 1 is situated at Reservoir 1 (pumping water to Reservoir 2), and Lift Pump Station 2 is situated at Reservoir 2 (pumping water to Reservoir 3). Both installations will be replaced with new installation housed in new pump station buildings.

All temporary works to keep the existing installations fully operational during the construction phase fall under the scope of work of the Contractor. Electrical upgrades at the Reservoir 1 site will be required as well as repairs to the raw water pump station electrical works.

Upgrading of the existing Telemetry and SCADA installation is also included in the project.

The specifications for each component of the scope of work is detailed below and itemised in the pricing schedule accordingly.

This contract will be executed as a subcontract to the main Civil Contract.

2. SITE

The coordinates the respective pump stations is summarised below:

Description	Coordinates	
	Latitude	Longitude
Reservoir 1	33°47'36.68"S	19°53'43.67"E
Reservoir 2	33°47'20.93"S	19°53'42.51"E
Reservoir 3	33°47'02.24"S	19°53'49.38"E

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Note: Robertson generally receives rainfall in the winter months. The average maximum daily temperatures range from 16˚C in June to 30˚C in January. The minimum temperatures are experienced in July at temperature drops to 5˚C. A maximum relative humidity of 80% recorded. Equipment must be rated and supplied to suite.

3. APPLICABLE STANDARDS

All work carried out, as well as equipment supplied, must fully meet and be in compliance with the requirements of the Occupational Health and Safety Act (Act 85 of 1993) and the Construction Regulations (2014) issued in terms of Section 43 of the Act.

In addition, the latest revisions of the following statutory regulations, laws and obligations as pertaining specifically to any and all electrical work applicable to this specific project are applicable:

- The regulations of the local Supply Authority
- The regulations of the Client, being either Governmental, Municipal, Parastatal or Private
- Local fire regulations
- SANS 10400-A: 2010 – The application of the national building regulations, Part A: General principles and requirements

All references to “SABS” specifications shall be read as “SANS” in light of the recent changes by the South African Bureau of Standards. Where a SANS Standard does not exist or if not applicable, the relevant IEC or BS Standard shall be applicable.

In the event of discrepancy between any of the specifications, regulations and codes of practice, the SANS 10142-1 Code of Practice for Wiring of Premises shall take precedence.

Additionally, the following specifications, whether specifically mentioned, or not, within this document, shall also apply:

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SANS 1091: 2012	National colour standards
SANS 10140 :2008	Identification colour marking
SANS 156:2007	Moulded case circuit breakers
SANS 60269-1:2010	Low-voltage fuses, Part 1: General
SANS 60269-4:2012	Low-voltage fuses, Part 4: Supplementary requirements for fuse-link for the protection of semiconductor devices
SANS 1507-1:2007	Electrical cables with extruded solid dielectric insulation for fixed installations (300/500V to 1900/3300V), Part 1: General
SANS 60439-1:2004	Low voltage switchgear and control gear assemblies, Part 1: Type-tested and partially type-tested assemblies
SANS 60439-2:2006	Low voltage switchgear and control gear assemblies, Part 2: Particular requirements for busbar trunking systems (busways)
SANS 1973-1:2007	Low voltage switchgear and control gear assemblies, Part 1: Type-tested assemblies with stated deviation and a short-circuit withstand strength above 10kA

SANS 1973-3:2008	Low voltage switchgear and control gear assemblies, Part 1: Safety of assemblies with a rated protective short-circuits up to and including 10kA
SANS 60947:2012	Low voltage switchgear and control gear assemblies
SANS 475:2013	Luminaires for interior lighting, streetlighting and floodlighting – Performance requirements
SANS 10114-1:2005	Interior lighting, Part 1: Artificial lighting of interiors
SANS 10222-5-1-3:2007	Electrical security installations, Part 5-1-3: CCTV installations - CCTV surveillance systems for use in security applications - Installation, planning and implementation requirements
SANS 60793-1-1:2008	Optical fibres, Part 1-1: Measurement methods and test procedures - General and guidance
SANS 10131:2004	Above-ground storage tanks for petroleum products
SANS 780:2009	Transformer Testing
SANS 1084-1/2 : 2014	Electric Motor Standards
SANS 10131:2004	Fuel Tank Design and Construction
SANS 10198:2014	Cable Trenching
SANS 1804:2007	Induction Motors
SANS 62: 2013	Steel pipes
SANS 719: 2011	Electric welded low carbon steel pipes for aqueous fluids (large bore)
SANS 10044: 2004	Welding
SANS 2001 (collection)	Construction works
ISO 12944: 2017	Paints and Varnishes: Corrosion protection of steel structures by protective paint systems
ISO 8501:2007	Preparation of steel substrates before application of paints and related products -- Visual assessment of surface cleanliness
SANS 121:2011	Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods
SANS 32: 1997	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants
SANS 1123: 2015	Pipe flanges
ISO 4014: 2011	Hexagon head bolts – Product grades A and B
ISO 4032: 2012	Hexagon regular nuts (style 1) – Product grade A and B

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ISO 7089: 2012	Plain washers – normal series – Product grade A
SANS 1200 (collection)	Standardized specification for civil engineering construction
SANS 664: 2011	Wedge gate and resilient seal valves for waterworks
BS EN 593: 2017	Industrial Valves. Metallic butterfly valves for general purposes
SANS 1551:2008	Check valves (flanged and wafer types)
ISO 9906: 2012	Rotodynamic pumps -- Hydraulic performance acceptance tests - Grades 1, 2 and 3
ISO 9905: 1994	Technical specifications for centrifugal pumps -- Class I
ISO 5199: 2002	Technical specifications for centrifugal pumps -- Class II
ISO 9908: 1993	Technical specifications for centrifugal pumps -- Class III
ISO 2585: 1975	End-suction centrifugal pumps (rating 16 bar) — Designation, nominal duty point and dimensions
ISO 3661: 1977	End-suction centrifugal pumps -- Baseplate and installation dimensions
BS EN 12756: 2001	Mechanical seals. Principal dimensions, designation and material code

4. HEALTH AND SAFETY

All work carried out, as well as equipment supplied, must fully meet and be in compliance with the requirements of the Occupational Health and Safety Act (Act 85 of 1993) and the Construction Regulations (2014) issued in terms of Section 43 of the Act.

Please note that the requirements of the new construction regulations 2014 have been in effect from February 2014. The new regulations place additional legal duties upon contractors and sub-contractors. Although this health and safety specification includes much of the content of these new requirements, the contractor will be deemed to be familiar with the requirements of these regulations, and to have factored in all the duties placed upon contractors and sub-contractors in the tender.

A copy of the regulations can be viewed on the Department of Labour's website.

The contractor shall allow for all costs involved, including but not limited to the initial documentation and contracts, compilation of the Health and Safety plan and file, all site inspections and reporting, attendance of site meetings, close out report, etc.

5. PROGRAMME

5.1 General

The required completion date of the project is as soon as possible after appointment and/or as stipulated in the civil contract conditions. The program must be broken down into various applicable tasks, indicating inter-dependencies with one another, with the critical path clearly highlighted within the program. The program must be submitted within the contractual timeframe with the necessary approval procedure to be followed as well. All sub-contractor work, lead times and deliverables must be included into the program to determine the critical path items.

The various tasks must include the periods in which they undertake to effect complete delivery of all material under the contract from the date of placing the order. Tenderers are also to state the period in which they undertake to complete all erection, adjustment, putting into proper working order and testing of all plant and material after receipt of the order from the Engineer to commence erection or after the date of final delivery of material, whichever is later.

When the work must be carried out in conjunction with the work of other Contractors or with that of the Employer, it shall be co-ordinated and arranged in such a manner so as to interfere as little as possible with the progress of such other work, and so as to offer every reasonable facility to other Contractors or to departmental employees of the Employer.

5.2 Project Specific

The programming of the supply and installation of the new pumping equipment is critical with regards to the switch over of the installations to provide access to other sections of the works. Due to the staggering of the mechanical, electrical and civil / building works, the Contractor will allow for multiple trips to site for both temporary and permanent works. All the work can not be done in a single trip to site.

Refer to the installation phase discussed under paragraph 7 of the Mechanical Specification for a proposed phasing of the installation at the existing Booster – and Lift Pump Stations 1.

At the existing Lift Pump Station 2:

- A new pump station building will be constructed together with a new suction pipeline from the reservoir to the pump station constructed. The installation and commissioning of the new installation is therefore dependant on these activities to be completed as well as the connection to the existing rising main.

The multiple installation trips to site for the itemised temporary and permanent works must be indicated on the programme, taking into account the civil / building / mechanical / electrical work that is required that is linked to an activity. Access to building around excavations must also be programmed due to underground pipework running over access areas.

6. ENGINEERING RESPONSIBILITIES

6.1 Design Services and Activity Matrix

The responsibility for design of the works, per design stage:

- Concept, feasibility and overall process : Employer (Engineer)
- Basic engineering and detail layout to tender stage : Employer (Engineer)
- Final design to be approved for construction stage : Contractor
- Temporary works : Contractor

- Preparation of As-Built drawings : Contractor

6.2 **Design Brief**

The mechanical contractor shall be responsible for the related design of his own propriety equipment and systems. All designs shall be done in accordance with good engineering practise, based on the specifications and tender drawings provided in the tender document. The Contractor shall ensure that all equipment designed and/or provided and installed by him shall be of robust construction capable of performing the desired work/duty in an efficient manner.

Although the Engineer may approve drawings and designs of the Contractor, this does not exempt the Contractor from this responsibility. The professional responsibility for such designs shall remain with the Contractor and his Engineer.

The Contractor's design must take into account the requirements around the switch over of the installation and the temporary works that may interfere with positions of new equipment.

6.3 **Method Statements for Switchovers**

The Contractor shall submit method statements describing how the switch-over at the respective pump installations will be done, indicating what influence and risks it has for the Employer. This method statement shall be submitted to the Engineer for approval (both by the Client and Engineer) at least four weeks (20 working days) prior to the planned shut-down / installation work. No work shall commence prior to approval by both parties. The Contractor shall allow at least two to three weeks for the discussion and approval process in the construction programme for this.

The Contractor shall make allowance for separate HAZOP sessions with the Client and Engineer to discuss and work through each of the method statements regarding switch-over of the installations. Each HAZOP shall be a full day session, based in Robertson at the Client's facility. The Contractor shall have representatives present for the mechanical, electrical and civil disciplines, including all travelling time and cost involved to attend the session.

The installation may only happen 5 working days after approval is provided and notices has been distributed to the public (in the case where there will be water supply disruptions). The Contractor will be responsible for compiling, printing and distributing of these notices to all affected parties.

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7. **SITE SECURITY**

The contractor shall make provision for the required site security and associated costs for the duration of the construction period. The type of security shall be determined by the contractor in line with the associated risks anticipated.

8. **DRAWINGS**

Within three (3) weeks after receiving written acceptance of the tender, the Contractor shall supply the following information in duplicate for approval before commencing manufacturing:

1. Working or "Shop" drawings of plant/donkey/borehole/pump installation including main items of equipment to be installed, as well as all cable and wiring diagrams.
2. MCC layout and single line diagrams detailing all control metering and indication circuits inclusive of a description of circuit operation
3. First round SCADA screenshots

NOTE:

Drawings must be neat and clearly legible. Circuit diagrams must be done on a grid system with elements of control equipment referred to applicable (grid) line numbers in a schedule directly below the relevant control device.

The Contractor shall supply neat and clearly legible As-Built drawings for all mechanical and electrical installations, including mechanical pipework workshop drawings, electrical circuit single line diagrams, solar array installation, MV or LV bulk line (including coordinates). All drawing shall be included in the O&M Manuals.

9. FACTORY TESTING

The following equipment must be demonstrated in the factory to the Engineer and all equipment necessary to test the performance and operation of said equipment must be provided:

1. Electrical Distribution Boards
2. Motor Control Centres (MCCs)
3. Miniature Substations (M/Ss), Ring Main Units (RMUs) and transformers
4. Power Factor Correction Equipment (PFC)
5. Telemetry outstations and programmed SCADA layouts, in conjunction with the MCCs

Before the Engineer is called to witness any testing, the Contractor must test the equipment and integrated control system on his own and confirm in writing to the Engineer that the equipment conforms to specification. Refer to each section of equipment with the project specification for detailed testing requirements.

10. SITE TESTING AND COMMISSIONING

The complete plant as installed must be functionally tested by the Contractor, and thereafter commissioned and optimised to ensure a fully functioning and compliant installation. Due to the nature of the project and the implementation of the installations, multiple commissioning and testing sessions will be held. The Contractor shall allow for all costs involved for such cases, including having all the relevant sub-contractors on site for this.

Due to the phasing of the installation, connections to existing infrastructure and keeping shutdown periods as short as possible, some installation shall be dry-commissioned before shutdowns are done to ensure the operation of the installation when the installation are made live after a shut-down. The Contractor shall allow for all costs involved for such cases, including having all the relevant sub-contractors on site for this.

No section of the plant may be made ‘live’ until a valid and complete Certificate of Compliance (COC) has been issued for said section of plant.

10.1 Functional tests that must be carried out and recorded must include:

- Mechanical installation:
  - Direction of motor rotation
  - Laser alignment of pump sets
  - Suction and discharge pressure head reading at shut-off and normal condition
  - Flow measurement
- Electrical installation:
  - Phase rotations
  - Insulation tests

- Continuity paths
- Routine tests as required per manufacturer equipment
- Energy meter calibration and integration with Client and Supply Authority, where required, including energy meter orientation and functional operation
- Measuring of voltages and currents, including overload protection settings
- Phase balancing for as even distribution as possible
- Site specific levels, pressures, flows
- All final system setpoints, values, protection settings and other applicable data must be compiled into a singular tabular format and included into the manuals to act as a basis for any further changes in the future.

10.2 **Plant Commissioning and Optimisation:**

It is required that the functional plant be run and further monitored to ensure that it runs at its most efficient point. Setpoint adjustments, protection settings, energy meter analysis and small system changes must all be implemented as part of the Contractor's commissioning responsibility.

Only once the Contractor confirms in writing that both the functional tests and commissioning optimisation exercises have successfully been conducted and that their performance and results are in line with the specification requirements, including providing the relevant data as requested above, can a date be set for the site taking-over inspection by the Engineer.

Due to the nature of the project and borehole scheme, it is envisioned that multiple testing and commissioning sessions will be done to test and inspect an area's or individual system, by the Contractor. The Contractor shall therefore allow for multiple trips, sessions and inspections, with the relevant personnel present. The work and sites will not all be ready at the same time and will follow both the final civil program as well as Client spend requirements. Adequate provision must be made in the P&Gs BOQ components to cater for this phased implementation approach and no additional claims in this regard will be entertained.

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11. OPERATIONAL SIGNAGE, INSTRUCTIONS AND OPERATIONAL AND MAINTENANCE MANUALS

11.1 Operational signage and instructions

The Contractor shall supply and install operational and health and safety signage and instructions for each installation. Signs shall be 3mm thick white, UV resistant Perspex as per Kontra Signs or similar and equally approved. Signs shall be installed on the walls of the plant rooms by means of PVC fisher plugs and Stainless Steel coach screws. All symbols shall comply with SANS 1186.

Provision shall be made for the following signage at each building:

- On outside of building:
  - "Unauthorised Entrance Prohibited" in three languages (English, Afrikaans and Xhosa)
  - "Danger: This Pump Station Starts Automatically"
- On inside of building:
  - All statutory and special safety warnings and instructions
  - Course of action during / after electrical shock

- "Danger: Equipment Starts Automatically"
- "Warning: Rotary Machinery"
- Warning: Floors slippery when wet symbolic sign

Warning / danger signs on the outside of building shall be minimum of 290 x 290 mm and on the inside 200 x 200 mm.

11.2 Operational and Maintenance Manuals

The Contractor must prepare and supply manuals for the successful operation and maintenance of the installation. A draft of the manual must be submitted before commissioning for approval. The draft must then be corrected, if required, and three sets of the manual must be submitted before first acceptance of the plant will be taken. Each set must include a USB memory stick with a soft copy of the complete O&M manual.

A taking-over inspection on-site will not be arranged if a first round of manuals has not been provided and commented on by the Engineer.

These manuals must contain the following information as a minimum:

Section 1 : System description

A comprehensive description of the system including schematic diagrams, where required for clarification.

Section 2 : Commissioning data

The results of all checks and measurements as recorded during the commissioning period must be included and be compiled in such a manner that every check and measurement is clearly defined.

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Section 3 : Operating instructions

3.1 Pre-start checklist for each individual plant.

3.2 Starting and stopping instructions.

3.3 Plant running checklist.

3.4 Safety precautions to be taken.

3.5 Manual operation.

3.6 Operator's duties.

Section 4 : Maintenance instructions

4.1 Schedule of maintenance particulars.

4.2 Part numbers of all replacement items.

4.3 Serial numbers of principal pieces of equipment.

Section 5: Mechanical equipment

The following information shall be provided for all Mechanical equipment:

5.1 Mechanical equipment schedule with make, model number, rating, commissioning setting and name, address and telephone number of supplier.

5.2 Maintenance instructions.

5.3 Manufacturer's brochures and pamphlets.

Section 6 : Electrical equipment

The following information shall be provided for all electrical equipment whether MV, MCC, PFC or field mounted.

6.1 Electrical equipment schedule with make, model number, rating, commissioning setting and name, address and telephone number of supplier.

6.2 Maintenance instructions.

6.3 Manufacturer's brochures and pamphlets.

Section 7 : Instrumentation, control and energy system

7.1 Description of each individual control system.

7.2 Control equipment schedule with make, model number, rating, commissioning setting and name, address and telephone number of supplier.

7.3 Manufacturer's brochures and pamphlets.

7.4 Maintenance instructions.

7.5 All setpoints, system settings and protection values in tabular format as per final installed system

Section 8 : Telemetry and SCADA

8.1 Description of each individual outstation including make, model number, rating, commissioning settings and name, address and telephone number of suppliers.

8.2 SCADA screenshots, parameter setpoints and basic control functionality.

8.3 Manufacturer's brochures and pamphlets.

8.4 Maintenance instructions.

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Section 9 : Drawings

Paper prints or reduced sized prints of all Contractor's drawings for all project components update to "as built" drawings. All drawings shall be formal CAD drawings with all information, dimensions and coordinates (if applicable) indicated on it.

The contract will be considered incomplete until all tests have been conducted to the satisfaction of the Engineer and all drawings and manuals have been handed over to the Engineer.

12. TRAINING

The contractor must allow for and include any respective operation and maintenance training required for key management and operations personnel of the client of all components covered in the scope of contract and installation. Allowance shall be made for all critical subcontractor(s) to be part of the presenting team in order to do training on their scope of works.

The training must be conducted for a minimum of one day during the commissioning of the installations and repeated once more after taking-over for another training session to reinforce the training done. The Operation and Maintenance Manuals must be used as the basis for the training and the training shall include both theoretical and on-site practical training. An attendance

register must be provided and signed at each training session, by all required and present members. It must be included into the O&M Manuals.

All associated costs involved with the training sessions must be allowed for, including the time and cost of the persons presenting, the training material etc.

13. TAKING-OVER TESTS

Only once the Contractor has confirmed in writing that the functional plant testing and commissioning optimisation has been done, including the first round of Client and operator training, as well as approved manuals are in place, can a date be set for the final taking-over inspection.

Due to the nature of the project and borehole scheme, it is envisioned that multiple testing and taking-over test sessions will be done to test and inspect an area's or individual system. The Contractor shall therefore allow for multiple inspections, with the relevant personnel present.

The Contractor will be required to make suitable arrangements for demonstrating the plant and equipment supplied under this contract in the presence of the Engineer or his representative, to prove it fully complies with the specification. Any or all of the test results must be demonstrated to the Engineer at his request.

A competent person per applicable discipline, fully conversant with all aspects of operation, must be present to carry out the demonstration.

14. DEFECTS LIABILITY PERIOD AND FINAL INSPECTION

After the 1 year/12 month defects liability/warranty period, a final meeting and equipment inspection will be held. Should all inspections prove successful, a final completion certificate will be issued to the contractor and any retention money will be approved and released for payment, the original guarantee returned, culminating in the successful completion of the project.

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SECTION 2: MECHANICAL

1. GENERAL SCOPE

The mechanical scope of works consists of the following main components:

- Temporary works required to keep the existing installations live during construction or installation periods.
- Supply and installation of equipment for the constant pressure booster installation, including pump sets, pipework, valves and supporting mechanical and electrical items as detailed on the plan and specified as part of this contract for a booster installation.
- Supply and installation of equipment for two lift installations, including pump sets, pipework, valves and supporting mechanical and electrical items as detailed on the plan and specified as part of this contract for a booster installation.

2. REFERENCE TO STANDARD SPECIFICATIONS

The Mechanical Project Specification shall be read in conjunction with the following Mechanical Standard Specifications:

MSS01	Pumping Equipment	Revision 03
MSS02	Pipework and Valves	Revision 04
MSS03	Materials and Coatings	Revision 01
MSS04	Ancillary Equipment	Revision 03

The Mechanical Project Specification shall take preference over the Mechanical Standard Specifications should there be contradictions. The Mechanical Specification shall also be read in conjunction with the Electrical Project Specification and Electrical Standard Specification(s) to ensure integration and allowance made for interfaces that may be required for instrumentation and other electrical equipment.

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3. PUMP SETS

3.1 Constant Booster Pump Installation:

The Contractor shall allow for the supply and installation of complete pump sets for the potable water booster installations. The pumps shall be of the long-coupled, end-suction type centrifugal pump suitable to pump potable water and it shall be driven by an electrical motor. The pump sets shall operate in parallel (3 duty / 1 standby) pumping into a common rising main operating as a constant booster installation.

The pump shall be equipped with bronze impellers to handle potable water. The pump sets shall be designed to be able to comply with the duty point, including the prescribed minimum pump efficiency, as discussed below. The impellers shall be trimmed to suit the duty point, and the electrical motor shall be sized accordingly. The shut-off pressure shall be at least 40 kPa higher than that of the specified maximum operational Total Dynamic Head. The pump shall be equally and similarly approved to KSB Pumps.

The rated power of the electrical motors shall be sized to be at least 15% higher than the shaft power required to operate at the maximum duty point with the impeller trimmed. Each motor shall be equipped with thermistors (PTC) in the windings (two per winding). The operational speed of the pump or motor shall not exceed 1500 rpm and the motor shall be rated to operate with VFCs and class H insulation.

All pump sets shall be laser aligned to the pump manufacturer's requirements after installation.

Maximum Total Pump Duty (Guaranteed duty point) with 3x duty pumps operating in parallel - 200 l/s (720 m³/h) @ 300 kPa TDH. (66.7 l/s @ 300 kPa TDH per pump set)

3.2 Lift Pump Station 1:

The Contractor shall allow for the supply and installation of complete pump sets for the potable water booster installations. The pumps shall be of the long-coupled, end-suction type centrifugal pump suitable to pump potable water and it shall be driven by an electrical motor. The pump sets shall operate individually (1 duty / 1 standby) pumping into a common rising main operating as a constant lift installation.

The pump shall be equipped with bronze impellers to handle potable water. The pump sets shall be designed to be able to comply with the duty point, including the prescribed minimum pump efficiency, as discussed below. The impellers shall be trimmed to suit the duty point, and the electrical motor shall be sized accordingly. The shut-off pressure shall be at least 80 kPa higher than that of the specified maximum operational Total Dynamic Head. The pump shall be equally and similarly approved to KSB Pumps.

The rated power of the electrical motors shall be sized to be at least 15% higher than the shaft power required to operate at the maximum duty point with the impeller trimmed. Each motor shall be equipped with thermistors (PTC) in the windings (two per winding). The operational speed of the pump or motor shall not exceed 1500 rpm and the motor shall be rated to operate with VFCs and class H insulation.

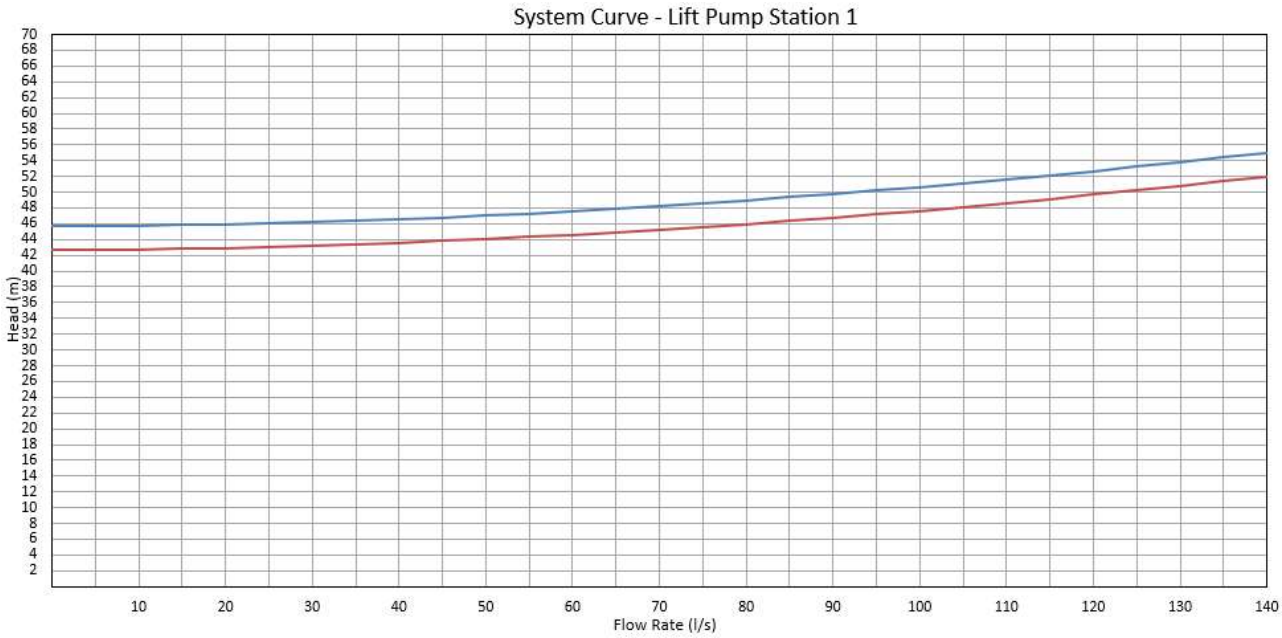
All pump sets shall be laser aligned to the pump manufacturer's requirements after installation.

Maximum Pump Duty (Guaranteed duty point) - 120l/s (432 m³/h) @ 527 kPa TDH
Note: Maximum Static Head = 45.7 m

Refer the system curve (for the final DN315 rising main) below to ensure that the pump is capable of handling the minimum duty as well.

NOTE: As part of the scope of works, a new DN315 rising main will be constructed from Reservoir 1 to Reservoir 2 and will replace the existing DN150 rising main. However, the new installation might need to be operational before the new rising main is completed and commissioned, therefore the new installation shall to operate at a reduced pump rate of ± 40 l/s not to cause damage to the existing DN150 rising main. The pump station may only operate at full speed once the pump station is connected to the new completed and commissioned rising main. The temporary operational duty will be confirmed on site.

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Pump Curves with duty point indicated as well as supporting brochure with technical details shall be supplied with the quotation.

3.3 Lift Pump Station 2

The Contractor shall allow for the supply and installation of complete pump sets for the potable water booster installations. The pumps shall be of the long-coupled, end-suction type centrifugal pump suitable to pump potable water and it shall be driven by an electrical motor. The pump sets shall operate individually (1 duty / 1 standby) pumping into a common rising main operating as a constant lift installation.

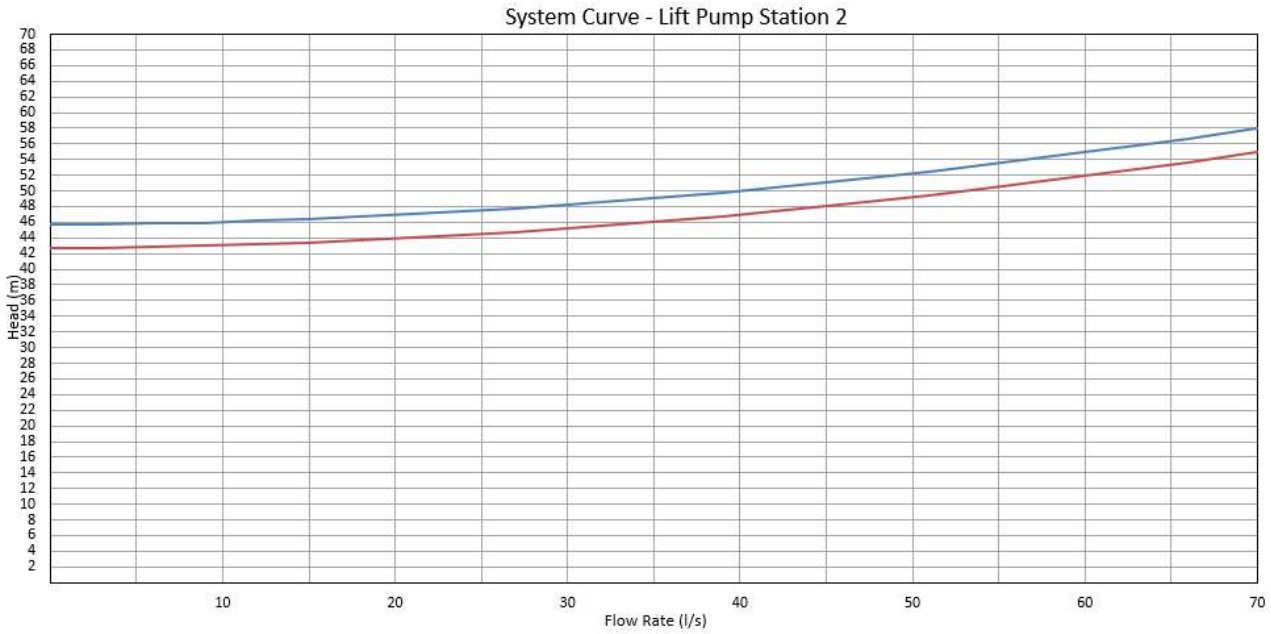
The pump shall be equipped with bronze impellers to handle potable water. The pump sets shall be designed to be able to comply with the duty point, including the prescribed minimum pump efficiency, as discussed below. The impellers shall be trimmed to suit the duty point, and the electrical motor shall be sized accordingly. The shut-off pressure shall be at least 50 kPa higher than that of the specified maximum operational Total Dynamic Head. The pump shall be equally and similarly approved to KSB Pumps.

The rated power of the electrical motors shall be sized to be at least 15% higher than the shaft power required to operate at the maximum duty point with the impeller trimmed. Each motor shall be equipped with thermistors (PTC) in the windings (two per winding). The operational speed of the pump or motor shall not exceed 1500 rpm and the motor shall be rated to operate with VFCs and class H insulation.

All pump sets shall be laser aligned to the pump manufacturer's requirements after installation.

Maximum Pump Duty (Guaranteed duty point) - 50l/s (180 m³/h) @ 525 kPa TDH
Note: Maximum Static Head = 45.7 m

Refer the system curve below to ensure that the pump is capable of handling the minimum duty as well.



Pump Curves with duty point indicated as well as supporting brochure with technical details shall be supplied with the quotation.

4. PIPEWORK

All pipework, fittings and specials shall be priced for the supply and installation as indicated on the plans.

Piping shall be flanged and shall be manufactured from mild steel according to SANS 719 with a minimum wall thickness of 6mm. Flange drilling shall comply with SANS 1123 Table 1000/3, rated to a minimum of 10 bar.

Piping shall be designed to facilitate dismantling, for inspection and future maintenance of ancillary equipment and valves installed.

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All connecting pipework shall include a gasket/packing which shall be of the full-face type or better and shall be a minimum of 3mm thick when uncompressed.

Piping shall be duplex coated (Hot dipped Galvanised and epoxy coated) after manufacture in accordance with the Standard Specification.

Underground (covered in soil) Mild Steel piping and joints shall be wrapped in a petroleum paste type wrap / tape, similar or equally approved to Denso tape and paste and allowed to set adequately before backfilling. Underground pipework shall be installed on a suitable sand bedding and a suitable sand blanket placed on top and shall be done as per SANS 1200.

Allowance must be made for a suitable sized reducer and flexible coupling suitable for uPVC class 9/12 pipework for connection with the rising mains.

Note: Any expected water forces and/or thrusts at bends or connection points must be taken into consideration and mitigated by means of pipe braces/supports and/or sufficient mass concrete. Pipe supports / anchors shall be manufactured from mild steel structural steel, and heavy duty hot dipped galvanised. It shall be secured to the floor by a minimum of four suitably sized chemical anchors.

5. VALVES

5.1. ISOLATING VALVES

Isolating valve shall be of the non-rising spindle type, flanged, resilient seat type gate valve, similar or equal to AVK manufacture. The valve shall be rated at 10 bars and shall be equipped with a hand-wheel. The flange drilling shall be suitable to fit the pipework. All valves shall be clockwise closing.

Valves installed directly in the ground shall be supplied with a colour-coded cap-top, uPVC sleeve and bell-tobie.

5.2. NON-RETURN VALVES

Non-return - / check valves shall be of the axial sprung, silent closing type check valve, rated at 10 Bar. The flange drilling shall be suitable to fit the pipework.

5.3. AIR-RELEASE VALVES

Air release valves shall be suitable for potable water rated at 10 bar, and equipped with a shut-off RSV gate valve. Since the air valves are not installed in the pump room, drainage piping is not required.

6. ANCILLARY EQUIPMENT

6.1. PRESSURE GAUGES

The Contractor shall supply and install pressure gauges on the suction and delivery of each pump set in accordance with the Mechanical Standard Specification. The pressure ranges shall as follow:

- Pump suction: -100 kPa to 200 kPa
- Pump delivery: 0 kPa to 750 kPa

Pressure gauges shall be 100mm nominal diameter; glycerine filled with stainless steel body and shall be installed with a gauge cock to suit.

Pressure gauges shall be connected to the suction – and discharge pipework by means of high-pressure nylon hoses. The pressure gauges should however be mounted on a common hot-dipped galvanised, mild steel stand in a safe and convenient place. This shall be done via a suitable sized and rated isolating valve at the tapping point and flexible pipe to the gauge itself.

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6.2. NUTS, BOLTS, READY-BAR AND PACKINGS

Nuts, bolts, washers (2 per bolt set), ready-bar (threaded rod) shall be hot dipped or electroplate galvanised mild steel. Where bolts and ready-bar is cut, the ends must be treated with an anti-corrosion coating. Bolts and ready-bar lengths shall allow for at least two screw threads to be visible when tightened.

Where applicable, all mounted into concrete shall be done with chemical anchors suited to the application, considering all respective forces and stresses applicable.

6.3. LIFTING EQUIPMENT

The Contractor shall supply and install suitable 1 ton rated SWL chain hoists, including geared crawls for each pump station. The geared crawl shall be suited to fit the I-beams.

The chain hoists shall have a lifting height of at least 5m.

6.4. DRAINAGE PUMP

Drainage pumps shall be supplied and installed in the Booster pump station and Lift Pump Station 1. Each pump shall be capable of delivering 4 L/s @ 8 m pressure head (TBC once the drainage water fall-out point is confirmed).

The pump set shall be of the single stage, centrifugal type submersible pump designed for heavy duty applications of pumping effluent or drainage water and shall be capable of handling particles of up to 35mm.

The pump housing, riser pipe, impeller and shaft shall be constructed out of Stainless Steel 304. The pump sleeve be constructed from Stainless Steel 316 and shall allow for an integrated, removable strainer. The construction of the pump set shall allow for sufficient cooling of the electrical motor. The pump and motor shaft shall be constructed out of Stainless Steel and shall be equipped with maintenance free, pre-lubricated ball bearings. The pump impeller shall be of the vortex design and shall be constructed from Stainless Steel.

Each pump shall be equipped with an integrated float switch to start and stop the pump. The motor shall be rated for 3 phase, 400V electrical supply and have an IP68 rating, suitable for complete submergence. The motor shall be equipped with a cooling jacket to enable the pump to permanently operate while partially submerged. The pump shall be supplied with a lead out cable with a minimum length of 2.5 m.

All pumps shall be equipped with all pipework and valves required to evacuate water from the building. This shall include DN63 uPVC pipework (including all fittings, bends, connectors, etc.) and valves (shut-off and non-return) suitable for handling raw water. Allowance shall be made to pump drainage water at least 20m away from the building.

The pump set shall be supplied with all required accessories for complete operation.

6.5. VENTILATION FAN SETS

The Contractor shall allow for the supply and installation of plate mounted, axial type ventilation fan sets for forced air ventilation in each of the pump stations. Each fan shall at least be capable of a volumetric flow rate of 1.0 m^3/s at a fan static pressure of 100 Pa. Each Fan shall be supplied complete with a temperature controller for automatic starting and stopping of the fan at a set temperature (adjustable on site) including required cabling and isolating breaker at the controller. The Contractor shall include for all cost related to the full operation of the fan set(s). All fans shall be driven by 3 phase electrical motors.

Suitably sized wall cowl(s) shall be supplied and installed on the outside of the pump station for each fan.

6.6. SPARES

The Contractor shall supply a complete list of critical spares and wearing parts for all equipment, including but not limited to the pumps, motors, valves, etc., that is required for full operation of the plant. The Contractor shall make provision for the supply of all spares and wearing parts that is not regularly kept in stock locally. A minimum of two (2) units per item shall be supplied.

7. INSTALLATION AND REMOVAL OF EQUIPMENT

The Contractor shall allow for all costs, including labour, material and machinery required, involved for the removal of the existing mechanical pumping equipment, including pipework and transporting it to the Municipal store in Robertson.

This shall include the breaking out of puddle pipes that must be replaced out of the existing concrete / brick structures.

The Contractor shall make allowance for all costs involved for the installation, including all labour, materials and machinery required for the transport, handling, rigging, installation, commissioning and testing for the fully operational installation. Allowance shall be made for multiple trips to site to complete the work at the respective installations, including transporting new equipment to site.

Due to the nature of the work, the parts of the installations will be required to be done during the off-peak and night-time periods. The Contractor shall allow for this, including all lighting and additional Health and Safety measure required to safely complete the work. Water supply to the

boosted network may not be interrupted for more than 1 hour. All shut downs shall be scheduled for off-peak period between 22h00 to 05h00 at night.

Since the installation must be kept live during the construction / installation of the new equipment, the Contractor will be responsible for all temporary works to keep the installations live. To minimise the duration of shut-down periods, the civil / building and mechanical / electrical work shall be done in phases. The provisional phasing of the installations and temporary works at the Booster – and Lift Pump Station 1 are envisioned as follows (The final phasing of the installation shall be confirmed and agreed upon in a HAZOP session between the Client, Engineers and Contractors).

At Reservoir 1, it is envisioned (however the Contractor is responsible for the final sequence of events and associated temporary works to be agreed upon by the Employer and Engineer) that the installation of the Lift Pump Station 1 and Booster Pump Stations equipment will happen as follows:

Phase 1: The existing lift pump station delivery pipework and rising main connection are altered / moved with a combination temporary – and permanent works to be outside of the construction area for the new building. The existing suction pipe may also require to be relocated to provide space for new permanent pipework into the existing building. Pipework that forms part of the permanent works shall be installed as part of this, including temporary connection to the existing DN150 existing rising main.

Phase 2: The new Lift PS 1 building and MCC room are constructed by the Main Contractor.

Phase 3: The mechanical and electrical equipment of the new Lift PS 1 shall be installed, including the suction pipework and – manifold (onto which the new Booster PS will connect) up to the connection with the existing DN500 pipe from the suction reservoir. The connection for the Booster PS shall be temporarily blanked-off. The new Mini-Substation shall also be installed and shall be commissioned. The new MCC shall be connected to the new Mini-Substation. The installation shall be dry commissioned to ensure the operation before the existing Lift PS 1 will be decommissioned.

Phase 4: This phase will involve a shut-down of the existing installations for the connection onto the existing DN500 pipe from the suction reservoir. The Lift PS 1 manifold shall be connected to the already installed permanent common delivery pipework, and the temporary pipework disconnected. The existing DN200 suction line feeding the existing Lift PS 1 shall be blanked off outside the existing valve chamber. Should the new DN315 rising main be completed and commissioned, the pump station delivery pipework shall be switched to connect with the new rising main. Lift PS 1 shall be put into operation.

Phase 5: With the new Lift PS 1 fully operational, the existing Lift PS can be decommissioned, and all mechanical equipment removed, including suction and delivery pipework. Part 1 of the building alterations to house the new Booster pumps shall be done, including alterations to the front wall and roof structure. The Contractor shall safeguard the existing pumping equipment against accidental damage due to building alterations and weather conditions (open roof and wall openings).

Phase 6: Once the Part 1 building alterations are completed, two of the new Booster pump sets can be installed in the area where the existing Lift PS 1 was located. This includes the installation of part of the new delivery manifold and the common delivery pipework up to the connection with the existing rising main. The suction pipework will be installed up to the new suction manifold and the new pump sets shall be connected to the new MCC and dry commissioned.

Phase 7: This phase will involve a shut-down of the existing and new installations for the connection of the Booster PS onto the existing rising main, and to the new suction

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Manifold. Once the connections are made, the new Booster pump sets shall be put in operation to take over from the existing installation.

Phase 8: Once the new Booster PS is partially operational (with the two pumps installed), the existing Booster installation shall be decommissioned and the equipment inside the building removed, including the common delivery line. A shut-down may be required to blank-off existing suction and delivery pipework should there not be suitable isolation points outside the pump station on the existing pipework.

Phase 9: Part 2 of the building alterations shall be done, including the demolition of the internal wall and walkway and construction of the plinths. The new pumping equipment shall be safeguard against the building alterations activities.

Phase 10: Once the building alterations are completed the last two booster pump sets can be installed with the pipework up to the suction and delivery manifold. The pumps shall be connected to the new MCC and dry-commissioned.

Phase 11: This phase will involve a shut-down of the new installations to connect the last two Booster pumps to the suction – and delivery manifolds. The new Booster PS shall be fully commissioned once the installation is made live.

Phase 12: All finishing off and minor work shall be completed, including the building.

The Contractor shall allow for multiple trips to site for the installation of the equipment based on a phased approach (such as described above). Access to the new and existing building may also be temporarily blocked due to excavations to install suction and delivery pipework outside the pump station, requiring additional trips to site under a specific phase (or standing time on site) which shall be allowed for at tender stage. No claims for addition trips to site shall be entertained.

8. TEMPORARY WORKS

The Contractor shall be responsible for keeping the three existing pump stations live during the construction and installation periods. Water supply to the boosted network may not be interrupted for more than 1 hour at a time and only during off peak times (22h00 to 05h00 at night). The Contractor shall allow for all material, labour and equipment required for the installation and removal following temporary works :

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- Lift Pump Station 1:
    - Alterations to existing delivery pipework and relocation of existing rising main outside of building to be place outside of construction area for new building.
    - Temporary reroute of Lift PS 1 suction pipeline to the new building.
    - Temporary work to enable the new Lift PS 1 without the new Booster equipment connected to new suction manifold (blanking-off of connections).
    - Temporary works required for switch over of the Lift PS 1.
- Booster Pump Station:
    - Temporary blanking-off of existing and new pipework, including removal to connect new pipework.
    - Temporary works required for cutting into the existing suction and delivery lines of the Booster pump station.
    - Temporary safeguarding of equipment (existing and new) during building alterations.

- Temporary works required for connecting new equipment to new suction manifold
- Temporary works required for switch over of the Booster Pump Station.

- Lift Pump Station 2:
  - Temporary works required for switch over of the Booster Pump Station.

9. MINOR CIVIL WORK

The Contractor shall allow for the related civil work to the removal of the existing mechanical equipment and installation of the new equipment.

The contractor shall allow for the following work that is required to complete the mechanical scope of works at the pump stations:

1. Excavation by hand to open existing services to confirm location of existing underground pipework.
2. The breakouts in the existing concrete or brick walls required for the removal of puddle pipes
3. Casting / grouting in of new puddle pipes, making allowance for the necessary wet-to-dry concrete products to ensure proper binding
4. The excavation, backfill with suitable material (including bedding and blanket) and compaction where required to access underground pipework.
5. All other work that the Contractor deem necessary to successfully complete the required work

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SECTION 3: ELECTRICAL

1 GENERAL SCOPE

The electrical scope of works consists of the following main components:

- Coordination with the Municipal Supply Authority and implementation of:
    - Disconnections of supply for change-over purposes
    - Supply and installation of a new miniature substation at Robertson WTW, for Booster/Lift PS1 pump station and associated supplies
- New Motor Control Centre (MCC) for:
    - WTW Pump Station (Booster and Lift Pump Station 1):
        - 4 x Booster Pumps with 30kW VSD Starters
        - 2 x Lift Pumps with 90kW VSD Starters
        - PLC controlled system with local HMI display
        - Small power and lighting for building
    - Lift Pump Station 2:
        - 2 x Lift Pumps with 37kW VSD Starters
        - PLC controlled system with local HMI display
        - Small power and lighting for building
    - Raw Water Pump Station:
        - 3 x Existing Raw Water Pumps with 55/30/15kW VSD Starters
        - Small power and lighting for building
- New control instrumentation for suction control, pump and motor protection as well as system monitoring
- Power, control and instrumentation cable installation to all required points of supply
- Local control stations for pump manual control
- Small lighting and power installations for the various buildings
- The final telemetry and SCADA scope will be determined during the construction phase of the project.

Note that the Client reserves the right to alter or reduce this section of the scope, in line with final water tests and availability.

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2 REFERENCED STANDARD SPECIFICATIONS

This Electrical, Control and Instrumentation (E,C&I) Project Specification must be read in conjunction with the following Electrical Standard Specifications:

SSE01	Medium Voltage	Rev 1
SSE02	LV and Control	Rev 1
SSE03	Instrumentation and Control Devices	Rev 1
SSE04	Telemetry and SCADA	Rev 2
SSE05	Generators	Rev 1

The E,C&I Project Specification takes preference over the Electrical Standard Specifications should there be contradictions. The E,C&I Specification must also be read in conjunction with the Mechanical Project Specification and Mechanical Standard Specification(s) to ensure integration and allowance made for interfaces that may be required for pump, motors and other mechanical equipment.

3 BULK ELECTRICAL SUPPLY TO SITE

The Supply Authority is the Langeberg Municipality, at all the applicable sites.

3.1 Booster / Lift PS1

The pump station is located at the Robertson WTW and is currently fed via a 315kVA miniature substation (M/S), which also feeds the WTW buildings.

A new 500kVA 11kV/400V miniature substation, with three-way RMU, must be provided under this contract, to act as the new main point of supply for the site. All connections, coordination and section of MV cable must be provided for under this contract.

Note that the Municipality currently has a three-year term tender with ABB and Actom, according to the specification below. Compliance must be met in all regards as part of this contract.

Further refer to the change-over methodology, where the existing supply will need to remain live along with the new supplies.

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3.1.1 STANDARD SPECIFICATION FOR MINIATURE SUBSTATIONS

Except where otherwise specified equipment and its auxiliaries and fittings shall comply with the following specifications and amendments:

- The Machinery and Occupational Safety Act No. 6 of 1983.
- Transformers to NRS 005: 1990 or SABS 1029
- Miniature Substations to NRS004: 1991 or SABS 1029 AND 1030
- Current transformers to SABS029: 1993
- High voltage fuses to BSS2692
- Bus bar to SABS1195: 1978
- Cable Boxes to BSS 2562
- Colour and markings to BSS 381C& 158 Colour C12 of SABS 1091

- Transformer oil to SABS 555: 1985
- L.T. Breakers tested to SABS 156: 1977
- Enclosure : Classification IAC AB (IEC 62271-202)
- Internal arc 20 kA 0.5s

Any departures from the requirements of the specification shall be stated.

3.1.2 DESIGN AND CONSTRUCTION

The miniature substation shall be designed to facilitate inspection, cleaning and repairs. All apparatus supplied shall be designed to ensure satisfactory, continuous operation and all materials used shall be suitable for working under the atmospheric conditions prevailing in the Breede River region, and under such variations of load and voltage as may be met with under working conditions, including those due to short circuits. All miniature substation transformers must be equipped with copper windings.

The design shall incorporate every reasonable precaution and for the safety of all those concerned in the operation and maintenance of the miniature substation and the associated cables. All materials used in the miniature substation shall be new and of best quality.

The miniature substation shall generally consist of 3 (three) separate compartments the whole design, which includes the roof and shall be made from 3 mm 3CR12 plate. Each compartment shall be provided with a separate door, the door handles of which shall be made from brass or stainless steel as well as the door hinges, having measurements not less than 60mm wide and 6 mm thick and not less than a 10mm diameter hinge pin.

NB (Doors shall be fitted with a restraining device to prevent whipping in windy weather).

The transformer compartment shall be designed so that removal and replacement by another rating unit can easily be done.

An earthing connection in the form of a copper strap 25.4 mm by 3.15 mm cross-sectional area, bonding all the compartments shall be provided. The earth strap shall have provisions for connections from all cable sheaths and earth electrodes. It shall be designed for mounting on a concrete plinth, having all incoming and outgoing cables buried underground. Cubicles shall be sufficiently, ventilated and shall be constructed in such a way as to prevent the ingress of rain or moisture.

All apparatus shall be designed to eliminate the risk of accidental short circuits due to birds, animals, insects and vermin.

All bolts, nuts and studs shall be of brass, phosphor bronze, stainless steel, electro galvanised of cadmium plated steel. All bolts shall be fitted with locking washers.

3.1.3 CLEANING AND PAINTING

All sheet metal work an all metal parts shall be thoroughly cleaned by shot blasting of all dirt, grease, rust mill scale, moisture and other contaminants to give a dry, bright metallic surface and immediately thereafter shall be treated in accordance with the requirements of SABS 005 - 1990 for transformers.

The equipment shall be fully painted and protected so that no further painting will be required after erection.

The miniature substation cover shall be 3CR12 steel to the relevant SABS Standard.

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Complete painting specification as proposed by the manufacturer for the individual items of equipment shall be stated.

3.1.4 H.V. COMPARTMENT

The compartment shall be equipped with the following:

- Two 11 kV cable boxes suitable for 3-core 95 mm^2 copper P.I.L.C.D.S.T.A. cables, complete with glands and armour clamps.
- The cable boxes shall be of approved design and so arranged to accommodate all the cable joint fittings required by the manufacturer of the cables.
- Cable boxes shall be suitable for heat shrink terminations and shall be provided with all necessary fittings including draining holes, single unit cable clamps and earthing clamp. The cable boxes shall not be constructed of cast-iron.

Ring Main Unit: SF6/ Vacuum Switch with Circuit –Breaker (CCV) and Protection Relay.

- The switchgear must comply to the relevant SABS, SANS and IEC Standards.
- The isolators shall be quick acting, spring loaded for making and breaking, suitable for a load operation and capable of withstanding a fault level of 250 MVA at 11000 Volts.
- An approved mechanically operated indicating device positively coupled to each isolator operating mechanism shall be provided to show whether the isolator is in on/off cable earthed position.
- The units shall be of the load breaking/fault making type, complete with frame support, "ON", “OFF” and "EARTH" switch positions, and all necessary cable boxes, bus bar, connections, etc.
- Rated voltage - 12 kV Power frequency withstand voltage - 28 kV
- Impulse withstand voltage – 95 kV Making capacity – 52.5 kA

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3.1.5 TRANSFORMERS

The transformers shall be of the double wound three phase copper winding oil immersed core type arranged for natural oil cooling (first filling of oil is required) manufactured, rated and tested in according with SABS 005 - 1990 and addenda thereto.

The normal frequency of the system will be 50 Hz, but the transformer shall be designed for operation at any frequency within ± 2½ % of normal and with ± 5 % voltage variation without exceeding the temperature rise specified in SABS 780, when the frequency and voltage variations are not in opposite directions.

All insulation materials shall be free from substances likely to become soft or to contaminate the oil in the transformer during its life, and each portion of the windings is to be impregnated before assembly and if varnished it shall be adequately dried before assembly or immersion in oil.

The tank and its cooling tubes shall be given two coats of best quality oil base paint at the factory. The total dry film thickness shall be at least 0,25mm and the paint shall comply with the requirements of SABS 780.

It is required that the transformers shall be specifically guaranteed free from objectionable humming, radio or TV interference. The oil shall comply with SABS 555.

The following requirements are applicable to the transformers:

- KVA Rating 500
- Number of phases 3
- Frequency 50 Hz
- Voltage 11000/420/231 volt
- Primary connections DELTA
- Secondary connections STAR
- Vector diagram DYN 11
- Primary terminal arrangement 3 x 11 kV Bushings
- Secondary terminal arrangement 4 Bushings connected to LT bus bar
- Cooling O.N.A.N

The transformer tapping arrangement shall be a voltage variation of ± 2½ % and ± 5 % tapping's.

3.1.6 L.V. COMPARTMENT

This compartment shall be equipped with the following:

(a) A set of suitable rated bus bars, 3 phases and neutral connected to the L.V. side to the transformer, of which the bus bars shall be mounted behind the front panel. A 750A incoming CB large frame moulded case (Heinemann Y 603 or equivalent) shall be provided.

(b) Current Transformers 800/5 - 10 VA class 3 with three maximum demanded ammeters of 20 minutes delay and with direct reading shall be provided.

(c)Four (4) large frame three-phase circuit breakers (MCCB) rated 200A, 200A, 400A and 80A amperes with a rupturing capacity of 30 kA to be surface mounted plus space for two (2) Large frame three-phase circuit breakers (MCCB) 200 Amp CB for future installations

(d) One 60-ampere tipple pole circuit breaker with a rupturing capacity of 15 kA.

(e) One direct online contractor, 100 ampere three phase double break, electro-magnetically operated type complying with BSS 775, the coil of which shall be 230 Volt.

(f) One 3-phase kWh meter 100 amperes and three single phase circuit breakers 40 amperes, which shall be used in con- junction with the 60 ampere T.P.C.B. and the direct online contractor for street lighting and shall be wired before delivery.

(g) Switch for testing of the streetlights.

(h) A galvanised gland plate complete with holes for five (5) no 4 Pratley cable glands, two (2) no 5 cable glands and four (4) no 1 glands.

(i) A 15 A industrial plug outlet with a 15 A M.C.B. and earth leakage shall be provided.

(j) One voltmeter scaled 0 - 500 volt with selector switch and HRC fuses.

3.1.7 LABELS AND PLATES

All labels for mounting on outdoor equipment shall be of an approved non-corrosive material and shall be fixed with stainless steel screws. "Danger" plates shall have red lettering on a white background. All labels and designations shall be in both official language and shall comply with the Machinery and Occupational Safety Act no. 6 of 1983, as amended. The high voltage compartment door/s shall be equipped with a "Danger High Voltage" sign in both official languages with letters not less than 400 mm high.

The M/S must also be provided with its specific site name.

3.1.8 SUPPLY CABLES

A new LV supply cable must be supplied and installed from the M/S to the new MCC. The existing WTW building cable currently runs from the existing pump station. This cable will need to be re-routed, and a joint and new section of cable provided, in order to connect it to the dedicated CB in the M/S. A temporary CB must be installed in the existing M/S, as this cable will need to be re-routed in the beginning of the contract, to allow for the excavations of the new lift pump station.

The other two existing LV supply cables must be re-connected.

3.2 Lift PS2

The pump station had an existing supply and outdoor wall-mounted metering and CB kiosk. Both the cable and kiosk will be re-used under this contract. Provision must be made for the relocation of the metering kiosk to the new pump station building, as well as a LV joint and new section of supply cable.

3.3 Reservoir Site

There is an existing underground supply cable that feeds the existing reservoir telemetry outstation. This supply will be re-used under this contract.

3.4 Raw Water PS

The existing raw water pump station's supply cable must be re-used and connected to the new MCC incomer, with the MCC installed in the same location as the existing.

Note that all Municipal coordination must be allowed for under this contract and switching can only be done by the Municipality.

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4 MOTOR CONTROL CENTRES (MCCs)

MCCs must be provided as detailed below and fully conform to the requirements of SANS 10142-1 (latest edition).

4.1 Booster and Lift Pump Station 1 MCC Construction

A new indoor MCC of the front-and-back access, floor-standing type must be supplied and installed in the position as indicated on the drawings. The stand and support pricing must be included as part of the MCC's pricing. Note the MCC will be installed on a floating slab, so MCC weights as well as sleeve/core locations must be provided as part of the tender offer.

Due to the VSD heat loading, ducting of the MCC must be provided to the outside, complete with all supports, outdoor weather-cowl and any fan ventilation required for effective heat dissipation.

The MCC design, steelwork and all required switchgear fault rating must be minimum 17kA, to be confirmed with the Engineer before construction.

The PLC and associated equipment must be installed within a dedicated tier at the end of the MCC, with all connections and terminals mounted in the rear. Any heating and cooling

requirements, specifically for the UPS, must be included as part of the MCC design and final tender offer. The HMI must be door-mounted.

The MCC must consist of the following:

4.1.1 Incoming Section

a) Main incoming CB sized for full equipment loading

b) Surge arrestors

c) Phase failure protection

d) E-Stop with indication light

e) Power meter

4.1.2 Outgoing Common Control Section for New Booster Pumps With:

a) All common control components such as duty selector switch, indication lights, reset and lamp test pushbuttons, ultrasonic display mounting, etc.

4.1.3 Outgoing Section for New Booster Pumps (4 Off), Each Equipped With:

a) Power and control equipment for motor and pump protection as well as control philosophy both internal and door-mounted, in line with section 5 below.

b) 30kW Variable Speed Drive (VSD) with specified protections. Note the manufacturer's cooling requirements that must be complied with, including external ducting that must be priced as part of the MCC offer, and harmonic mitigation must be provided as part of the offer in-line with IEEE519 requirements. The keypad must be door-mounted.

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4.1.4 Outgoing Common Control Section for New Lift Pumps With:

a) All common control components such as duty selector switch, indication lights, reset and lamp test pushbuttons, ultrasonic display mounting, etc.

4.1.5 Outgoing Section for New Lift Pumps (2 Off), Each Equipped With:

a) Power and control equipment for motor and pump protection as well as control philosophy both internal and door-mounted, in line with section 5 below.

b) 90kW Variable Speed Drive (VSD) with specified protections. Note the manufacturer's cooling requirements that must be complied with, including external ducting that must be priced as part of the MCC offer, and harmonic mitigation must be provided as part of the offer in-line with IEEE519 requirements. The keypad must be door-mounted.

4.1.6 Outgoing Section for Local Lighting and Power

a) 15A SP CB, with 30mA Earth Leakage Unit, as well as 15A door-mounted socket outlet

b) 15A SP CB for local power

c) 32A TP CB for Local DB

d) 10A SP CB for telemetry outstation system

e) 2 x 10A SP CBs for local lighting

f) 2 x 10A SP CB for extraction fans

g) 20A SP CB for aircon

h) 5 x 10SP CB spare positions and 2 x 20A TP CB spare positions

4.1.7 PLC, HMI and Control Section

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

4.2 Lift Pump Station 2 MCC Construction

A new indoor MCC of the front-access, floor-standing type must supplied and installed in the position as indicated on the drawings. The stand and support pricing must be included as part of the MCC's pricing.

The MCC design, steelwork and all required switchgear fault rating must be minimum 10kA, to be confirmed with the Engineer before construction.

The PLC and associated equipment must be installed within a dedicated tier at the end of the MCC, with all connections and terminals mounted in the front and bottom. Any heating and cooling requirements, specifically for the UPS, must be included as part of the MCC design and final tender offer. The HMI must be door-mounted.

The MCC must consist of the following:

4.2.1 Incoming Section

a) Main incoming CB sized for full equipment loading

b) Surge arrestors

c) Phase failure protection

d) E-Stop with indication light

e) Power meter

4.2.2 Outgoing Common Control Section for New Lift Pumps With:

a) All common control components such as duty selector switch, indication lights, reset and lamp test pushbuttons, ultrasonic display mounting, etc.

4.2.3 Outgoing Section for New Lift Pumps (2 Off), Each Equipped With:

a) Power and control equipment for motor and pump protection as well as control philosophy both internal and door-mounted, in line with section 5 below.

b) 37kW Variable Speed Drive (VSD) with specified protections. Note the manufacturer's cooling requirements that must be complied with, including external ducting that must be priced as part of the MCC offer, and harmonic mitigation must be provided as part of the offer in-line with IEEE519 requirements. The keypad must be door-mounted.

4.2.4 Outgoing Section for Local Lighting and Power

a) 15A SP CB, with 30mA Earth Leakage Unit, as well as 15A door-mounted socket outlet

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b) 32A TP CB for Local DB

c) 10A SP CB for telemetry outstation system

d) 2 x 10A SP CB for extraction fans

e) 5 x 10SP CB spare positions and 2 x 20A TP CB spare positions

4.2.5 PLC, HMI and Control Section

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

4.3 Raw Water Pump Station MCC Construction

A new indoor MCC of the front-access, floor-standing type must supplied and installed in the existing MCC's location. The stand and support pricing must be included as part of the MCC's pricing.

The MCC design, steelwork and all required switchgear fault rating must be minimum 10kA, to be confirmed with the Engineer before construction.

The control must be relay-based only.

The MCC must consist of the following:

4.3.1 Incoming Section

a) Main incoming CB sized for full equipment loading

b) Surge arrestors

c) Phase failure protection

d) E-Stop with indication light

e) Power meter

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4.3.2 Outgoing Common Control Section for Existing Raw Water Pumps With:

a) All common control components such as duty selector switch, indication lights, reset and lamp test pushbuttons, ultrasonic display mounting, etc.

4.3.3 Outgoing Section for Existing Raw Water Pump (1 Off), Equipped With:

a) Power and control equipment for motor and pump protection as well as control philosophy both internal and door-mounted, in line with section 5 below.

b) 55kW Variable Speed Drive (VSD) with specified protections. Note the manufacturer's cooling requirements that must be complied with, including external ducting that must be priced as part of the MCC offer, and harmonic mitigation must be provided as part of the offer in-line with IEEE519 requirements. The keypad must be door-mounted.

4.3.4 Outgoing Section for Existing Raw Water Pump (1 Off), Equipped With:

a) Power and control equipment for motor and pump protection as well as control philosophy both internal and door-mounted, in line with section 5 below.

b) 30kW Variable Speed Drive (VSD) with specified protections. Note the manufacturer's cooling requirements that must be complied with, including external ducting that must be priced as part of the MCC offer, and harmonic mitigation must be provided as part of the offer in-line with IEEE519 requirements. The keypad must be door-mounted.

4.3.5 Outgoing Section for Existing Raw Water Pump (1 Off), Equipped With:

a) Power and control equipment for motor and pump protection as well as control philosophy both internal and door-mounted, in line with section 5 below.

b) 15kW Variable Speed Drive (VSD) with specified protections. Note the manufacturer's cooling requirements that must be complied with, including external ducting that must be priced as part of the MCC offer, and harmonic mitigation must be provided as part of the offer in-line with IEEE519 requirements. The keypad must be door-mounted.

4.3.6 Outgoing Section for Local Lighting and Power

a) 15A SP CB, with 30mA Earth Leakage Unit, as well as 15A door-mounted socket outlet

b) 32A TP CB for Local DB

c) 10A SP CB for telemetry outstation system

d) 5 x 10SP CB spare positions and 2 x 20A TP CB spare positions

4.3.7 Outgoing Section for Monitoring Terminals

Remote monitoring and control terminals (voltage free), mounted in an enclosed compartment of the MCC, for all required MCC status, instrumentation and process parameter signals for remote SCADA monitoring and control.

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

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4.4 PLCs and HMIs

The PLC with associated equipment and UPS must be mounted in a dedicated tier within the MCC. All terminals and connections must be provided for in the rear section (except in a front-access only MCC, where the terminals must be mounted in the front and bottom of the tier). A weatherproof RJ45 connection point must be door-mounted for laptop access.

The PLC offered must be of the Schneider M340 and/or similar type, with networked backplane and 25% spare capacity in terms of hardware and software capacity. A battery and inverter back-up configuration is preferred to a UPS. All heating and ventilation requirements to be taken into account as part of the design process.

The general intent and system configuration must be that the pumps can be run in manual, with required protections in place, should the PLC be faulty. All protections must therefore be hard-wired.

A 15" touch-screen HMI, of the Schneider and/or similar type, setup and configured as per the standard specification requirements must be door-mounted at the PLC tier. All licensing costs must be provided for under this contract. The HMI must be specifically suited for abrasive conditions (IP66), being fanless and stainless.

All required PLC and HMI hardware and software components, including licensing, programming and configuration costs must be included under the MCC price in the BOQ. Further provision must

be made in the pricing for three iterations of the HMI layout and trending requirements with the Client and Engineer.

5. SYSTEM CONTROL

There are three distinct systems that form part of this contract.

The first system is the clearwater lift system, pumping water through two pump stations (Lift 1 and Lift 2) from the WTW to the final main reservoirs. The lift pumps are all level controlled from their remote/demand reservoirs, with additional on-site reservoir suction control. The reservoir signals will be transmitted through telemetry outstations. All control must be done by the respective PLCs.

The second system relates to the booster pump station also located at the WTW, adjacent to the new Lift PS1. The Booster pump station is responsible for maintain system pressure in the largest pressure zone within the town of Robertson. There are several duty pumps, responsible for maintaining a tight pressure band, depending on the system's demand profile. The PLC will be responsible for maintaining this pressure band, while selecting both the number of duty pumps as well as the speed (Hz) at which the selected duty pumps must run. The system must run as close as possible to the pumps' Best Efficiency Point (BEP).

The third system relates to the raw water pumps, which are currently manually started and stopped by the operators, after the configuration of several external network valves. Under this contract, the new MCC with VSDs will provide the operators with better flow control, but also the capability of remote starting and stopping of specifically selected duty pumps, by means of SCADA Control.

All required telemetry outstation, monitoring and control signals must be coordinated and provided between the MCC manufacturer, System Integrator and the specialist telemetry supplier and no claims will be entertained for lack of coordination and signal/voltage disparities. This includes all inter-plant control cables and I/O allowances.

5.1 Lift Pump Station 1 Pumping System

5.1.1 Pump Control modes

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The pump station can either be run in manual or automatic mode, with automatic mode via level control from the Lift Pump Station 2 ground reservoir and suction WTW reservoir.

Each pump panel must be equipped with a three-position selector switch labelled Manual/Off/Auto, with the control as set-out below. A running pump must stop when switched to off and no pump can be initiated to run with the selector switch in the off position.

No more than one pump can run at any time.

5.1.1.1 Manual Mode

Each pump must be started and stopped via a start and stop pushbutton on the MCC, as well as from the local control station in close proximity to the respective pumpsets.

Note that even in manual mode, the respective hard-wired pump and motor protections must remain active to protect said equipment.

5.1.1.2 Automatic Mode

5.1.1.2.1 Primary Level Control

The pumps must be level controlled from Lift Pump Station 2's ground reservoir. The reservoir signal will be provided by means of a new ultrasonic level sensor, with the 4-20mA signal relayed

via telemetry to the pump station. The starting and stopping levels must then be adjusted on the HMI (with minimum two configurable relay outputs), with the reservoir level also displayed on the HMI.

The duty pump must start when the reservoir has dropped to a pre-determined low level and stop when the reservoir has reached a pre-determined full level, provided the suction control conditions have been met as described below. At the reservoir low level, a LEVEL START DEMAND indication light must come on and switch off once the reservoir is full.

The duty pump must run at a fixed speed, programmed into the VFCs (provisionally for 130l/s). The speed must be selected to always provide more water than the WTP provides, balancing the system and preventing the WTP from unnecessarily starting and stopping. The system curve and energy efficiency of the pump sets must also be considered. The minimum allowable frequency of the pumps must be evaluated on-site so that the required flow and pressure is still available through the delivery pipeline.

5.1.1.2.2 Secondary Suction Control

When the water level in the suction reservoir has dropped to a low level, the duty pumps must stop and only restart (if required) once the water level has risen above a high (enable) level.

The level signal must be derived from a new ultrasonic level sensor to be installed in the suction reservoir, as per section 6 below (two-relay control, so the control can be replaced with float level switches if needed). The level signal is common for both Lift PS1 and the Booster PS.

A SUCTION ENABLE indication light must switch off when the low level has been reached and only switch on once the reset level is reached.

NOTE:

1. When both the LEVEL START DEMAND and SUCTION ENABLE conditions are present, a START DUTY PUMP indication light must switch on and only switch off if one or both of these conditions are no longer active.

2. All switching (control and protection) conditions must be delayed with adjustable timers to prevent unnecessary starting during transient conditions.

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5.1.1.2.3 Duty Selection

The pumps must be provided with a common selector switch labelled Alt/P1/P2, door-mounted in the common control section. With the switch in Alt mode, the pumps must alternate their duty cycle after every 24 hours.

Should a running pump trip, be switched off (CB and selector switch) or fail to start, then the standby pump must takeover and start immediately. Should the tripped pump be fixed/reset, then it must not start up again and act as the standby pump.

In P1 or P2 that selected pump must start. However, even with the selector switch in that position, the standby functionality as detailed above must still be applicable.

5.1.1.3 Emergency Control

Delivery High Level

A new float level switch mounted in Lift PS2's ground reservoir will act as the high level cut-off alarm, if the pump did not stop at the normal stop level. This switch must stop (but not latch) a running pump in both auto and manual modes, with indication light labelled DELIVERY RESERVOIR HIGH LEVEL to come on in this condition.

Suction Low Level

A new float level switch mounted in the suction reservoir will act as the low level for the pump suction protection, if the pump did not stop at the normal stop level. This switch must stop (latch) a running pump in both auto and manual modes, with indication light labelled SUCTION SUMP LOW LEVEL to come on in this condition.

The pump must be manually reset and provision must be made for both local reset, as well as via telemetry.

Delivery High Pressure

A new pressure sensor on the common pump delivery line must be utilised for system pressure protection. The new pressure sensor must stop the duty pump if the system pressure rises above a certain value (in metres, to be confirmed on-site, in line with the system curve and pipe classes).

At this condition, a DELIVERY HIGH PRESSURE indication light must switch on (latch) and can only switch off once the fault has been assessed and manually reset on the MCC (only).

5.1.2 Protections

The pump must be protected, in all control modes, by means of the protective devices described below. At the occurrence of a fault, the motor must STOP and a FAULT indication light must energize.

Each protective device must be accompanied with a manual reset capability, either inherently built-in, or via a separate reset door-mounted push-button. No tripped equipment may start running until a manual reset has been initiated, unless otherwise specifically specified.

- Comprehensive starter protection by means of the VFC
- Motor overheat protection by means of integral klixons
- Pump no-flow protection by means of the common inline electromagnetic flow meter (refer section 6 instrumentation below). Individual pump protection must be provided, with the standby control functionality remaining in effect.
- Pump high pressure protection by means of a pressure switch

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5.1.3 Alarm and Status Indication

Each item monitored must be provided with the relevant indication as detailed below:

a) Pump Panel (2 No)

- RUN
- STARTER TRIP
- MOTOR OVERHEAT
- NO-FLOW
- HIGH PRESSURE
- E-STOP

b) Common Control Panel (shared with Booster PS)

- LEVEL START DEMAND

- SUCTION ENABLE
- START DUTY PUMP
- DELIVERY RESERVOIR HIGH LEVEL
- SUCTION RESERVOIR LOW LEVEL
- DELIVERY HIGH PRESSURE

c) Common Control HMI (shared with Booster PS)

- ALL DISCRETE PUMP AND SYSTEM STATUS SIGNALS
- WTW RESERVOIR DISPLAY
- LIFT PS2 LEVEL DISPLAY
- FINAL RESERVOIR LEVELS
- PUMP PRESSURE
- PUMP FLOW

5.1.4 Remote monitoring and control

The required monitoring and control signals for the telemetry and SCADA system must be provided by means of Modbus-networked communication.

Note all analogue 4-20mA signals must also be made available and communicated to the telemetry outstation. Any loop isolators required must be provided for in the MCC.

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

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5.2 Lift Pump Station 2 Pumping System

5.2.1 Pump Control modes

The pump station can either be run in manual or automatic mode, with automatic mode via level control from the Remote Main ground reservoir and suction Lift PS2 reservoir.

Each pump panel must be equipped with a three-position selector switch labelled Manual/Off/Auto, with the control as set-out below. A running pump must stop when switched to off and no pump can be initiated to run with the selector switch in the off position.

No more than one pump can run at any time.

5.2.1.1 Manual Mode

Each pump must be started and stopped via a start and stop pushbutton on the MCC, as well as from the local control station in close proximity to the respective pumpsets.

Note that even in manual mode, the respective hard-wired pump and motor protections must remain active to protect said equipment.

5.2.1.2 Automatic Mode

5.2.1.2.1 Primary Level Control

The pumps must be level controlled from the Remote Main ground reservoir. The reservoir signal will be provided by means of a new pressure probe, with the 4-20mA signal relayed via telemetry to the pump station. The starting and stopping levels must then be adjusted on the HMI (with minimum two configurable relay outputs), with the reservoir level also displayed on the HMI.

The duty pump must start when the reservoir has dropped to a pre-determined low level and stop when the reservoir has reached a pre-determined full level, provided the suction control conditions have been met as described below. At the reservoir low level a LEVEL START DEMAND indication light must come on and switch off once the reservoir is full.

5.2.1.2.2 Secondary Suction Control

When the water level in the suction reservoir has dropped to a low level, the duty pumps must stop and only restart (if required) once the water level has risen above a high (enable) level.

The level signal must be derived from a new ultrasonic level sensor to be installed in the suction reservoir, as per section 6 below (two-relay control, so the control can be replaced with float level switches if needed).

A SUCTION ENABLE indication light must switch off when the low level has been reached and only switch on once the reset level is reached.

NOTE:

1. When both the LEVEL START DEMAND and SUCTION ENABLE conditions are present, a START DUTY PUMP indication light must switch on and only switch off if one or both of these conditions are no longer active.

2. All switching (control and protection) conditions must be delayed with adjustable timers to prevent unnecessary starting during transient conditions.

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5.2.1.2.3 Duty Selection

The pumps must be provided with a common selector switch labelled Alt/P1/P2, door-mounted in the common control section. With the switch in Alt mode, the pumps must alternate their duty cycle after every 24 hours.

Should a running pump trip, be switched off (CB and selector switch) or fail to start, then the standby pump must takeover and start immediately. Should the tripped pump be fixed/reset, then it must not start up again and act as the standby pump.

In P1 or P2 that selected pump must start. However, even with the selector switch in that position, the standby functionality as detailed above must still be applicable.

5.2.1.3 Emergency Control

Delivery High Level

A new float level switch mounted in the Remote Main ground reservoir will act as the high level cut-off alarm, if the pump did not stop at the normal stop level. This switch must stop (but not latch) a running pump in both auto and manual modes, with indication light labelled DELIVERY RESERVOIR HIGH LEVEL to come on in this condition.

Suction Low Level

A new float level switch mounted in the suction reservoir will act as the low level for the pump suction protection, if the pump did not stop at the normal stop level. This switch must stop (latch) a running pump in both auto and manual modes, with indication light labelled SUCTION SUMP LOW LEVEL to come on in this condition.

The pump must be manually reset and provision must be made for both local reset, as well as via telemetry.

Delivery High Pressure

A new pressure sensor on the common pump delivery line must be utilised for system pressure protection. The new pressure sensor must stop the duty pump if the system pressure rises above a certain value (in metres, to be confirmed on-site, in line with the system curve and pipe classes).

At this condition, a DELIVERY HIGH PRESSURE indication light must switch on (latch) and can only switch off once the fault has been assessed and manually reset on the MCC (only).

5.2.2 Protections

The pump must be protected, in all control modes, by means of the protective devices described below. At the occurrence of a fault, the motor must STOP and a FAULT indication light must energize.

Each protective device must be accompanied with a manual reset capability, either inherently built-in, or via a separate reset door-mounted push-button. No tripped equipment may start running until a manual reset has been initiated, unless otherwise specifically specified.

- Comprehensive starter protection by means of VFC
- Motor overheat protection by means of integral klixons
- Pump no-flow protection by means of the common inline electromagnetic flow meter (refer section 6 instrumentation below). Individual pump protection must be provided, with the standby control functionality remaining in effect.
- Pump high pressure protection by means of a pressure switch

5.2.3 Alarm and Status Indication

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Each item monitored must be provided with the relevant indication as detailed below:

a) Pump Panel (2 No)
    - RUN
    - STARTER TRIP
    - MOTOR OVERHEAT
    - NO-FLOW
    - HIGH PRESSURE
    - E-STOP

b) Common Control Panel
    - LEVEL START DEMAND
    - SUCTION ENABLE

- START DUTY PUMP
- DELIVERY RESERVOIR HIGH LEVEL x 2
- SUCTION RESERVOIR LOW LEVEL
- DELIVERY HIGH PRESSURE

c) Common Control HMI

- ALL DISCRETE PUMP AND SYSTEM STATUS SIGNALS
- 2 x REMOTE MAIN RESERVOIRS LEVEL DISPLAY
- LIFT PS2 LEVEL DISPLAY
- WTW RESERVOIR LEVEL DISPLAY
- PUMP PRESSURE
- PUMP FLOW

5.2.4 Remote monitoring and control

The required monitoring and control signals for the telemetry and SCADA system must be provided by means of Modbus-networked communication.

Note all analogue 4-20mA signals must also be made available and communicated to the telemetry outstation. Any loop isolators required must be provided for in the MCC.

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

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5.3 Booster Pumping System

5.3.1 Pump Control modes

The pump station can either be run in manual or automatic mode, with automatic mode via network pressure control within the specified pressure band.

Each pump panel must be equipped with a three-position selector switch labelled Manual/Off/Auto, with the control as set-out below. A running pump must stop when switched to off and no pump can be initiated to run with the selector switch in the off position.

No more than three pumps can run together at any time.

5.3.1.1 Manual Mode

Each pump must be started and stopped via a start and stop pushbutton on the MCC, as well as from the local control station in close proximity to the respective pumpsets.

Note that even in manual mode, the respective hard-wired pump and motor protections must remain active to protect said equipment.

5.3.1.2 Automatic Mode

5.3.1.2.1 Primary Pressure Control

The pumps must maintain a constant minimum network pressure of 3bar (provisional). The network flow profile can differ greatly throughout the day, and between seasons (peak summer at 200l/s, with nightly flow very low (for example)). The number of duty pumps running will be a function of the current flow/demand requirement, configured against the current and pressure setpoint. The speed (Hz) of the duty pumps must be optimised to run close to the pump's BEP.

The duty pumps must run to maintain a pressure bandwidth of between 3.3 and 3.0 bar, with the pressure not allowed to drop below the minimum specified pressure. A PRESSURE START DEMAND indication light must switch on whilst the network pressure is within this band. The indication light must switch off once the pressure has climbed to above 3.5bar.

The switching of duty pumps (both starting up more pumps, and stopping pumps) must be carefully programmed to prevent unnecessary starting/stopping, and system hunting. Pressure and flow values will need to be present for a certain period before control changes take place. Existing duty pump Hz adjustments to be made first, before starting/stopping of additional pumps. All duty pumps running must run at the same Hz.

The PLC will need to PID within the pressure band, where the following parameters must be adjustable and provided with time delays before switching:

- Minimum motor speed
- PID parameters' rate of change
- System pressure
- System flow
- Duty pumps running
- VFC ramping times

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5.3.1.2.2 Secondary Suction Control

When the water level in the suction reservoir has dropped to a low level, the duty pumps must stop and only restart (if required) once the water level has risen above a high (enable) level.

The level signal must be derived from a new ultrasonic level sensor to be installed in the suction reservoir, as per section 6 below (two-relay control, so the control can be replaced with float level switches if needed). The level signal is common for both Lift PS1 and the Booster PS.

A SUCTION ENABLE indication light must switch off when the low level has been reached and only switch on once the reset level is reached.

5.3.1.2.3 Duty Selection

The pumps must be provided with a common selector switch labelled Alt/P1/P2/P3/P4, door-mounted in the common control section. With the switch in Alt mode, the pumps must alternate their duty cycle after every 24 hours.

Should a running pump trip, be switched off (CB and selector switch) or fail to start, then the standby pump must takeover and start immediately. Should the tripped pump be fixed/reset, then it must not start up again and act as the standby pump.

In P1, P2, P3 or P4 that selected pump must start. However, even with the selector switch in that position, the standby functionality as detailed above must still be applicable.

5.3.1.3 Emergency Control

Suction Low Level

A new float level switch mounted in the suction reservoir will act as the low level for the pump suction protection, if the pump did not stop at the normal stop level. This switch must stop (latch) a running pump in both auto and manual modes, with indication light labelled SUCTION SUMP LOW LEVEL to come on in this condition.

The pump must be manually reset and provision must be made for both local reset, as well as via telemetry.

Delivery High Pressure

A new pressure sensor on the common pump delivery line must be utilised for system pressure protection. The new pressure sensor must stop the duty pumps if the system pressure rises above a certain value (in metres, to be confirmed on-site, in line with the system curve and pipe classes).

At this condition, a DELIVERY HIGH PRESSURE indication light must switch on (latch) and can only switch off once the fault has been assessed and manually reset on the MCC (only).

5.3.2 Protections

The pump must be protected, in all control modes, by means of the protective devices described below. At the occurrence of a fault, the motor must STOP and a FAULT indication light must energize.

Each protective device must be accompanied with a manual reset capability, either inherently built-in, or via a separate reset door-mounted push-button. No tripped equipment may start running until a manual reset has been initiated, unless otherwise specifically specified.

- Comprehensive starter protection by means of the VFC
- Motor overheat protection by means of integral klixons
- Pump no-flow protection by means of non-intrusive, calorimetric flow switch

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5.3.3 Alarm and Status Indication

Each item monitored must be provided with the relevant indication as detailed below:

a) Pump Panel (4 No)

- RUN
- STARTER TRIP
- MOTOR OVERHEAT
- NO-FLOW
- E-STOP

b) Common Control Panel (shared with Lift PS1)

- PRESSURE START DEMAND
- SUCTION ENABLE

- SUCTION RESERVOIR LOW LEVEL
- SYSTEM HIGH PRESSURE

c) Common Control HMI (shared with Lift PS1)

- ALL DISCRETE PUMP AND SYSTEM STATUS SIGNALS
- WTW RESERVOIR DISPLAY
- PUMP/SYSTEM PRESSURE
- PUMP FLOW
- DUTY PUMP / FLOW / PRESSURE SELECTION TABLE

5.3.4 Remote monitoring and control

The required monitoring and control signals for the telemetry and SCADA system must be provided by means of Modbus-networked communication.

Note all analogue 4-20mA signals must also be made available and communicated to the telemetry outstation. Any loop isolators required must be provided for in the MCC.

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

5.4 Raw Water Pumping System

5.4.1 Pump Control modes

The pump station can either be run in manual or automatic mode, with automatic mode remote SCADA control operator input.

Each pump panel must be equipped with a three-position selector switch labelled Manual/Off/Auto, with the control as set-out below. A running pump must stop when switched to off and no pump can be initiated to run with the selector switch in the off position.

All three pumps can run together.

5.4.1.1 Manual Mode

Each pump must be started and stopped via a start and stop pushbutton on the MCC.

Note that even in manual mode, the respective hard-wired pump and motor protections must remain active to protect said equipment.

5.4.1.2 Automatic Mode

5.4.1.2.1 SCADA Control

Each pump must be able to be started remotely from the central SCADA. No further system interlocks are required.

Provision must be made for separate Start and Stop inputs, per pump selection (provided by telemetry).

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5.4.2 Protections

The pumps must be protected, in all control modes, by means of the protective devices described below. At the occurrence of a fault, the motor must STOP and a FAULT indication light must energize.

Each protective device must be accompanied with a manual reset capability, either inherently built-in, or via a separate reset door-mounted push-button. No tripped equipment may start running until a manual reset has been initiated, unless otherwise specifically specified.

- Comprehensive starter protection by means of the VFC
- Motor overheat protection by means of integral klixons
- Pump no-flow protection by means of non-intrusive, calorimetric flow switch

5.4.3 Alarm and Status Indication

Each item monitored must be provided with the relevant indication as detailed below:

a) Pump Panel (3 No)

- RUN
- STARTER TRIP
- MOTOR OVERHEAT
- NO-FLOW

b) Common Control Panel

- PUMP 1 SCADA START
- PUMP 2 SCADA START
- PUMP 3 SCADA START

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5.4.4 Remote monitoring and control

The required monitoring and control signals for the telemetry and SCADA system must be provided by means of voltage free contacts in a separate compartment.

Note all analogue 4-20mA signals must also be made available and communicated to the telemetry outstation. Any loop isolators required must be provided for in the MCC.

Note that it remains the responsibility of the Main Contractor to fully coordinate the required signals, as well as the format and voltage, between the MCC manufacturer and specialist telemetry supplier and no additional claims in this regard will be entertained.

6. INSTRUMENTATION

All instrumentation wired from the MCC must individually be equipped with dedicated Class 3 inline surge protection, complete with visual indicator.

Refer standard specification SSE03 for further technical details and requirements.

6.1 Level

6.1.1 Ultrasonic level sensor

New ultrasonic level sensors for level control must be provided at:

- WTW Reservoir (monitoring of water level and secondary control)
- Lift PS1 Reservoir (monitoring of water level and primary/secondary control)

Provision must be made in the MCC for a dedicated display of said level.

The units must be of the Mobray, Siemens or Endress+Hauser type.

6.1.2 Float Level Switches

The following float level switches must be provided for emergency control, pump/motor protection and alarm indication:

- WTW reservoir (low and high)
- Lift PS2 (low and high)
- 2 x Main Reservoirs (low and high)

The float level switches must be 24VDC only.

6.1.3 Level Probe

The level of the two main reservoirs must be measured by means of pressure level probes.

The sensors must further comply with the following requirements:

- Measuring range: 0m – 6m (max)
- Sensor: Capacitive
- Membrane: Ceramic
- Accuracy: 0.25% or less
- Transmitter: Remote (telemetry) mounted
- Power Supply: 24VDC (preferably)
- Output: 4-20mA proportional to reservoir level

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6.2 Flow

6.2.1 Electromagnetic Flow Meter

The electromagnetic flow meters must be of the SAFMAG, Siemens, Endress + Hauser and/or similar type.

6.2.1.1 Lift PS1 Pumps:

- Sensor Diameter: To suit new pipework (300Ø)

- Flange Type: To suit new pipework (including class type)
- Lining: Suitable for potable water
- Flow speed range: 0.01 – 10m/s
- Flow rate range: 0 – 140l/s
- Accuracy: 0.3% or less
- Transmitter: Remote (wall) mounted
- Power Supply: 24VDC (preferably)
- Output: 4-20mA proportional to flow, frequency/pulse outputs (all forward and reverse) and Modbus

6.2.1.2 Lift PS2 Pumps:

- Sensor Diameter: To suit new pipework (200Ø)
- Flange Type: To suit new pipework (including class type)
- Lining: Suitable for potable water
- Flow speed range: 0.01 – 10m/s
- Flow rate range: 0 – 60l/s
- Accuracy: 0.3% or less
- Transmitter: Remote (wall) mounted
- Power Supply: 24VDC (preferably)
- Output: 4-20mA proportional to flow, frequency/pulse outputs (all forward and reverse) and Modbus

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6.2.1.3 Booster Pumps:

- Sensor Diameter: To suit new pipework (350Ø)
- Flange Type: To suit new pipework (including class type)
- Lining: Suitable for potable water
- Flow speed range: 0.01 – 10m/s
- Flow rate range: 0 – 220l/s
- Accuracy: 0.3% or less
- Transmitter: Remote (wall) mounted
- Power Supply: 24VDC (preferably)

- Output: 4-20mA proportional to flow, frequency/pulse outputs (all forward and reverse) and Modbus

6.2.2 No-Flow

6.2.2.1 Flow Meter

No-flow protection must be done by means of the electromagnetic flow meter and relay control, where specified. Timers must be provided for any transient conditions and the duty/standby functionality must remain as specified.

6.2.2.2 Flow Switches

Where specified, no-flow protection must be provided by means of non-intrusive flow switches, based upon the calorimetric principle, similar or equal to the IFM SI series. The unit must be provided complete with stainless steel probe, LED flow status and no moving parts.

6.3 Pressure

6.3.1 Delivery Pressure Sensor

Provision must be made on the various pumps' common delivery pipework for the installation of a pressure sensor.

6.3.1.1 Lift PS1 Pumps:

The sensor must further comply with the following requirements:

- Sensor Diameter: Socket-installed (size to suite equipment)
- Measuring range: 0bar – 6bar (min)
- Sensor: Capacitive
- Membrane: Ceramic
- Accuracy: 0.5% or less
- Transmitter: Remote (wall) mounted, with 4-20mA to MCC HMI
- Power Supply: 24VDC (preferably)
- Output: 4-20mA proportional to system pressure

6.3.1.2 Lift PS2 Pumps:

The sensor must further comply with the following requirements:

- Sensor Diameter: Socket-installed (size to suite equipment)
- Measuring range: 0bar – 6bar (min)
- Sensor: Capacitive
- Membrane: Ceramic
- Accuracy: 0.5% or less

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- Transmitter: Remote (wall) mounted, with 4-20mA to MCC HMI
- Power Supply: 24VDC (preferably)
- Output: 4-20mA proportional to system pressure

6.3.1.3 Booster Pumps:

The sensor must further comply with the following requirements:

- Sensor Diameter: Socket-installed (size to suite equipment)
- Measuring range: 0bar – 5bar (min)
- Sensor: Capacitive
- Membrane: Ceramic
- Accuracy: 0.5% or less
- Transmitter: Remote (wall) mounted, with 4-20mA to MCC HMI
- Power Supply: 24VDC (preferably)
- Output: 4-20mA proportional to system pressure

6.3.2 Pump Pressure Switches

Provision must be made on the delivery pipework for the installation of a pressure switch per pump set. The switch must comply with the following requirements:

- Lift PS1: Measuring range: 0bar – 6bar (min)
- Lift PS2: Measuring range: 0bar – 6bar (min)

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7. GENERAL ELECTRICAL WORK

The general electrical installation covers the supply, installation and connection of equipment provided under this contract, as well as the connection of other MCCs and control panels provided by others.

Refer standard specification SSE02 for further technical requirements.

7.1 CABLES, TRAY AND SUNDRIES

The Contractor must allow for the supply and installation of all required electrical, control and instrumentation cables, heavy duty cable ladder outside and within the plant as per the schedule in the Bill Of Quantities (BOQ).

7.2 LOCAL CONTROL STATIONS

Local control stations must be manufactured from Stainless Steel (SS) 304, including all nuts, bolts, handles and hinges. The mounting configuration must be as detailed below per specific application. The equipment housing/junction box, including mounted devices, must be of the IP67 type. 50mm overhang hoods/covers must be provided for all outdoor applications in addition to the requirements above.

Internal space must be designed as such that all necessary field terminals, relays, timers, terminations as well as 20% spare capacity is provided for. Stations must be lockable, or only accessible by means of a tool.

Detailed labels must be provided throughout pertaining to station name, equipment designation as well as incoming and outgoing cable feeds.

The control station must consist of:

- Green start push-button
- Red Mushroom-type E-Stop with separate release mechanism

7.3 SYSTEM EARTHING

Where specified and indicated on the drawings and in the BOQ, dedicated Bare Copper Earth Conductors (BCEC) must be installed alongside and strapped to its associated electrical supply cable. The size of the BCEC is provisional along with the supply cable size. BCEC must be fitted crimped lugs and must be solidly bolted at both ends.

All required electrical points and paths along the installation must be solidly bonded, with the return path solidly connected to the MCC's main earth.

In addition, a dedicated earth mat must also be supplied and connected to the main MCC's earth bar. The mat must be a minimum 1m x 1m with 70mm^2 BCEC Cadwelded together, with internal grids of no more than 200mm x 200mm. The earth mat must be installed adjacent to the MCC and connected by means of a 70mm^2 BCEC to ensure an earth resistance of one ohm or less. All required excavations, connections and coordination must be included as part of the earth mat price.

Note that should the mat be installed without the initial supply cable earth wire readings provided to Engineer, then no compensation will be provided to the Contractor for the earth mat nor ancillaries.

Note that for mechanical strength reasons no BCEC may be smaller than 4mm^2.

All ancillary equipment such as nuts, bolts, hinges, etc. must be manufactured from stainless steel.

7.4 SMALL LIGHTING AND POWER

A Local DB must be provided, wall-mounted within the pump stations. All lighting and small power feeds must be taken from this DB.

Socket outlets must be of the double type, provided with weatherproof cover, mounted at a minimum of 1200mm AFL.

Lights must be installed as detailed in the BOQ, per respective building.

All lighting circuits to be min 1.5mm^2 wire, with power circuits being minimum 2.5mm^2.

Bosal must be used throughout, on suitable spacers, for lighting and power installation.

8. SCADA AND TELEMETRY

This section of the Project Works requires a dedicated and specialist sub-contractor to execute the required Works. Close cooperation is critical between the Main Contractor, specialist sub-contractor as well as MCC manufacturer and no claims in this regard will be entertained.

The project specification covers the related design, construction, supply, delivery, installation, testing, commissioning and site optimisation of a radio telemetry and central SCADA system.

Currently the scope must be further defined, with PC SUM allocations made for specific portions of the intended scope. Quotations will be requested from specialist suppliers once a Main Contractor has been appointed. The Main Contractor will be expected to assist in the quotation process.

This project's estimated scope of works could include:

- New telemetry outstations at several sites, for point-to-point communication and remote monitoring
- All required interfacing, coordination and control between the outstations and MCC
- New central SCADA system at the Municipality's office (with licensing costs where required), including the incorporation of the various sites
- Data storage, dashboard monitoring pages and possible reporting
- Remote monitoring of system at newly established central command centre

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SECTION 4: DRAWING LIST

DRAWING NUMBER	DESCRIPTION	SIZE	LOCATION
21108-M-001	Booster and Lift Pump Station 1 Mechanical and Electrical Layout (Sheet 1)	A1	Externally attached
21108-M-001	Booster and Lift Pump Station 1 Mechanical and Electrical Layout (Sheet 2)	A1	Externally attached
21108-M-002	Lift Pump Station 2 Mechanical and Electrical Layout	A1	Externally attached
21108-E-001	Booster and Lift Pump Station 1 Lighting and Power Layout	A1	Externally attached
21108-E-002	Lift Pump Station 2 Lighting and Power Layout	A1	Externally attached

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SECTION 5: STANDARD SPECIFICATIONS

The following Standard Specifications shall be applicable to the project, and shall be read in conjunction with the Project Specifications in Sections 1 to 4:

a) MECHANICAL STANDARD SPECIFICATIONS

1.	Pumping Equipment	11	pages
2.	Pipework and Valves	10	pages
3.	Materials and Coatings	6	pages
4.	Ancillary Equipment	16	pages

b) ELECTRICAL STANDARD SPECIFICATIONS

1.	Medium Voltage	16	pages
2.	LV and Control	38	pages
3.	Instrumentation and Control Devices	41	pages
4.	Telemetry and SCADA	17	pages
5.	Generators	7	pages

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MECHANICAL STANDARD SPECIFICATION 01 – PUMPING EQUIPMENT:

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1. PUMP CHARACTERISTICS GUARANTEE AND TESTING OF PUMP SETS:

The performance of the pump set(s) offered shall be guaranteed to comply within the tolerances as described in ISO 9906:2012 Grade 2B. The following characteristics shall be guaranteed as a minimum:

- Pump rate
- Total dynamic pumping head
- Pump efficiency
- Shaft Power

Where specified in the Project Specification, the Contractor shall include for costs to factory bench test as follows:

a) The contractor shall make provision to test each pump set at the manufacturer's premises according to ISO 9906:2012 Grade 2B, including pump efficiency, (unless otherwise indicated in the Project Specification) and send the test reports to the Engineer for approval. The test reports must be approved in full before the pump sets may be shipped to site.
   Should one or more of the pump sets fail to comply with any of the guaranteed parameters the contractor shall be liable for all cost involved to rectify the issue or to replace the pump set, as well as the cost to retest the pump set(s).
   The Contractor must allow for all costs involved with the testing of the pump sets and supplying Test Certificates as well as provided sufficient time in the programme for this.

b) The contractor shall make provision to witness test each pump set at the manufacturer's premises according to ISO 9906:2012 Grade 2B, including pump efficiency, (unless otherwise indicated in the Project Specification).
   The Contractor shall allow for all costs involved to send three persons (1x Employer representative, 1x Engineer representative and 1x Contractor representative) to witness the factory bench testing of all the pump sets. Theses cost shall include for all costs incurred by the representative to attend the testing, including but not limited to the transport, airfares, visas, accommodation, incidentals, subsistence etc, shall be provided for in the pricing.
   Should one or more of the pump sets failed fail to comply with any of the guaranteed parameters the contractor shall be liable for all cost involved to rectify the problem or to replace the pump set, as well as the cost to retest the pump set(s) including the cost involved for all parties required to be at the witness testing.
   The Contractor must allow for all costs involved with the testing of the pump sets and supplying Test Certificates as well as provided sufficient time in the programme for this.

2. RAW SEWAGE PUMP SETS:

2.1. Submersible type sewage pump set:

Submersible sewage pump sets shall be designed for handling raw, unscreened sewage and be suitable for a complete submerged installation. The pump sets shall be close-coupled centrifugal type of pump sets.

The pump volute, motor housing and seal housing shall be constructed out of grey cast iron, EN-GJL-250 or similar approved. The impeller shall be constructed out of the following materials: Grey Cast Iron (EN-GJL-250); Duplex Stainless Steel (EN 1.4593 or higher); Nickle-Aluminium Bronze (BS EN 12163); or Tin Bronze (C90300 / SAE620). The preferred material shall be Grey Cast Iron unless otherwise indicated in the Project Specification. The pump - and motor shafts shall be constructed out of 316 grade Stainless Steel (EN 1.4401 or higher).

The preferred impeller type shall be the Vortex type with a minimum solids handling of 80mm, unless otherwise indicated in the Project Specification. For higher flow applications, single or two (s) channel non-clog impeller with a minimum solids handling of 100mm may be considered. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

Shaft seals shall be double mechanical type seals and oil lubricated. All bolts sets shall be of grade 316 Stainless Steel or higher. Bearings shall be of the permanently lubricated, ball - and angular roller type bearings. All motors larger than 22kW shall be equipped with insulated bearings on both the drive end and non-drive end of the motor.

The electrical motors shall be suitable for underwater operation and shall have a IP 68 rating and class F insulation. Electrical motors shall preferably have a rated speed lower than 1500 rpm. Higher rated speed shall be considered in special conditions. The motor sizing shall be selected at least 15% larger than the shaft power required with the impeller / pump combination at the design duty point. It shall also allow for at least 20% higher flow than the design point without overloading the motor. For a non-overloading power curve characteristic, the motor shall be sized at 10% above the maximum power required impeller / pump combination.

Motor cables shall be suitably sized for the motor rating and the length of cable shall such to reach the Motor Control Centre (MCC) or a cable connection box as discussed in the Electrical Specification but shall not be shorter than 10m. Cable extension shall not be accepted. All cables shall be installed and sealed in the factory.

The motor shall be equipped with moisture-ingress – and seal-failure sensors. It shall also be equipped with three thermal switches (Klixon), one on each phase.

All Submersible pump sets shall be installed on an auto coupling and shall be supplied complete with a duckfoot-bend, grade 316L guide rails and cast iron top bracket. For pump sets with a weight more than 100kg or in the case where the sump is deeper than 4m, a twin guide rail arrangement shall be supplied and installed. The pump sets shall be equipped with a 10mm long, grade 316L Stainless Steel lifting chain, including rated shackle to connect to the pump set and a hook installed in the manhole opening to hang the chain from. The duckfoot-bend shall be installed with Stainless Steel chemical anchor bolts with a minimum length of 150mm.

Pump sets installed on a pedestal and equipped with a flexible hose shall not be accepted.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number

c) Impeller size
d) Operational speed
e) Design duty point (pump rate and pressure head)
f) Electrical motor sizing

2.2. Immersible / dry well type sewage pump set:

Immersible sewage pump sets shall be designed for handling raw, unscreened sewage and be suitable for a complete submerged or dry-well (complete or partial) installation. The pump sets shall be close-coupled centrifugal type of pump sets.

The pump volute, motor housing, cooling jacket and seal housing shall be constructed out of grey cast iron, EN-GJL-250 or similar approved. The impeller shall be constructed out of the following materials: Grey Cast Iron (EN-GJL-250); Duplex Stainless Steel (EN 1.4593 or higher); Nickle-Aluminium Bronze (BS EN 12163); or Tin Bronze (C90300 / SAE620). The preferred material shall be Grey Cast Iron unless otherwise indicated in the Project Specification. The pump - and motor shafts shall be constructed out of 316 grade Stainless Steel (EN 1.4401 or higher).

The preferred impeller type shall be the Vortex type with a minimum solids handling of 80mm, unless otherwise indicated in the Project Specification. For higher flow applications, single or two (2) channel non-clog impeller with a minimum solids handling of 100mm may be considered. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

Shaft seals shall be oil lubricated, mechanical type seals. All bolts sets shall be of grade 316 Stainless Steel or higher. Bearings shall be of the permanently lubricated, ball - and angular roller type bearings. All motors larger than 22kW shall be equipped with insulated bearings on both the drive end and non-drive end of the motor.

The electrical motors shall be suitable for underwater operation and shall have a IP 68 rating and class F insulation. Electrical motors shall preferably have a rated speed lower than 1500 rpm. Higher rated speed shall be considered in special conditions. The motor sizing shall be selected at least 15% larger than the shaft power required with the impeller / pump combination at the design duty point. It shall also allow for at least 20% higher flow than the design point without overloading the motor. For a non-overloading power curve characteristic, the motor shall be sized at 10% above the maximum power required impeller / pump combination.

The motor shall be equipped with cooling jacket with a closed internal cooling circuit for effective cooling of the motor under any situations. Making use of the pumped medium for cooling purposes shall not be accepted.

Motor cables shall be suitably sized for the motor rating and the length of cable shall such to reach the Motor Control Centre (MCC) or a cable connection box as discussed in the Electrical Specification but shall not be shorter than 10m. Cable extension shall not be accepted. All cables shall be installed and sealed in the factory.

The motor shall be equipped with moisture-ingress – and seal-failure sensors. It shall also be equipped with three thermal switches (Klixon), one on each phase.

In a submerged application, the pump sets shall be installed on an auto coupling and shall be supplied complete with a duckfoot-bend, grade 316L guide rails and cast iron top

bracket. For pump sets with a weight more than 100kg or in the case where the sump is deeper than 4m, a twin guide rail arrangement shall be supplied and installed. The pump sets shall be equipped with a 10mm long, grade 316L Stainless Steel lifting chain, including rated shackle to connect to the pump set and a hook installed in the manhole opening to hang the chain from. The duckfoot-bend shall be installed with Stainless Steel chemical anchor bolts with a minimum length of 150mm.

In a drywell application, the pump sets shall be installed either in a vertical or horizontal orientation, as indicated int eh project specification and drawings. The pump set shall be properly supported on a purpose made base plate, providing support to both the pump and motor. The base plate shall be constructed out of heavy duty hot dipped galvanised mild steel. The base plate shall be fixed to the concrete plinth by means of chemical anchor bolts.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number
c) Impeller size
d) Operational speed
e) Design duty point (pump rate and pressure head)
f) Electrical motor sizing

2.3. Self-priming type sewage pump set:

The pump shall be of the centrifugal, self-priming type designed to handle raw, unscreened sewage or slurries up to 5% consistency. The pump volute shall be designed in such a way to allow for automatic re-priming of the pump in a totally open system without the use of external non-return valves on the suction and discharge. The impeller shall be of the two-vane, semi-open, non-clog type impeller and shall be designed to allow a solid spherical object up to 75mm in diameter to pass through the pump without causing blockages. The impeller shall be equipped with integral pump-out vanes on the back of the impeller. The wear plate / impeller alignment shall be adjustable for outside of the pump set. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

The volute shall be equipped with suitably pressure rated flange connections for both suction and discharge pipe connections, with threaded both holes to suit.

The pump shall be equipped with an inspection hatch, providing access to the pump internals without dismantling any pipework to gain access. The hatch may not weigh more than 30kg and shall be adequately sized to allow for servicing of the pump set. It must be possible to replace the complete rotating assembly, impeller, shaft, bearings and seal, through the access hatch without disturbing the pipework.

The pump shall be equipped with a self-cleaning, replaceable wear plate, which shall have notches, grooves and a lacerating tooth to break up stringy material. Wear plates making use of sharp chopper blades shall not be accepted. The pump will be equipped with a moulded, one-piece, suction check valve which must be replaceable through the hatch.

The pump volute and seal housing shall be constructed out of grey cast iron, EN-GJL-250 or similar approved. The impeller shall be constructed out of the following materials: Grey Cast Iron (EN-GJL-250).

The shaft and bearings shall be installed in a suitably sized bearing pedestal that can handle all forces exerted on the pump / rotating assembly. Suitable ball type thrust and - radial bearings shall be used.

The pump shall be driven by an TEFC type electrical motor, rated for 400 V, 50 Hz, and shall be mounted on a common base plate. The electrical motor shall have a rated speed lower than 1500 rpm.

Preferably, the motor shall be coupled to the pump by means of a direct type coupling. The motor coupling shall be either a flexible pin and bush type coupling or a flexible grid coupling, both of which must be suitable for operating with a VSD. The assembly shall be laser aligned to ensure optimal operation. Alternatively, should motor / pump duty / impeller combination not allow for this, the pump shall be belt driven and shall be supplied with suitable pulleys, v-belts and coupling guard that cover all moveable parts.

The pump set shall be installed on a purpose built base plate, housing both the pump, electrical motor and belt drive. The base plate shall be constructed out of heavy duty hot-dipped galvanised mild steel and shall be designed to handle all static and dynamic forces. The base plate shall provide for a pedestal onto which the electrical motor shall be installed, and it shall be equipped with four jacking bolts to align the motor. Provision shall be made in the baseplate to tension the belt drive to the correct tension required for the installation. The base plate shall be bolted to the concrete plinth by a minimum of 3 bolts on each length side, or as recommended by the manufacturer.

The pump and motor shall be properly aligned by means of laser alignment by an approved third party to the specification and requirements of the manufacturer prior to commissioning or start-up to ensure no damage to the equipment.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number
c) Impeller size
d) Operational speed
e) Design duty point (pump rate and pressure head)

3. RAW – AND POTABLE WATER DRYWELL PUMPS

3.1. End-suction type centrifugal pump sets

The pumps shall be horizontally installed, single-stage, volute casing type, end-suction centrifugal pump, suitable for pumping potable and screened raw water and shall be driven by an electrical motor. The pump shall have an axial inlet port, a radial outlet port and a horizontal shaft.

Pump shall comply with ISO 5199:2002, ISO 9905: 1994 and ISO 9908: 1993 as well as ISO 2858: 1975. All flanges dimensions and drillings shall be according to EN 1092-2.

The pump casing, bearing housing and seal housing shall be constructed out of grey cast iron (EN-GJL-250) or similar approved. The impeller shall be constructed out of the following materials: Grey Cast Iron (EN-GJL-250); Duplex Stainless Steel (EN 1.4593 or higher); Nickle-Aluminium Bronze (BS EN 12163); or Tin Bronze (C90300 / SAE620). The preferred material shall be Tin Bronze unless otherwise indicated in the Project Specification. The pump - and motor shafts shall be constructed out of 316 grade Stainless Steel (EN 1.4401 or higher).

The impeller shall be of the closed, radial type impeller with multiple curved vanes. The impeller shall be trimmed to suit the design duty point, unless otherwise indicated in the Project Specification, and the electrical motor shall be sized accordingly. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

All pumps shall be equipped with a single / double mechanical seal according to EN 12756. Oil lubricated, deep-groove ball bearings shall be used.

The pump casing shall provide for a back-pull-out design to remove the complete rotating assembly without disturbing the suction - and discharge pipework. The pump shall be equipped with suitably designed bearing housing and - pedestal to handle all static and dynamic forces. Bearing brackets shall be considered for smaller pump application by the Engineer.

The pump shall be driven by an electrical motor mounted on a common baseplate. The pump and motor shall be coupled by means of a flexible rubber coupling, suitable for use with a VSD. All rotating assemblies must be completely covered by guards. Close coupled pump and motor sets shall only be considered where the motors are smaller than 9 kW.

The pump set shall be installed on a purpose built base plate, in accordance with ISO 3661, housing both the pump, electrical motor and coupling. The base plate shall be constructed out of heavy duty, hot-dipped galvanised mild steel and shall be designed to handle all static and dynamic forces. The base plate shall provide for a pedestal onto which the electrical motor shall be installed, and it shall be equipped with four jacking bolts to align the motor. The base plate shall be bolted to the concrete plinth by a minimum of 3 bolts on each length side, or as recommended by the manufacturer.

The pump and motor shall be properly aligned by means of laser alignment by an approved third party to the specification and requirements of the manufacturer prior to commissioning or start-up to ensure no damage to the equipment.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number
c) Impeller size
d) Operational speed
e) Design duty point (pump rate and pressure head)

3.2. Horizontal, multistage type centrifugal pump sets

The pumps shall be horizontal, high-pressure, multi-stage, ring sectional design, radial-suction and -discharge type centrifugal pump, suitable for pumping potable and screened raw water and shall be driven by an TEFC type electrical motor, rated for 400 V 50 Hz.

All flanges dimensions and drillings shall be according to EN 1092-2.

The pump casing, bearing housing and seal housing shall be constructed out of grey cast iron (EN-GJL-250) or similar approved. The impeller shall be constructed out of the following materials: Grey Cast Iron (EN-GJL-250); Duplex Stainless Steel (EN 1.4593 or higher); Nickle-Aluminium Bronze (BS EN 12163); or Tin Bronze (C90300 / SAE620). The preferred material shall be Tin Bronze unless otherwise indicated in the Project Specification. The pump - and motor shafts shall be constructed out of 316 grade Stainless Steel (EN 1.4401 or higher).

The pump shall have a radial inlet port (at the drive end of the pump), a radial outlet port (at the non-drive end of the pump) and a horizontal shaft. The individual casing parts and volute rings shall be sealed by O-rings clamped together by means of external tie bolts / rods. The pump feet shall form part of the suction and discharge casings and arranged to be beneath the pump. The orientation of the suction and discharge ports shall be indicated on the drawing(s).

The impeller shall be of the closed, radial type impeller with multiple curved vanes. The impeller shall be trimmed to suit the design duty point, unless otherwise indicated in the Project Specification, and the electrical motor shall be sized accordingly. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

All pumps shall be equipped with a single / double mechanical seal according to EN 12756. Oil lubricated bearings shall be used in bearing housings flanged onto each end of the pump. Cylindrical roller bearings shall be used on the suction side of the pump and deep groove / angular bearing for the discharge side. The rotating assembly shall be hydraulically balanced by means of back vanes at the rear of the impeller to minimise the axial thrust created. All residual thrust shall be handled by the bearing on the discharge side.

The pump shall be driven by an electrical motor mounted on a common baseplate. The pump and motor shall be coupled by means of a flexible rubber coupling, suitable for use with a VSD. All rotating assemblies must be completely covered by guards. Close coupled pump and motor sets shall only be considered where the motors are smaller than 9 kW.

The pump set shall be installed on a purpose built base plate, in accordance with ISO 3661, housing both the pump, electrical motor and coupling. The base plate shall be constructed out of heavy duty, hot-dipped galvanised mild steel and shall be designed to handle all static and dynamic forces. The base plate shall provide for a pedestal onto which the electrical motor shall be installed, and it shall be equipped with four jacking bolts to align the motor. The base plate shall be bolted to the concrete plinth by a minimum of 3 bolts on each length side, or as recommended by the manufacturer.

The pump and motor shall be properly aligned by means of laser alignment by an approved third party to the specification and requirements of the manufacturer prior to commissioning or start-up to ensure no damage to the equipment.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number

c) Impeller size
d) Operational speed
e) Design duty point (pump rate and pressure head)

3.3. Horizontal split-case type centrifugal pump sets

The pumps shall be horizontally installed, single-stage, volute casing type, horizontal split-case centrifugal pump, suitable for pumping potable and screened raw water and shall be driven by an electrical motor. The pump shall have flanged radial inlet- and outlet ports with an inline design, and a horizontal shaft and make use of a double-suction design to reduce axial forces. The operational speed of the pump shall not exceed 1500rpm.

Pump shall comply with. All flanges dimensions and drillings shall be according to EN 1092-2.

The pump casing, bearing housing and seal housing shall be constructed out of grey cast iron (EN-GJL-250) or similar approved. The impeller shall be constructed out of the following materials: Grey Cast Iron (EN-GJL-250); Duplex Stainless Steel (EN 1.4593 or higher); Nickle-Aluminium Bronze (BS EN 12163); or Tin Bronze (C90300 / SAE620). The preferred material shall be Duplex Stainless Steel unless otherwise indicated in the Project Specification. The pump - and motor shafts shall be constructed out of 316 grade Stainless Steel (EN 1.4401 or higher).

The impeller shall be of the closed, double-suction type impeller. The impeller shall be trimmed to suit the design duty point, unless otherwise indicated in the Project Specification, and the electrical motor shall be sized accordingly. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

The shaft shall be supported by both drive-end – and non-drive-end bearings. All pumps shall be equipped with a single / double mechanical seal according to EN 12756. Oil lubricated, deep-groove ball bearings shall be used.

The pump casing shall provide for a horizontal split casing design to remove the complete rotating assembly without disturbing the suction - and discharge pipework. The pump shall be equipped with suitably designed bearing housing and - pedestal to handle all static and dynamic forces.

The pump shall be driven by an electrical motor mounted on a common base plate. The motor coupling shall be either a flexible pin and bush type coupling or a flexible grid coupling, both of which must be suitable for operating with a VSD.

The pump set shall be installed on a purpose built base plate, housing both the pump, electrical motor and coupling. The base plate shall be constructed out of heavy duty, hot-dipped galvanised mild steel and shall be designed to handle all static and dynamic forces. The base plate shall provide for a pedestal onto which the electrical motor shall be installed, and it shall be equipped with four jacking bolts to align the motor. The base plate shall be bolted to the concrete plinth by a minimum of 4 bolts on each length side, or as recommended by the manufacturer.

The pump and motor shall be properly aligned by means of laser alignment by an approved third party to the specification and requirements of the manufacturer prior to commissioning or start-up to ensure no damage to the equipment.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number
c) Impeller size
d) Operational speed (pulley sizes if applicable)
e) Design duty point (pump rate and pressure head)

4. SLUDGE AND OTHER APPLICATIONS DRYWELL PUMPS

4.1. Positive displacement – progressive cavity pump sets

The pumps shall be horizontally installed, single rotor type progressive cavity type pump, suitable for pumping raw – or potable water as well as slurries and sludge with a solids content of at least 4 % (40 000mg/l). The pump shall have an axial inlet port, a radial outlet port and a horizontal shaft.

The flanged ports, pump casing, bearing housing and seal housing shall be constructed out of grey cast iron (EN-GJL-250) or similar approved. The stator housing shall be constructed from thick-wall mild-steel tubing. The rotor shall be constructed out of the following materials: EN8 carbon steel; heat-treated tool steel or 316 Stainless Steel. The Stator shall be manufactured from nitrile, natural, Hypalon or viton rubber. The Supplier shall confirm the suitable material that suits the pump medium. The pump shaft shall be constructed out of 316 grade Stainless Steel (EN 1.4401 or higher).

The rotor shall be of the helical type, suitable for reversible and self-priming action with a high suction capability. The motor shall be size to handle at least 15% motor the maximum shaft power. The complete rotating assembly shall be dynamically balanced to ensure optimum operation.

All pumps shall be equipped with a double mechanical seal according to EN 12756. Oil lubricated, taper-roller bearings shall be used.

The pump casing shall provide for a front-pull-out design to remove the complete rotating assembly without disturbing the discharge pipework. The suction pipework shall be designed in suction a way that a short spool piece is provided that can easily be removed should the rotor be required to be removed. The pump shall be equipped with suitably designed bearing housing and - pedestal to handle all static and dynamic forces. The pedestal shall provide suitable fixing points for the reduction gear box and motor.

The pump shall be driven by an electrical motor mounted on a reduction gearbox. The pump and motor shall be coupled by means of a fixed coupling in the gearbox, and shall be suitable for use with a VSD.

The pump set shall be installed on a purpose built base plate, in accordance with ISO 3661, housing both the pump, electrical motor and gearbox. The base plate shall be constructed out of heavy duty, hot-dipped galvanised mild steel and shall be designed to handle all static and dynamic forces. The base plate shall provide for a pedestal onto which the electrical motor shall be installed, and it shall be equipped with four jacking bolts to align the motor. The base plate shall be bolted to the concrete plinth by a minimum of 3 bolts on each length side, or as recommended by the manufacturer.

The pump shall be equipped with a name plate with the following information as a minimum:

a) Pump Manufacturer
b) Pump range and model number
c) Impeller size
d) Operational speed
e) Design duty point (pump rate and pressure head)

5. ELECTRICAL MOTORS FOR DRYWELL PUMPS

Electrical motors utilised to drive drywell pumps shall comply with the following requirements.

The electrical motor shall be a TEFC type motor, rated for 400 V, 50 Hz. The motor casing, dimensions and ratings shall comply with the SANS 1804. Testing of the motors shall be according to IEEE Standard 112-2004.

The motor casing shall be constructed from cast iron. It shall be equipped with cooling fins that is positioned in such a way that will not accumulate liquids and dust over the motor. The motor casing shall be equipped with a minimum of 2 eyebolts for lifting purposes. The motor shall be equipped with a directly coupled fan, with a fan cover, for cooling of the motor.

The motor terminal box shall preferably be placed on the side of the motor, with the electrical wiring entering from the bottom.

The motor shall be equipped with deep groove, ball bearings. Both drive-end - and non-drive-end bearings shall be insulated to ensure the motor is rated for use with Variable Frequency Drive (VFDs). Where applicable, motors must be adapted and rated to work with a VFD to be able to handle the voltage spikes, additional stresses, etc.

The motor shall have a IE3 level of efficiency (Premium Efficiency). The enclosure shall be IP55 rated according to IC411-TEFC and shall be foot-mounted. Where the installation or environment require a higher IP rating, the motor supplied shall comply with such requirements. Electrical motors installed at the ocean or close to the ocean, the motor shall be rated for marine applications.

The electrical motor shall be equipped, assessed based upon the respective motor sizing, with the following protection proposed:

a) Rating of 2.2kW to 22kW – Starter protection only
b) Rating of 22kW to 110kW – Motor overheat protection by means of thermistor protection in the motor winding (two per winding)
c) Rating of 132kW and greater – Motor protection by means of PT100’s installed in the motor windings (two per winding) and at the motor bearings (drive and non-drive ends), as well as general vibration protection of the pump and motor respectively (drive and non-dive ends of both).

In situations where the motor operates at low speeds, forced cooling shall be provided by means of external forced ventilation kit. In such case the supplied base plate must have adequate space to place the kit.

Higher rated speed shall be considered in special conditions. The motor sizing shall be selected at least 15% larger than the shaft power required with the pump / speed combination at the design duty point. It shall also allow for at least 20% higher flow than the design point without overloading the motor. For a non-overloading power curve characteristic, the motor shall be sized at 10% above the maximum power required impeller / pump combination.

Operational speeds higher than 1450 rpm shall not be allowed in motor sizing larger than 90 kW.

6. REDUCTION GEARBOX FOR MOTORS FOR DRYWELL PUMPS

The gearbox / speed reducer shall be designed for continues operation over 24h per day. The mechanical power ratings (according to AGMA rating) shall be greater than 2.25 times the installed power and shall account for D.O.L. starting of the unit at full load conditions (maximum immersion). Thermal power ratings shall be based on an ambient temperature of 40°C.

Speed reducers units shall be specifically designed and selected for horizontally mounted surface aerator duties and shall use standardised components. Only units specifically designed and certified by the manufacturer to be used for aerators duties shall be considered (supporting documentation must be submitted at tender stage), non-compliance may lead to rejection of the tender. Tenderers will be required to provide a catalogue of the make of speed reducer offered and to indicate how the selection was done.

The helical and spur gears shall be manufactured from alloy steel and shall be thoroughly hardened and ground after machining. The gears shall have a high durability factor, maximum strength and low noise level. Worm gears shall not be considered.

All bearings shall be designed for a life of at least 100 000h at a L10 rating. In addition, the bearings on the output shaft shall be capable of withstanding the resultant forces caused by the combination of radial and axial loads, imposed by the aerator, acting simultaneously, and shall be selected such that the following condition is complied with:

$$\left(\frac{Actual\ Radial\ Load}{Permissible\ Radial\ Load}\right) + \left(\frac{Actual\ Axial\ Load}{Permissible\ Axial\ Load}\right) \leq 1$$

The Permissible loads are the manufacturer's figure for 5 000h at a L10 rating. Tenderers shall indicate what these forces are and how they are accommodated.

The casings shall be manufactured out of close grain cast iron and shall be designed such as to prevent moisture from entering the unit. A standard dry well for the vertical down shaft, low speed shaft bearing is required to avoid complete drainage of oil in the event of an oil seal failure. The housing shall be equipped with a breather, drain and oil level plugs which shall be accessible from above the mounting frame.

All speed reducers must be provided with jacking bolts of Stainless Steel, allowing at least 100mm adjustment up and down.

The motor shall be vertically mounted to the speed reducer via an accurately located lantern housing. A precision high speed flexible coupling, incorporating rubber buffers shall transmit power from the motor to the speed reducer.

Inspection of the speed reducer and gears shall be possible without dismantling the speed reducer. It shall have lifting lugs for lifting purposes. The coupling between the aerator and the speed reducer shall be such that the aerator can be easily removed without shifting the speed reducer.

The speed reducer shall be fitted with an effective and accessible oil filling plug, oil level indication mechanisms and drain plug. Speed reducers rated at more than 75kW shall have oil pressure indicators and oil pressure limit switches fitted for protection purposes.

Forces cooling and cooling fans shall not be permitted, and the thermal power rating of the speed reducer shall exceed the motor power after derating for 40°C ambient temperature.

All bearings shall be located within the speed reducer and shall be lubricated by means of a positive splash-action system. Where immersion or splash lubrication is not deemed adequate by the manufacturer, lubrication shall be achieved by a forced lubrication system directly driven by a reducer shaft. Oil levels shall be easily controlled. Should greasing of certain bearings be required, the grease pump shall be driven by the movement of the speed reducer.

The speed reducer shall be mounted on a suitable base plate. Each unit shall be fitted with a nameplate showing at least the following information:

- Speed reducer Manufacturer, type and model number
- Serial number
- AGMA rating
- Nominal ratio
- Approximate oil quantity required

MECHANICAL STANDARD SPECIFICATION 02 – PIPEWORK AND VALVES:

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1. PIPEWORK:

The specification covers the design, manufacture and supply of electric welded, low carbon steel pipes, specials and other fittings for the conveyance for water for duties up to 4.6MPa.

The Contractor shall be responsible for the detail design and compilation of workshop drawings for the pipework to be approved by the Engineer. The pipework shall be designed in such a manner that allows dismantling of the pipework for inspections and maintenance. All pipework shall be properly supported and anchored by means of suitably designed pipe-supports to handle stresses caused by static and dynamic forces, including shocks caused by water hammer, in the pipework. The weight if the pipework may not be supported by the pump, and suitable supports shall be provided.

Steel pipes and specials up to and including DN150 shall be in accordance with SANS 62 with a Heavy Wall specification and API 5L with a steel grade up to X52, and pipes of DN200 and larger, shall be in accordance with SANS 719 with steel grades of A, B and C as well as API 5L steel grades X46, X52, X56 and X60. The minimum wall thickness shall be as follows:

Nominal Pipe Sizing:	Minimum wall thickness (mm):
DN200 to DN500	6
DN600 to DN800	8
DN900 to DN1200	10
DN1300 to DN1600	12
DN1700 to DN1800	14
DN1900 to DN2200	16
>DN2200	TBC

In the case where there is additional specification provided for pipe sizes larger than DN2200, the specification used for pipes of DN2200 shall apply. Tolerance on all pipe diameters shall be in accordance with SANS 719, except for pipes larger than DN1200, tolerances shall be +6mm and -6mm.

Pipe flanges shall be manufactured from steel plates in accordance with SANS 50025 300W. Flange dimensions and drillings shall be accordance with SANS 1123 table 3. The minimum rated nominal pressure shall be 1000kPa.

All welds shall be in accordance with SANS 719 and SANS 10044.

All pipe specials and fittings shall be manufactured from materials that correlate with the applicable pipe sizing as above and according to SANS 62 and SANS 79 as applicable. All manual or semi-automatic welds and repairs may only be done by qualified welders, as per the tests laid down in the Code of Practice for Welding SANS 10044.

Pipe flanges shall be in accordance with SANS 1123 table 3 and shall have a minimum rating of 10bar. Unless the flange rating and drilling schedule is indicated in the Project Specification, it shall be selected higher than the applicable pump's shut-off pressure head.

All pipe bends shall be long radius, smooth formed. With pipework larger than ND700, segmented bend may be considered and must be approved by the Engineer. The maximum angle between oblique butt-ends of segments for gusseted bends shall not

exceed 22.5°. Segmented bends shall be long radius type with the radius are equal to three times the diameter. Cut-and-shut bends shall not be accepted.

All tee-offs or tee-connections shall be long radius, smooth formed, swept tees. The thickness of the barrel and branch plates shall be sufficient so that the maximum stress shall not be greater than that for an uncut piece of pipe of the theoretically required thickness. In cases where it is more economical to make use of saddle-type rings or triform shoes as external reinforcements, it may be considered and shall be approved by the Engineer. Full penetration welding shall be used for the attachment of reinforcements.

All reducers shall not have an angle larger than 8°. Reducers on the suction side of pump sets shall always be eccentric reducers, and reducers on the delivery of the pump may be concentric reducers.

Couplings shall be of the flange adapter, self-anchoring type and shall be able to handle deflection of ±3°. The pipework shall incorporate a restraining flange to anchor the flange adapter when it is utilised on the delivery pipework and the pipework is not anchored within a wall. Flanges adapters shall be supplied with all required accessories and fasteners.

Ø32mm sockets shall be provided on all pump suction and delivery pipework for ancillary mechanical and electrical gauges and instrumentation. The sockets shall be positioned on the suction and delivery pipe reducers. It shall be positioned in such a way that the turbulence caused by the pump suction and delivery flows or created by valves have as little as possible influence on readings taken at the points.

All pipes and specials shall be clearly hard stamped alongside a longitudinal or spiral weld on one end of the pipe section with the following information provided:

a) The grade and thickness of Steel used;
b) The serial number of the pipe or pipe-special;
c) The nominal diameter;
d) The hydraulic test pressures.

The applicable flange drilling table shall be clearly hard stamped on the periphery of all flanges.

All underground pipework shall be wrapped in a petrolatum paste / wrap to prevent corrosion.

Underground pipework shall be installed on sand bedding and - blanket, as described in SANS 1200, to provide sufficient support to pipework and prevent damage to the coating.

2. VALVES:

2.1. Shut-off valves:

2.1.1. Gate valves - General:

All gate valves shall be double flanged and shall be either of the resilient seated – or wedge-gate type valves. The gate shall lift completely clear of the stream in the open position. The valve shall make use of a non-rising spindle. It shall be capable of withstanding both specified test pressures and nominal pressures (PN) from both sides

of the valve and the gate shall be fully operational in both conditions. All valves shall be right-hand closing, unless otherwise indicated in the Project Specification.

The minimum pressure rating for the supplied valves shall be 10bar (PN10) but shall be indicated in the Project Specification and drawings. The pressure rating of the valve shall not be less than the pressure rating of the connecting pipework. Valve bodies shall be test to 1.5x PN rating (in bar) and the seal to 1.1x PN rating (in bar). Flange drillings shall be in accordance with SANS 1123 with the applicable pressure rating.

The valves shall be designed and constructed in accordance with SANS 664. The body of the valve shall be designed and constructed to withstand all forces and not to distort under high pressure conditions. The valve body shall make provision for connecting flanges to install an external gearbox or actuator, and it shall not be directly on the stuffing box.

All valves shall be fitted with a back seal to permit replacement of the stem seal under pressure without disturbing the pipework.

All valves larger than DN400 shall be equipped with a bypass and valve. Resilient Seated valves may be considered for sizing up to DN300 mm and approval must be obtained from the Engineer. Wedge-gate valves shall have preference for sizes DN50 to DN700.

The Manufacturer shall have an ISO 9000 certified quality system which is audited by an independent third party. Each finished item shall be tested for compliance with the product standards and local market specification.

2.1.2. Gate valves – Flanged Resilient Seated Gate Valves:

The valve body shall provide a straight, unobstructed body passage free of pockets or crevice's that might catch debris or cause stagnant water. Prominent gate guides shall be incorporated in the body of the valve. It shall be designed in such a way to provide support to the gate for in all positions, yet is shall not interfere with the flow path of the water.

The wedge of the valve shall be fully vulcanized with a drinking water approved EPDM type rubber compound and it shall be drop tight over the pressure range of the valve. It shall be designed to ensure even distribution of sealing pressure and it shall be capable of handling foreign matter up to a particle size of 1mm. The wedge shall be equipped with an integral wedge shoe and it shall accurately fit the body guide profile to allow smooth operation of the wedge and not cause shudder.

The stem shall be manufactured out of 316 grade Stainless Steel and shall have wedge stops and rolled threads for high strength. The valve shall have a wiper / scraper to ensure the shaft is clean and prevent foreign matter ingress. Low friction materials suitable for drinking water application shall be used with O-rings to seal the valve body. The valves shall have a non-rising stem unless otherwise indicated in the Project Specification.

The bonnet gasket shall be encircled the bonnet bolts which must be countersunk and sealed.

The valve body, bonnet and wedge shall be constructed out of Ductile Iron (EN-GJS-500), the stem shall be 316 grade Stainless Steel, the stem nut shall be Bronze, and all the

fasteners shall be Stainless Steel. The valve body shall internally and externally be coated with a drinking water approved epoxy coating to a DFT of 300microns.

2.1.3. Gate valves – Flanged Wedge-Gate Valves:

The valve body shall provide a straight, unobstructed body passage. Prominent gate guides shall be incorporated in the body of the valve. It shall be designed in such a way to provide support to the gate for in all positions, yet is shall not interfere with the flow path of the water.

The wedge shall be manufactured out of Ductile Iron (EN-GJS-500) with firmly secured Copper Alloy or Aluminium Bronze face rings which shall be machined to a fine surface finish to ensure optimum contact seal with the body seat rings. The guides shall ensure uniform closure irrespective of the pressure and shall be capable of handling foreign matter up to a particle size of 1mm. The housing shall be designed in such a way that prevent water from accumulating in a pocket or become stagnant.

The stem shall be manufactured out of 316 grade Stainless Steel and shall have wedge stops and rolled threads for high strength. The valve shall have a wiper / scraper to ensure the shaft is clean and prevent foreign matter ingress. Low friction materials suitable for drinking water application shall be used with O-rings to seal the valve body.

The bonnet gasket shall be encircled the bonnet bolts which must be countersunk and sealed.

The valve body, bonnet and wedge shall be constructed out of Ductile Iron (EN-GJS-500), the seats and faces shall be Copper Alloy or Aluminium Bronze, the stem shall be 316 grade Stainless Steel, the stem nut shall be Bronze, and all the fasteners shall be Stainless Steel. The valve body as well as the wedge shall internally and externally be coated with a drinking water approved epoxy coating to a DFT of 300microns.

2.1.4. Gate valves – Knife-Gate Valves:

The valve body shall provide a straight, unobstructed body passage. Prominent gate guides shall be incorporated in the body of the valve. It shall be designed in such a way to provide support to the gate for in all positions, yet is shall not interfere with the flow path of the water.

The wedge shall be manufactured out of Stainless Steel (AISI 304 for raw and potable water applications and AISI 316 for sewage and sludge application). The seat shall be metal / metal or EPDM rubber. The guides shall ensure uniform closure irrespective of the pressure and shall be capable of handling foreign matter and the body and seat shall assure non-clogging shut-off on suspended solids. The housing shall be designed in such a way that prevent water from accumulating in a pocket or become stagnant.

The stem shall be manufactured out of 316 grade Stainless Steel and shall have wedge stops and rolled threads for high strength. The packing shall be OTFE impregnated synthetic fibre and will have an EPDM o-ring.

The valve body, bonnet and wedge shall be constructed out of Cast Iron (EN-GJS-400), the seats and faces shall be Copper Alloy or Aluminium Bronze, the stem shall be 316 grade Stainless Steel, the stem nut shall be Bronze, and all the fasteners shall be Stainless Steel. The valve body shall have lugs for locating purposes with the flange bolts. The valve

body shall internally and externally be coated with a drinking water approved epoxy coating to a DFT of 300microns.

2.1.5. Butterfly Valves - General:

Butterfly valves shall be of the double flanged, long body, double-offset, full-bore type butterfly valves unless otherwise indicated in the Project Specification. Wafer – and lug type valves may be considered for low cost or temporary applications and shall not exceed ND150. All valves shall be designed, manufactured and tested in accordance with BS EN 593.

The maximum flow rate in a valve shall not exceed 5m/s and the blade in the fully open position shall not cause any cavitation. The valves shall be capable of opening and closing under the maximum specified head and flow rate. The disk shall be designed to eliminate any flutter under open conditions.

The valves shall be installed in an orientation that the valve will operate along the horizontal axis, with the lower part of the disk opens towards the downstream side of the valve. Direction of closing shall be right-hand. The valve shall be water tight in both flow directions and shall be of the resilient seal type.

The hubs for the shaft bearings housing shall be incorporated in the valve body. The valve body shall be equipped with adjustable mechanical stops to prevent the disk from over travel in the open and closed positions.

The valve body shall allow for a connecting flange to install a gearbox or actuator. All valves shall be equipped with a gearbox and hand wheel, unless the Project Specification states otherwise.

The disk shall be manufactured from a single casting of approved hydrofoil section. The combined stresses in the disk in situations where an unbalanced force is applied to the valve may not exceed 20% of the minimum yield strength of the material used.

The retaining rings shall be coated Stainless Steel to prevent galvanic corrosion. All recesses for the retaining ring, both in the body and on the disk, shall be coated and the retaining ring inserted while the coating is still wet.

Valve shall make use of resilient seal type arrangement. The seal shall be adjustable, removable and replaceable from the down stream side of the valve without removal of the valve body from the pipework. The seals shall be suitable for potable water, non-weathering, non-sticking and long-life properties.

The valve body shall have a smooth and continuous seat profile and the design shall allow the seal to open and close on the Stainless Steel seat only. Seats and seals installation shall prevent water ingress under the seat or seal in any of the operating positions and it shall be designed and manufacture in such a water to prevent the seal or seat to come loose.

The shafts shall be of the stub-shaft design configuration and shall extend at least 1.5 times the shaft diameter into the disk hub. The shaft shall not protrude from the hubs. It shall be connected to the disk by means of keys, dowel pins or taper pins and shall be designed to transmit shaft torque equivalent to at least 75% of the torsional strength of the shaft. Dowel – and taper pins shall be mechanically secured in place.

The bearings shall be fitted to the hubs in the valve body and shall be of the self-lubricating sleeve type bearing. The valve shall be equipped with at least one adjustable thrust bearing in order to adjust and hold the disc securely concentric with the seat.

The valve body and disk shall be constructed out of Ductile Iron (EN-GJS-500), the seal retaining ring shall be grade 304 Stainless Steel, the shaft shall be grade 304 Stainless Steel, the disc or body seal shall be EPDM type rubber, and all the fasteners shall be Stainless Steel. The valve body and disk shall internally and externally be coated with a drinking water approved epoxy coating to a DFT of 300microns.

The Manufacturer shall have an ISO 9000 certified quality system which is audited by an independent third party. Each finished item shall be tested for compliance with the product standards and local market specification.

2.2. Non-return valves:

2.2.1. Non-return / check valve – General:

The body shall be designed in accordance with SANS 1551 or BS EN 1074. Both the housing and the disk shall be free off flow obstructions or pockets.

The minimum pressure rating for the supplied valves shall be 10bar (PN10) but shall be indicated in the Project Specification and drawings. The pressure rating of the valve shall not be less than the pressure rating of the connecting pipework. Valve bodies shall be test to 1.5x PN rating (in bar) and the seal to 1.1x PN rating (in bar). Flange drillings shall be in accordance with SANS 1123 with the applicable pressure rating.

The body of the valve shall be designed and constructed to withstand all forces and not to distort under high pressure conditions.

The valve body, bonnet and disk shall be constructed out of Ductile Iron (EN-GJS-400 or higher), the seal inlay shall be Bronze, the shaft shall be grade 304 Stainless Steel, and all the fasteners shall be Stainless Steel. The valve body and disk shall internally and externally be coated with a drinking water approved epoxy coating to a DFT of 300microns.

The Manufacturer shall have an ISO 9000 certified quality system which is audited by an independent third party. Each finished item shall be tested for compliance with the product standards and local market specification.

2.2.2. Single disk, swing type non-return valve:

Single disk, swing type non-return valves shall be of the double flanged, long-body, type check valve suitable for potable and raw water, or raw unscreened sewage.

The main seal shall be a bronze ring inlaid along the circumference of the disk and shall be closing along another bronze ring inlaid into the housing seat. The disk shall be completely enclosed (except for the seal ring) in potable water approved EPDM. The valve body shall be equipped with a bonnet that allow full access to the internals of the valve for maintenance and repairs without disturbing the pipework connections. It must be able to remove the disk through the opening.

The disk shall be mounted on a hinge made of epoxy coated ductile iron for sizes larger than DN250 and Stainless Steel for sizes up to and including DN200. The connection shall

be a loose-fitting polyamide bushing that enables the disk to tilt slightly in all directions to adjust exactly to the valve seat. The shaft shall extend from the valve body to fit a counter weight and lever. All valves shall be equipped with a counter weight and lever and the valve shall be capable of either horizontal or vertical installation and operation.

2.2.3. Tilting disk non-return valve:

Tilting disk type non-return valves shall be of the double flanged, long-body, type check valve suitable for potable and raw water, or raw unscreened sewage. The valve shall be of the eccentric butterfly valve design and the seat shall be angled at ±20° to provide a shorter stroke for opening and closing of the valves. It shall be equipped with a metal seat.

The valves shall be equipped with an external hydraulic damper, unless otherwise stated in the project specification, to control the opening and closing of the valve. The damper shall be adjustable to control the rate of closing.

2.2.4. Ball type non-return valve:

Ball type non-return valves shall be of the double flanged, long-body, type check valve suitable for raw unscreened sewage. The valve shall be designed to ensure a self-cleaning construction, where the ball rotates during operation to eliminate the chance of impurities getting stuck on the ball. The flow passage shall be full bore to ensure minimum pressure drop over the valve.

The ball shall be manufactured from aluminium for sizes up to and including DN100 and cast iron for sizing larger than DN100. The ball shall be rubber coated. The rubber coating shall be of such hardness to prevent the ball from getting stuck in the seat, not will the seat create indents on the rubber.

The body shall be equipped with a removable bonnet to inspect the internals and replace the ball without disturbing the pipework.

2.2.5. Axial sprung, silent closing type non-return valve:

The valve shall be of the long body, axial sprung, silent closing type valve suitable for potable and raw water. The valve design shall prevent shock closing the valve body shall designed to have a hydrodynamically efficient flow path to minimise head loss through the valve. The spring shall be Stainless Steel and the guide rod shall be supported within a non-corroding, non-galling bearing material.

2.2.6. Double door wafer type non-return valve:

Double door, wafer type non-return valves shall be suitable for potable and raw water. These valves shall may be used for sized up to and including DN80.

The body shall be constructed from cast iron, the flaps / doors shall be constructed from stainless steel with machined sealing faces. The flaps shall be light, butterfly type and it shall be specifically designed to be non-sticking and be equipped Teflon bearings washers. The axles and springs shall be stainless steel. The springs shall be designed to initiate closing before reverse flow are experienced.

2.3. Air Release valves:

2.3.1. For liquids carrying solid particles

Provision shall be made for the supply and installation of a flanged, double action / combination type, air-release valve specifically designed for liquids carrying solid particles such as raw water / - sewage installation. Valves shall be rated at the same pressure rating than that of the pipework it is installed on, with flange drilling to suit the pipework (minimum PN10). Each air-release valve shall be equipped with a suitably sized flanged, cast iron, resilient seated gate valve, suitable for raw water / - sewage. The valve shall have an operating range from 0.5 bar to the valve PN rating.

A drainage pipe running continuously to the sump from the air-release valve shall be supplied and installed, to direct any liquid released by the valve back to the sump / drainage channel. The air-release valve body shall be designed to have a screw connection onto which the drainpipe will connect.

The minimum grade for material and coatings shall be as follows:

- Body : Epoxy coated steel
- Cover : Reinforced nylon
- Discharge outlet : HDPE
- Inner metal parts : Stainless Steel 316
- Floats : Polypropylene / Polycarbonate
- Fasteners : Stainless Steel 316

The position and sizing of the valves shall be in accordance with the Mechanical drawings and Bill of Quantities.

2.3.2. For liquids not carrying solid particles:

Provision shall be made for the supply and installation of a flanged, double action / combination type, air-release valve specifically designed for liquids not carrying solid particles such as screened / filtered water or effluent installation. Valves shall be rated at the same pressure rating than that of the pipework it is installed on, with flange drilling to suit the pipework (minimum PN10). Each air-release valve shall be equipped with a suitably sized flanged, cast iron, resilient seated gate valve, suitable for raw water / - sewage. The valve shall have an operating range from 0.1 bar to the valve PN rating.

A drainage pipe running continuously to the sump from the air-release valve shall be supplied and installed, to direct any liquid released by the valve outside of the building / to a drainage channel. The air-release valve body shall be designed to have a screw connection onto which the drainpipe will connect.

The minimum grade for material and coatings shall be as follows:

- Body : Epoxy coated ductile iron
- Cover : Epoxy coated ductile iron
- Discharge outlet : Epoxy coated ductile iron
- Inner metal parts : Stainless Steel 316
- Floats : Polypropylene, glass reinforced Nylon
- Fasteners : Stainless Steel 316

The position and sizing of the valves shall be in accordance with the Mechanical drawings and Bill of Quantities.

3. ELECTRIC ACTUATORS

Electric Actuators shall be provided in either partial-turn or multi-turn models and it shall be specifically matched to the valve design as described in the Project Specification, applicable drawings and Bill of Quantities. Actuators shall either have open/close or modulating function, and units with modulating function shall be designed for continues modulation operation.

The actuator motor shall be rated for 400 V, 50 Hz supply, shall have a class F (or better) insulation. It shall be equipped with thermostats for overload protection. The motor and gearbox shall form one integrated unit and the complete unit, including all glands and controls, installation work shall have an ingress protection rating of IP67 or higher (unless otherwise indicated in the Project Specification). Each unit shall be equipped for manual override operation by means of a level operated clutch and handwheel (hand operated gearwheel) and the unit shall have indication of open and close directions. The output drive shall be hollow to accept rising valve stems. All components of the drive shall be designed to prevent backlash. The unit shall be equipped with oil bath lubrication that will enable the unit to be installed in any orientation.

The continuous actuator torque rating shall be at least 200 % and 400 % of the start- or stop torque, to open/close and modulating units respectively, which ever is higher as specified by the manufacturer for the application (taking the mechanical advantage into account provided by the gearbox).

The gear ratio of the gearbox shall be such to provide a continuous operation between opening and closing, without any pulsing during the operation, to conform to the opening / closing time as specified in the Project Specification, without the motor having to stop or start during the closing / opening operation.

Each unit shall have local controls to operate the actuator. It shall be equipped with a Local / Off / Remote switch, to change between Local and Remote control of the actuator, and an Open / Close push button switches for local control (opening and closing) of the actuator.

Each unit shall be equipped with continues mechanical valve position indication, even without power. The terminal compartment shall be separately sealed from the mechanisms and internal control electronics. The actuator unit shall be equipped with independent torque and position sensor for protection.

It shall initiate a trip condition if:

a) It fails to move the valve within a suitable period,
b) Failure to open or close,
c) The motor windings overheat,
d) High torque situation,
e) Phase imbalance / phase rotation.

Each actuator shall have discreet control inputs and outputs for control, as follows:

a) Valve position,

b) Valve action (opening or closing),
c) Valve control,
d) Trip condition.

The actuator shall be equipped with the following functions should the Project Specification call for it:

a) The actuator shall provide an impact effect to overcome a tightly sealed valve or unintended loss of movement.
b) The actuator shall be network compatible to feed the following information to the control panel or, if applicable, to the SCADA system:
   - Torque on output shaft,
   - Valve position,
   - Valve action (opening or closing),
   - Valve control,
   - Trip conditions,
c) It shall be possible to configure the control instructions and interrogate the actuator status without removing the covers.

MECHANICAL STANDARD SPECIFICATION 03 – MATERIAL AND COATINGS:

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1. MATERIAL SELECTION

Any references made to the South African National Standards (SANS) or the British Standards Institution (BS) shall be deemed to refer to the latest revision of the applicable specification, or in cases where a standard was replaced with a new one, the new standard shall apply.

In general, all materials offered, shall be the best grade of material in its specific class and shall be suitable for the working conditions (including working pressures, temperatures, environment, etc.) without distorting or deteriorating or creating stresses in the material.

The Contractor shall supply corrosion resistant materials in cases where high corrosive environments are expected, for instance where the material will be in contact with water or sewage. Should any material show signs of corrosion, pitting or tuberculation, during the defects liability period, it shall be replaced by the Contractor at his own account with materials as approved by the Engineer.

All joints, channels, angles, plates and structural steel shall conform to SANS 2001.

2. PAINTING, COATINGS AND FINISHES

In general, the following shall apply for all items to be painted or coated under this specification:

a) The surface of the item to be painted shall be thoroughly cleaned in accordance with ISO 12944-4 (Part 6.1.4 Alkaline Cleaning) to remove all traces of oil, grease, dust, mill-scale, rust or corrosion, or any residue of any nature before paint or coating may be applied.
b) Metal surfaces shall be moisture dry before paint is applied, and paint surfaces shall be “hard” dry before further coats may be applied, unless otherwise specified.
c) In situations where the shop coat was left for several months, the surface shall be cleaned with emery paper or steel wool prior to applying the final coating.
d) The final coating must be applied to the equipment prior to final installation in situations where surfaces are inaccessible after installations.
e) The painter shall ensure that the final coat covers all prior coatings.
f) A non-destructive thickness gauge shall be used to measure the final dry film thickness (DFT).
g) The coating manufacturer’s instructions and requirements must be strictly adhered to.

Preparation of Metal surfaces shall be as follows:

a) All metal surfaces shall be sandblasted to a minimum of Sa2½ finish, according to ISO 8501-1 to the roughness as specified by the coating manufacturer.
b) The abrasive material shall fully comply with SANS 064 and shall be free of any traces of grease, oil, foreign objects or corrosive contaminants.
c) The abrasive and blast cleaning process shall be adjusted to ensure that the minimum amount of abrasive material remains embedded in the steel.
d) The blast cleaning shall only be conducted in the correct environment and atmospheric conditions. No cleaning shall be done if there is dew on the metal

surface or when the humidity is such that moisture condenses at the nozzle during work in the case of nozzle blasting.

e) The blasted surface shall be cleaned of all abrasive material prior to being painted by brushing or vacuuming. The primary coat shall be applied as soon as possible, but not later than 4 hours after blasting.

The preparation of the paint, the environment and application of the coatings shall be strictly in accordance with the manufacturer's requirements and specifications. Method statements for these processes shall be submitted to the Engineer and approved prior to commencement of the painting process.

2.1. Specification for structural steel:

The following specifications shall be used, unless otherwise specified in the Project Specification. Preparation and application shall strictly comply with the manufacturer's requirements and specifications and it must be adhered to at all time.

2.1.1. General Steelwork (Dry conditions – low to medium corrosive environment)

Primer : One coat of a two-component amine cured epoxy coating, suitable for use in highly corrosive environments, similar or equally approved to Jotun Penguard Express. Minimum DFT of 150 microns. The product shall at least a 74% solids of volume content according to ISO 3233.

Finishing coat : One coat, two components chemically curing aliphatic acrylic polyurethane coating, suitable for use in highly corrosive environments, similar or equally approved to Jotun Hardtop XP. Minimum DFT of 60 microns. The product shall at least a 63% solids of volume content according to ISO 3233.

Minimum total dry film thickness: 210 microns

2.1.2. General Steelwork (Dry conditions – high corrosive environment)

Primer : Two coats of a two-component amine cured epoxy coating, suitable for use in highly corrosive environments, similar or equally approved to Jotun Penguard Express. Minimum DFT of 125 microns. The product shall at least a 74% solids of volume content according to ISO 3233.

Finishing coat : One coat, two components chemically curing aliphatic acrylic polyurethane coating, suitable for use in highly corrosive environments, similar or equally approved to Jotun Hardtop XP. Minimum DFT of 60 microns. The product shall at least a 63% solids of volume content according to ISO 3233.

Minimum total dry film thickness: 310microns

2.1.3. General Steelwork (Wet conditions – fresh – and sea water)

Primer : One coat of a two-component polyamine cured epoxy coating, suitable for use in highly corrosive environments, similar or equally approved to Jotun Marathon in 038 grey colour. Minimum DFT of

300 microns. The product shall at least an 80% solids of volume content according to ISO 3233.

Finishing coat : One coat of a two-component polyamine cured epoxy coating, suitable for use in highly corrosive environments, similar or equally approved to Jotun Marathon in 038 grey colour. Minimum DFT of 300 microns. The product shall at least an 80% solids of volume content according to ISO 3233.

Both epoxy coatings shall be high scratch resistant and suitable for use in marine applications. Minimum total dry film thickness: 310microns

2.1.4. Hot-dipped Galvanised Steel

All traces of protective coatings must be removed prior to painting using the approved cleaning agent(s)

Primer(s) : One coat approved galvanising etching agent
Undercoat : One coat universal undercoat
Finishing coat(s) : Two coats approved gloss enamel

2.2. Specification for pipes (Epoxy Coating):

The following specification shall be used, unless otherwise specified in the Project Specification:

- Internal Lining:
  - Surface preparation: Perform an abrasive blast to Sa2½ as per ISO 8501-1, blasting profile 40-70microns;
  - Coating 1: Apply two coats of reinforced high solids type coating (similar to Sigmaguard 720 or another approved epoxy coating) to a minimum DFT of 125-150microns;
  - Coating 2: Apply reinforced high solids type coating in pipe blue (similar to Sigmaguard 720 pipe blue or another approved epoxy coating) to a minimum DFT of 125-150microns;
  - The total coating minimum DFT should be 375microns
- External Coating:
  - Surface preparation: Perform an abrasive blast to Sa2½ as per ISO 8501-1, blasting profile 40-70 microns;
  - Coating 1: Apply a two-component, high solids, polyamide cured, zinc rich epoxy primer (similar to SigmaZinc 109 HS7200 or another approved epoxy primer) to a minimum DFT of 75-100microns;
  - Coating 2: Apply two coats of a Two-component, high-build, micaceous iron oxide-pigmented, polyamide-cured recoatable epoxy coating (similar to SigmaCover 435 or another approved epoxy coating) to a minimum DFT of 100-125microns for each coat;
  - Coating 3: Apply a two-component, aliphatic acrylic polyurethane finish coat (similar to Sigmadur 550 or another approved coating) to a minimum DFT of 50-60;
  - The total coating minimum DFT should be 325microns

The colour of the external top coat (Coating 3) shall be in accordance with SANS 10140 to indicate the specific medium flowing through or in contact with the pipe surface.

2.3. Specification for pipes (Hot-dipped Galvanising):

The following specification shall be used, unless otherwise specified in the Project Specification:

Where the specification refers to Galvanising, it shall always be heavy-duty, hot-dipped galvanising and shall comply with SANS 121 (ISO 1461) for fabricated iron and steel articles and SANS 32 (BS EN 10240) for tubes or pipes. In addition to the National and International Standards, it shall comply with the requirements set out by the Hot Dip Galvanizers Association of Southern Africa (HDGASA).

The surface of the item to be galvanised shall be thoroughly cleaned to remove all traces of oil, grease, dust, mill-scale, rust or corrosion, or any residue of any nature before the coating may be applied. Further cleaning must be done by means of acid pickling, and a coating of flux must be applied once the object is sufficiently cleaned and rinsed.

The applicable standards shall apply for the specific composition of material, the zinc temperature, the immersion items, etc. A coating of at least 765g/m² must be achieved.

Sweep blast cleaning shall be performed on all freshly galvanised items as the surface preparation for painting of duplex coating of items. This shall be done in accordance with the Code of Practice as described by HDGASA.

When repairs to the galvanising surfaces may be required due to onsite modification, zinc rich epoxy (Galvpatch or similar approve) may be used, provided that the repaired surface achieves a coating thickness of at least 100microns. Repairs may only be considered if the repaired area does not exceed 0.5% of the total surface area of the component, nor shall an individual repair exceed 10cm². Should the repair area be larger, the entire component must be re-galvanised.

2.4. Specification for pipes (Duplex Coating):

Where the Project Specification calls for a Duplex Coating, all items shall first be Hot-dipped Galvanised, and then an epoxy coating shall be applied. Both coatings shall be according to the specific specifications as discussed in the Standard Specification.

2.5. Final Paint Coating:

After installation, all galvanised and epoxy coated pipework shall be painted with an approved enamel paint and shall be colour coded and marked according to SANS 10140 for the respective mediums. Where SANS 10140 does not specify requirements for a type of medium, the following shall apply:

Type of medium	Basic colour	Colour code indicator (single band)
Raw & industrial water	Brilliant Green (H10)	Golden Yellow (B49)
Cold drinkable (potable) water	Brilliant Green (H10)	Cornflower (F29)
Firefighting water	Signal Red (A11)	
Backwash water	Brilliant Green (H10)	Light Stone (C37)
De-sludge water	Brilliant Green (H10)	Canary Yellow (C61)
Final treated effluent	Aquamarine (E67)	
Raw sewage	Olive Green (H05)	
Sea water	Light Brunswick Green (H07)	
Primary sludge	Dark Brown (B03)	

Waste activated sludge	Light Brown (B15)	
Digested Sludge	Light Brown (B15)	Light Olive Green (H21)

The basic colour shall be applied to the entire length of pipe, including all flanges and all valves. The indicate band shall be 250mm wide and not further than 4 000mm apart.

2.6. Coating of underground Pipework:

All underground pipework, flange connections and valves shall be coated with a thick polymer bitumen adhesive tape with a tough plasticised PVC backing. An overwrap shall be applied to act as mechanical protection to the coating.

MECHANICAL STANDARD SPECIFICATION 04 – ANCILLARY EQUIPMENT:

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1. FASTENERS:

1.1. Nuts, Bolts and Ready-bar

Unless otherwise indicated in the Project Specification, all nuts, bolts, washers (2 per bolt set) and ready-bar used for galvanised or epoxy coated mild steel pipework shall be hot-dipped galvanised. When ready-bars and bolts are cut, the ends must be treated with a corrosion protective coating. All nuts, bolts, washers (2 per bolt set) and ready-bar used for Stainless Steel pipework shall be grade 316 Stainless Steel. All bolts shall be high tensile bolts (grade 8.8).

All nuts, bolts, washers and ready-bar shall be in accordance with SANS 1700 and shall be sized according to the flange requirements as described in SANS 1123 table 3. Bolts and ready-bar shall be sized to allow for at least two screw threads to be visible above the nut when tightened.

1.2. Packings and Gaskets

Packings or Gaskets shall be of the full-face type, with pre-punched holes for the bolts to suite the applicable flange and drilling table. Material of manufacture shall be high quality, Non-Asbestos grade based on aramid fibre with a nitrile rubber binder. The gaskets/packings shall not be less than 3mm thick (uncompressed) and suitably rated for the “Shut Off/Maximum” pressures where used.

2. PRESSURE GAUGES:

Pressure gauges shall be installed on each pump set’s dedicated suction (where applicable) and delivery pipework. Pressure take-off points shall be allowed for on the pipework and the pressure gauges shall not be mounted directly on the pipework. Pressure take-off points on pumps shall not be accepted. It shall be installed on Hot dipped galvanised gauges stands, positioned in such a way to allow for the operator to read the gauges while standing in front of the MCC. High pressure nylon pressure hose shall be used to connect the gauges to the pressure take-off points. The pipes shall be of adequate length to be neatly routed from the pipework to the gauges. Bosal piping shall be used to protect the nylon hoses.

The pressure gauges shall be of the bourdon tube type and shall be no less than 100mm in diameter. It shall be glycerine filled with Stainless Steel bodies with a pressure range suited to the pump’s delivery, unless otherwise indicated in the Project Specification. All gauges shall comply with a class 1.0 accuracy class and shall be IP65 rated. Each gauge shall be equipped with a Stainless Steel surface mounting flange and a brass, three-way isolating cock. All fittings and accessories required for a fully operational installation must be allowed for.

Suction and delivery gauges shall be labelled as such. After commissioning, the operating pressure (or range if applicable) shall be neatly labelled on the gauge.

Pressure gauges in sewage pump stations shall be suitable for handling raw sewage, including the connecting hose / and fittings.

The gauge stand shall be suitably sized to house two gauges, and the height of the stand shall be such that the pressure gauges shall be on the same height as the pump inlet /

centre line. The gauge stand shall be hot-dipped galvanised, mild steel and shall be bolted to the floor by a minimum of four hold down bolts.

3. LIFTING EQUIPMENT – CHAIN BLOCK:

Lifting equipment shall be of the manual, hand chain blocks type be with a minimum Safe Working Load (SWL) of 500kg or as otherwise indicated in the project specification. Manual chain blocks shall be applicable up to a SWL of 2000kg. All chain blocks shall comply with SANS 1594. The chain block covers shall be manufactured from thick, pressed steel and shall be of a rugged design to be operational in extreme conditions. Both the gear and wheel shall be fully enclosed. The hoist shall be equipped with a self-activating, double pawn mechanism, load brake with asbestos-free friction discs.

The hoist shall be provided with a load rated, top hook that is able to swivel through a complete 360°. Both top and bottom hook shall be drop-forged and fracture-resistant. The hooks shall gradually deform as a safety indicator when being overloaded and not reaching the breaking point and fail. It shall be equipped with a stopping mechanism to prevent damage to the unit due to excessive lowering. Both hooks shall be ISO 7597 compliant and it shall be equipped with latches.

The hand chain shall be hot dipped galvanised, and the load chain shall be high strength, grade 80, galvanised alloy steel.

In applications at sewage pump stations, both the hand chain and the load chain shall be Stainless Steel to handle the corrosive environment. The length of chain shall be determined on site and shall be long enough to lift items from ground level or bottom of a sump, which ever may be applicable.

All chain hoists shall be supplied with geared trolley / crawl that had the same SWL rating as the hoist. Push type trolley shall not be accepted. The trolleys shall be adjustable to accept a wide range of beams. It shall be equipped with steel wheels and self-lubricated ball bearings. Anti-tilt and anti-drop devices shall be incorporated in the body. The material for the hand chain shall be similar to the hand chain of the chain block.

All lifting equipment shall be supplied with a load testing certificate from the manufacturer, which must be included in the applicable section of the operation and maintenance manual as specified.

4. LIFTING EQUIPMENT – OVERHEAD TRAVELLING CRANE

4.1. General

All Overhead Travelling Cranes shall comply with specification and applicable International and Industry Standards. A complete and fully functional, electrical driven Overhead Travelling Crane (including, but not limited to: the rails, trollies, section – and main girders, electrically driven trolley, electrical hoist, all control and electrical connections and accessories, etc.) shall be provided for, including all installation costs.

The design, manufacture, installation working of the Overhead Travelling Crane shall comply with the following codes and standards (latest available revision or replacement standard where applicable), including all reference documents:

- BS EN 15011: Cranes – Bridges and gantry cranes
- BS EN 1991: Actions on Structures
- BS EN 14492: Power driven hoists

- BS EN 13001: Crane – General design
- BS EN 1993: Design of steel structures
- BS EN 12385: Steel wire ropes
- ISO 16625: Cranes and hoists – Selection of wire ropes, drums and sheaves
- ISO 4301: Cranes – Classifications
- SANS 10375: The inspection, testing and examination of overhead cranes
- Occupational Health and Safety Act (Act 85 of 1993)

In the absence of an alternative proposal, it shall be understood that all requirements in the specification and related standards are met without any exception.

All cranes shall be load tested and certified in accordance with the applicable standard by a certified third party. All cost shall be allowed for.

4.2. Scope of Supply

The Contractor shall inform the Engineer about elements in the scope of supply that might be inadequately defined or missing. The Contractor shall allow for the supply and installation of a complete, fully functional travelling crane, including all accessories and ancillary equipment required. This shall include, but not limited to, the following:

- A set of runway beams and - rails, to suit the building / structure, including all clamps and bolt sets required,
- A single / double overhead girder, including all accessories required,
- Motorized End-trucks to suit the girder,
- Motorized trolley for hoist to suit girder,
- Electrical hoist, including all accessories,
- Resilient bumpers and rubber buffer or hydraulic pumpers where necessary,
- End stops at crane rail ends and / or at hoist beam ends
- Anti-derailing devices
- Lubricators on all moving parts
- Chain and cable guides
- Swivel type hook with safety latch
- Rail sweepers
- Oil and grease for the first filling
- Maintenance platform, if required
- Access ladders and walkways
- All fittings, bolt sets, etc
- Special tools required for maintenance
- Surface finishing and painting
- Chain basket for chain hoists
- Electrical control unit
- Electrical supply cable, isolator etc.

4.3. Design Requirements

4.3.1. General Design Requirements:

The equipment and installation shall be designed with a service life of 25 years. The maximum Safe Working Load (SWL) of the crane shall be clearly and visibly marked in

English on the equipment. It shall be neatly painted directly on the equipment and shall be done on two opposing visible sides of the crane. Hand operated cranes shall be limited SWL less than 3 tonnes, when frequent or fast cranes are not required.

The hoist brake system shall automatically prevent the load from falling in the event of loss of electrical power and the brake shall not overrun or creep. The supplier shall propose a system to lower the load under the before mentioned. The brake system shall be of the enclosed, disc type. No external brakes shall be allowed.

Unless otherwise indicated in the Mechanical Project Specification, the operating speeds of the equipment shall be as follows:

- Electrical hoist : slow speed : 0.3 – 0.4 m/min with jog or inching facility
- Electrical hoist : high speed : 4.5 – 5.5 m/min with jog or inching facility
- Cross Travel speed : 5 – 7 m/min with jog or inching facility
- Long Travel speed : 8 – 10 m/min with jog or inching facility

4.3.2. Mechanical Design Requirements:

The following mechanical design requirements shall be allowed for:

a) Energy absorbing end stop brackets and buffers shall be supplied and installed at the limits of the long – and cross travel motions. These stop brackets and buffers shall be designed in such a way to ensure that a the fully loaded crane travelling at the maximum speed into the stop will not cause any damage to the supporting structure or create a hazardous situation.

b) The supplier shall specify the maximum resulting horizontal dynamic forces of the trolley with maximum vertical load hitting the bumpers. As this has an impact on the supporting structure design or building, this value shall be agreed upon between the Supplier and the Contractor prior to the purchase order.

c) All wheels shall be manufactured from non-sparking material, such as bronze alloy, brass, cast iron, etc.

d) The crab of the crane shall be equipped with tamper proof, overload protection device. It shall be set at a maximum of 10% above the crane's SWL.

e) All rotating parts such as wheels, motors, etc., shall be equipped with sealed bearings (dust and sand proof) and shall be in accordance with ISO standards with a minimum bearing service life (L 10H) of 20 000 hours.

f) All mechanical moving parts of the crane, such as travel wheels, reeving, gears etc., shall be guarded. For hazardous areas, these guards shall be manufactured from non-sparking material. Plastic guards shall not be allowed.

g) Steel wire rope shall be preferred to chains. Chains are not allowed above 7 tonnes capacity or 30 m length. The hoist rope or chain shall be designed to have a minimum safety factor of 5 times that of the SWL of the crane. The length of rope or chain shall be such that there are no less than 5 full wraps on the winding drum when the hook is at the lowest position, as given in the Project Specification. Unless otherwise indicated, this shall be the lowest floor level of which the crane is servicing.

h) The capacity of the winding drum shall be sized in accordance with the required length and size of rope or chain required. Winding on drums shall be restricted to a single layer.

i) Sheaves shall be designed to prevent the wire rope from slipping off and to facilitate reeving. The sheaves shall have a machined rope surface and shall be equipped with sealed bearings. The surfaces shall have hardness qualities compatible with the rope, as recommended by the rope manufacturer.

j) The load hook shall incorporate a safety latch and shall be of the swivel type.

4.3.3. Structural Design Requirements:

The following structural design requirements shall be allowed for:

a) Single girder cranes shall not be used in applications where the span is more than 15 m and or a lifting height more than 10 m.

b) The crane girders shall be designed for a maximum vertical deflection (under test load conditions) to be less than L/750 of the span between the two rails.

c) The fabrication of the crane structure or girders shall be such that no welding shall be required on site.

d) Bolts used for the bridge-to-end-carriage connections should be of a minimum grade 8.8 and shall be in accordance with the applicable Standard Specification.

4.3.4. Maintenance and access Design Requirements:

The crane design shall facilitate safe access to all areas for inspections and maintenance. All walkways, ladders, platforms, lighting, etc required for access shall be provided for. Walkways and platforms shall not be narrower than 750 mm and shall be equipped with hand railings.

4.3.5. Electrical Design Requirements:

The following electrical design requirements (where applicable) shall be allowed for:

a) Cranes shall have electric drives for hoisting, long and cross travel (unless otherwise indicated in the Project Specification). The control unit and the associated switch gear shall be capable of performing any two of the three crane motions operations simultaneously.

b) The electrical installation and components, including but not limited to the electrical motors, control circuit, cabling, connection, junction boxes, etc., shall be designed as per the applicable standards and regulations, including the IEC standards, and shall be rated for temperatures of up to 50°C.

c) All electrical motors shall be rated for 3 phase, 50 Hz (400 V) supply and the control circuit and equipment shall be rated for single phase, 50 Hz (230V).

d) All motors shall be controlled, protected and isolated within the package.

e) All electrical equipment shall be designed for an intermittent duty of up to 150 operations per hour.

f) The contractor shall allow for all cables required, and the supply point shall be situated in the MCC as described under the Electrical Specification.

4.3.6. Control Design Requirements:

The following electrical design requirements (where applicable) shall be allowed for:

a) A pendant type control unit / box suspended from the crane shall be provided.

b) The control box shall allow for low - and high-speed selection of the motors (hoist) and shall make use of push button. These shall be designed so that the machinery motion will stop when pressure is released from the button.

c) The pendant / control box shall be made from high impact (non-breakable), antistatic plastic. The weight of the pendant shall be supported by a galvanised wire, suspended from the crane. Making use of the electrical control cable to support the weight of the unit is not allowed.

d) An emergency stop push button shall be provided for on the pendant. It shall cut control supply to all motions.

e) The pendant shall be IP56 rated and the control signals shall be 24V DC.

f) Two sets of limited switches shall be supplied for each range of motion (bridge travelling / long travel, trolley traverse / cross travel and hook lifting / lowering). The first set will reduce the operating speed (lower to slow speed) and the second set shall stop the motion.

5. VENTILATION FAN:

Where forced ventilation fans (extractor fans) are indicated on the plans and in the project specifications, plate mounted, axial aerofoil type fans shall be supplied and installed.

The fan shall be mounted in a fibreglass / GRP mounting plate suitably sized for opening as indicated on the drawing(s). An alternative mounting plate manufactured from galvanised mild steel shall only be accepted in low humidity / dry climate / low corrosive environment applications. It will have an aerodynamic inlet bell to optimise fan efficiency. The air inlet side / motor side of the fan shall be equipped with a spiral wound, epoxy coated, wire guard with integrated motor supports. For fans sizes larger than Ø700 mm, separate motor support arms shall be provided. The fan discharge side of the fans shall also be equipped with a wire guard, as well as a wall cowl, all suitably sized as per the manufacturer's recommendations.

The fan shall make use of aerofoil shaped aluminium impellers in a pressed steel hub suitable for developing medium pressures at large flow rates. The impeller assembly shall be balanced in accordance with ISO 1940 to grade G6.3. The flow rate and static fan pressure required shall be described in the Mechanical Project Specification.

The fan shall be driven by a 3 phase, 400 V, class F, IP55 electrical motor with a minimum IE2 efficiency class rating. Where applicable, explosion proof motors shall be supplied. The fan shall be supplied with, but not limited to, all starters, controllers and cables / wiring and other equipment required for a complete automatic operation. The fan shall be controlled by means of an external temperature controller which shall start and stop the fan on a set temperature (adjustable on site). The fan shall be operational between - 10 °C and + 40 °C. All wiring and cable work shall be done in accordance with the applicable SANS standards and in manner as described in the Electrical Project and Standard Specifications. Further electrical requirements shall be as per the applicable Electrical Specifications.

Each fan shall be supplied with a suitably sized wall cowl mounted on the outside of the building and comply with the fan manufacturer's requirements. The cowl shall be manufactured from electroplated or hot dipped galvanised sheet metal and epoxy coated. It shall be designed to prevent (rain) water from entering the through the wall

opening the air intake shall be close to horizontal (perpendicular to the wall). The cowl shall be a continues short radius bend and segmented cowls shall not be accepted. The wire mesh shall be installed at the opening to prevent medium to large objects from entering the cowl. It shall be fastened to the wall by means of Stainless Steel fasteners.

6. ELEVATED WALKWAYS AND PLATFORMS, HAND RAILINGS, STAIRCASES AND LADDERS:

6.1. Elevated Walkways and platforms

Open grid steel covers and floor panels shall be manufactured by an approved firm specialising in such work. All walkway shall have a minimum of 900 mm internal clearance (between hand railings). They shall be pressure locked or welded (or both). All platforms, walkways, staircases -structures and floors shall be designed to handle the dead weight load of the structure plus a dynamic load of 250 kg/m² or a point load of 100 kg which ever may produce the worst deflection. All span-bars shall have a thickness, depth and spacing such that the deflection of any bar under design load conditions does not exceed 1/200th of the clear span, or 10 mm, whichever is lesser.

Flooring shall be of the open grid type floor made up in panels of sizes that conform to the overall dimensions given on the drawings. The panels shall be supplied prefabricated with cut-outs that conform to the details given. All floors shall be hot dipped galvanised after manufacturing. Unless authorised to do so, the Contractor shall not cut or weld open grid floor panels on Site. All floor sections shall be supplied with a toe-board / kick plate at the edges with a minimum height of 100 mm and 6mm thick flat bar.

The frames and structures shall be constructed out of mild steel sections and hot-dipped galvanised after manufacturing. All walkways and platforms shall be supplied complete with all the necessary fixing bolts, nuts, etc.

6.2. Hand railings

Handrails shall be of the tube and sphere type similar to Monoweld and shall be manufactured by an approved firm specialising in such works.

Handrails shall be 1 000 mm high and shall consist of a handrail and a knee-rail, both manufactured of steel tubing of nominal thickness 2,6 mm and of nominal outside diameter of at least 34 mm. The guard rails around walkways and platforms, as well as staircases, shall be able to handle a point load of 55 kg or a 33 kg/m load, whichever produces the worst deflection applied at any point or direction on the top rail.

Stanchions shall be manufactured pre-formed in one piece and shall be of steel tubing of nominal thickness of 2,6 mm and of nominal outside diameter of at least 42 mm. The bases of the stanchions shall be manufactured of 150 mm x 75 mm x 12,5 mm flat bars and shall be pre-formed to suit the situation in which they are to be installed (i.e. for platform- or side-mounting, and for horizontal- or sloped-mounting on concrete or steel), and the stanchion spheres shall be pre-formed to suit right angled or other angled intersections), all as shown on the drawings.

Stanchions shall be spaced at intervals not exceeding 1,5 m and shall be fixed with two M16 galvanised bolts, washers and nuts each. All joints shall be welded.

Handrails shall be hot-dip galvanised after manufacture.

The Contractor shall ensure, by making in-situ measurements before manufacture is started, that the handrails suit the situation in which they are to be installed. Handrails shall be supplied complete with all the necessary fixing bolts, nuts, etc.

6.3. Staircases and ladders

Staircases shall be used to provide quick and safe access to areas. Ladders shall only be used where insufficient space is available for a staircase. The material and equipment used for walkways shall be used for the staircases. All staircases shall have a minimum of 900 mm internal clearance (between hand railings). All steps shall have a going of 250 mm long and a rise of 200 mm. All staircases shall be equipped with hand railings on both sides of the staircase.

The length of a staircase section shall not be more than 18 rises after which a landing is required. A change in direction shall be provided after every 36 rises, unless the landing is more than 2 m long. Provision shall be made for all necessary fixing bolts, nuts, etc.

Ladders may be used where there is an occasional requirement for access. It shall be positioned in such a way to ensure no objects blocks the path of the user and will provide comfortable clearance to all body parts.

Ladders shall be at least 600mm wide to allow for step through actions. All ladders shall terminate with hand rails to the at least 1 000 mm higher than the platform to ensure ample support for the user to enter or exit the ladder at the top. The styles shall be flat bar with a minimum width of 80 mm by 10 mm thick, but the ladder shall be designed to be stable and deflect under load. The rungs shall be at least Ø20 mm and be able to match the load carrying capacity of a 20 mm mild steel solid bar. The rungs shall be spaced at 250 mm and it shall be fully sealed to the styles. All ladders shall be manufactured out of hot-dipped galvanised mild steel, unless otherwise indicated in the Project Specification. All ladders that is partially of completely submerged in water or sewage shall be manufactured out of Stainless Steel 316L or higher.

A ladder cage shall be supplied to all ladders where a person may fall more than 4 m, unless it is superseded by a local legislation that is stricter. The cage shall be manufactured out of flat-bar, with an internal dimension of 1 000 mm. The cage shall be welded to the ladder and the material of the cage shall be equal to that of the ladder. All ladders shall be bolted to concrete or steel structures with spacings no more than 1.5 m apart.

7. ELECTRICALLY DRIVEN MACERATOR

7.1. General

The Contractor shall make allowance for the supply and installation of the complete macerating mechanical and electrical equipment. This shall include the mechanical machinery including driver, electrical and control equipment and all cabling required for a complete and working operation.

All equipment or components shall be provided by the same manufacturer.

All National - and International Standards listed in the Project Specification shall adhere to, as well as the following:

- American Society for Testing and Materials (ASTM) A36 Carbon Steel Plate
- American Society for Testing and Materials (ASTM) A536-84 Ductile Iron Castings

- American Iron and Steel Institute (AISI) 4130 Heat Treated Alloy Steel
- American Iron and Steel Institute (AISI) 4140 Heat Treated Alloy Steel
- American Iron and Steel Institute (AISI) 8620 Heat Treated Alloy Steel
- American Iron and Steel Institute (AISI) 303 Stainless Steel
- American Iron and Steel Institute (AISI) 304 Stainless Steel
- American Iron and Steel Institute (AISI) 316 Stainless Steel
- American Society for Testing and Materials (ASTM) Grade 630 (UNS S17400) Stainless Steel
- Society of Automotive Engineers (SAE) 660 Bearing Bronze
- National Electrical Manufacturer's Association (NEMA) Standards
- National Electrical Code (NEC)
- Underwriters Laboratory (UL and cUL)
- International Electrotechnical Commission (IEC)

All equipment must be equipped with a corrosion-resistant nameplate, indicating Manufacturer's name and address, equipment model name, serial number, etc.

The Manufacturer shall be ISO9001 certified. All equipment shall be factory tested and verified prior to shipment.

Prior to ordering of equipment, the contractor shall submit documentation for final approval. This shall include equipment description and sizing, functional descriptions, operating instructions, dimensional drawings, catalog data, installation (job specific) drawings, manufacturer's instructions and recommended spares.

The supplier shall submit two (2) copies of the complete operation & maintenance manuals. An electronic version of the complete manuals shall also be provided. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, recommended lubricants, and recommended spares.

The Manufacturer shall provide a minimum 12 months warranty on the equipment supplied and installed, or in accordance with the liability period as disrobed in the Contract Conditions, which ever may be longer.

All equipment shall be packaged, handled, shipped, stored etc strictly in accordance with the manufacturer's requirements and procedures.

7.2. Mechanical Equipment

Performance requirements:

The Grinder / Macerator shall reduce or shred suspended solids to acceptable sizes (in accordance with the down stream equipment) to protect downstream equipment from blockages and damage.

The following design summary is applicable:

- Number of Grinders : Refer Project Specification
- Grinder installation configuration : Refer Project Specification
- Number of motor Controllers : Refer Project Specification
- Environmental rating for grinders : Non-hazardous

- Environmental rating for motor controllers : Non-hazardous
- Power supply : 3 phase / 400 V / 50 hz
- Nominal Stack Height : Refer Project Specification
- Minimum liquid handling capacity per grinder : Refer Project Specification
- Maximum head drop across cutter stack : Refer Project Specification
- Cutter type : Serrated 17-tooth
- Spacer type : Knurled
- Shaft seal type : Mechanical, Tungsten Carbide
- Seal maximum pressure : 90 psi (620 kPa)
- Speed reducer type and ration : Cycloidal, 29:1
- Installed power : 2.2 kW
- Motor type : TEFC, rated for high humidity environments
- Motor service factor : 1.15
- Minimum motor efficiency rating : IE3
- Minimum peak shaft torque : 720 Nm/kW
- Minimum peak force at cutter tip : 12 kN/kW

Frame and Support:

The frame and / or support shall provide a method for securely positioning the grinder / macerator in a channel or wet well. Should a flanged unit be required, the frame shall incorporate suitable flange connections on both sides of the frame in accordance with the connecting pipework as described in the Project Specifications and Drawings. The frame of channel mounted grinders shall allow installation and removal without any disassembly of the frame of grinder.

The frame shall be fabricated of 304 Stainless Steel and epoxy coated as a minimum. The frame shall be designed to prevent unwanted bypassing of the unit. A baffle plate shall be provided and installed to suit the chamber / sump / channel and shall be fabricated of 304 Stainless Steel.

Grinder:

The grinder shall be of the two-shafted design consisting of individual cutters and spacers driven by hexagonal shafts. The cutters shall actively grab and pull material into the stack for shredding. It shall have upper and lower housings to retain the shafts support bearings and seals. Each shaft shall be supported both on the drive-end and non-drive-end. An electrical motor, including speed reducer, shall be used to drive the shafts. The maximum shaft speed shall not exceed 60 rpm. The cutters be serrated and shall be specifically designed to operate in Municipal sewage, such as rags, wipes, bottles, etc.

Grinder Components:

- Cutters and Spacers:
  - The cutting stacks shall be of nominal height listed in the Project Specification
  - The cutting stacks shall consist out of interleaved cutters and spacers

- The cutters and spacers shall be individual disks constructed of heat treated allow steel with a hardness of 45-53 HRc and 34-53 HRc respectively.
- Cutters shall have at least 17 teeth.
- The cutter shall have radial serrations on the leading edges.
- The cutter tooth height shall not be greater than 13mm above the base diameter of the cutter
- The cutter and spacer tolerances shall be +0.000/-0.025mm and +0.025/-0.000mm respectively.
- The spacers design shall aid in tearing of material by having a knurled outside diameter.
- The cutter to cutter clearance shall not be greater than 0.25mm
- The cutters and spacers shall be at least 10mm thick.

- Shafts:
  - The shafts shall be hexagonal, with a minimum of 50mm across flats
  - The shafts shall be of heat treated 4140 alloy steel with a minimum tensile strength of 1000 kPa and a hardness of 38-42 HRc.

- Intermediate Shaft Yoke:
  - The intermediate shaft yokes shall be provided where applicable and shall provide radial support to the shafts during severe grinding demands.
  - It shall be constructed from 304 Stainless Steel and shall be lubricated by means of high temperature marine grade grease
  - Grease nipples / fittings shall be provided for periodic maintenance.
  - Intermediate shaft yokes shall by supplied on cutter stacks of 810mm and taller.

- Side Rails:
  - Side rails shall be constructed from ASTM A536 ductile iron
  - Cutter side rails shall have evenly spaced horizontal fingers. It shall be designed to create a pressure differential towards the centre of the grinder, directing solids into the cutter stack, while minimizing the pressure drop through the grinder.
  - Clearance between cutter side rails and adjacent cutters shall not exceed 2.6mm

- Shaft Bearings and Seals:
  - Sealed, oversized, deep-groove ball bearings shall be used to bear all radial and axial loads.
  - Shaft seals shall be of the mechanical type.
  - Each bearing and seal arrangement shall be incorporated into a cartridge-style housing.
  - Cutter shafts shall be supported on both drive-end and non-drive-ends. Single supports shall not be permitted.
  - Dynamic and rotating seal faces shall be Tungsten Carbide with 6% Nickel binder
  - Seal cartridges shall be rated to a maximum of 620 kPa
  - All O-rings shall be of BUNA-N.

- Seal cartridges shall not require flushing and seals shall be rated to operate both wet or dry.

- Housing and Covers:
  - Housings and top covers shall be of ASTM A536 ductile iron and the bottom cover shall be of A36 carbon steel.
  - The end housings shall have integrated busing deflectors to guide solids away from the seal cartridges.

- Transfer Gears:
  - Transfer gears shall be of the involute profile and fabricated from heat treated alloy steel.
  - The design, thickness and hardness of the transfer gears shall be suited to the transfer torque between the shafts up to the rated breakdown torque of the motor.
  - The interface between gears shall be lubricated by means of grease.
  - The transfer gear ratio shall be such that the ratio of the cutter tip speed on the low speed shaft and high speed shaft shall be between greater than 0.9 and less than 1.0. This shall be to promote tearing of material pass through the grinder.

- Low Speed Coupling:
  - It shall be of the 3-jaw type and shall be manufactured out of 4140 alloy steel.
  - Each low speed coupling half shall be encapsulated on its mating shaft to facilitate proper engagement of coupling lobes (1.5 – 3.0 mm)
  - The interface between lobes shall be lubricated by means of grease.

- Speed reducer:
  - Speed reducers shall be of the cycloidal type and have a speed reduction of 29:1
  - It shall be grease lubricated

- High Speed coupling:
  - It shall be of the 3-jaw type with elastomer spider and the halves shall be of sintered iron
  - The spider shall be of BUNA-N

- Motor:
  - The motor shall be of the TEFC, rated for high moisture environments
  - The motor housing shall allow for flanged mounting.

- Lifting Brackets:
  - The grinder shall be fitted with two (2) lifting rings / brackets rated for the weight of the unit.

<u>Finishes / Coatings:</u>

Paint Coatings (Ferrous Materials)

- Ferrous metal surfaces shall be prepared to SSPC-SP6 (Commercial Blast Cleaning) and shall be coated in accordance with the applicable Standard Specification with a minimum 150-200 microns TDFT thickness.
- All mechanical frames, motors, etc shall be coated.

Paint Coatings (Previously Coated Materials)

- All previously coated components (motors, speed reducers, etc.) shall be prepared to SSPC-SP1 (Solvent Cleaning) and SSPC-SP2 (Hand Tool Cleaning) and shall be coated in accordance with the applicable Standard Specification with a minimum 150-200 microns TDFT thickness.

7.3. Electrical Equipment and Control

A complete and functional electrical control panel shall be supplied and installed to provide programmable operation of the grinder system. The controller shall have all required switches, indicator lights and other control devices required. It shall be designed and rated for the performance requirements indicated in the specification. The Contractor will allow for all cables, connections, trunking, etc. for the complete electrical installation to the Standard as described in the Electrical Project - and Standard Specifications.

All motor control panels shall adhere to the applicable National and International Standards and regulations.

Components:

- Enclosure:
  - The enclosure shall be powder coated mild steel, rated at IP66
  - It shall house all components, including the motor starter, PLC and other control devices
- Selector Switches:
  - All selector switches shall be 22mm or larger in size, and shall be rated equal or higher than the enclosure
  - The Grinder selector switch shall be three-position and indicate On, Off / Reset, Remote.
- Pilot Lights:
  - Lights will be 22mm in size, LED (pilot lamp), and shall be rated equal or higher than the enclosure
  - Indication / pilot lights shall be provided as a minimum for POWER ON, GRINDER RUN, GRINDER JAMMED, and MOTOR FAULT
- Motor Starter:
  - The Starter shall be IEC compliant, full voltage, and reversing
  - Contactor shall have 110V / 230V operating coils
  - Overload relays shall be adjustable and sized to full load amperes (FLA) of the motor
- Control Power Transformer:
  - The transformer shall produce 110V / 230V AC power from the power supply to provide power to the control circuit. It shall be correctly sized in

accordance with the applicable codes and regulations to accommodate the control power requirements.

- Controller:
  - A Programmable Logic Controller (PLC) shall be used for the control of all equipment.
- Current Transducer:
  - The current Transducer shall be of the discrete output type
  - It shall have an adjustable set point range of 1A - 135A, with a 200ms or faster response time.
- Cabling:
  - All motor - and signal cables, including terminations, required for the full operation shall be supplied and installed as part of the cost.
  - Cable sizing shall be in accordance with the Electrical Project – and Standard Specifications.
- Emergency stop:
  - An Emergency Stop shall be provided within arm's length from the grinder equipment, and shall include all required cabling.
  - The activation of the Emergency Stop will immediately stop the grinder and de-energize the motor.

7.4. Operation:

The system shall have the following operational functionality:

- Selector switch functionality:
  - OFF / RESET – the grinder shall not run, and the motor controller faults shall be cleared
  - ON – the grinder shall start and run in the forward direction
  - REMOTE – the grinder shall operate as controlled by a remote start / stop dry contact
- When an obstruction jams the grinder, the controller shall stop the grinder and reverse the rotation to clear the obstruction. If the obstruction is cleared the controller shall return the grinder to normal operation. If three (3) reverse cycles occur within a 30 second period, the controller shall stop the motor and activate the GRINDER JAMMED indicator and relay
- In a motor overload or motor over-temperature condition, the motor shall be de-energized, the MOTOR FAULT indicator lamp shall be illuminated, and the MOTOR FAIL contact shall be closed
- When a power failure occurs while the system is operating, the system shall return to normal operation when power is restored. Should a power failure occur while the grinder is in a fail condition, the system shall return to a fail state / condition when the power is restored, the fail state / condition shall not be cleared until it is reset
- Rest of the grinder shall only be accomplished from the controller selector switch

7.5. Execution:

<u>Installation:</u>

The Contractor shall coordinate and execute the installation of the equipment strictly in accordance with the manufacturer's instructions, drawings and related specification

sections. The installation and equipment shall be in accordance with all Occupational Health and Safety Act requirements and Mechanical and Electrical National – and International Standards and Regulations.

Commissioning / Start-up:

The Contractor shall allow for all cost involved for a representative of the equipment supplier / manufacturer for a minimum of one (1) day to inspect the equipment for proper installation, apply power for the first time and check proper motor rotation, oversee the initial introduction of material into the system and confirm the equipment operates as intended. The representative will also provide services as detailed in the Training Requirements below.

Training:

Training by a representative of the equipment supplier / manufacturer shall be provided to all operating, maintenance and supervisory staff and shall form part of the formal training described elsewhere in the documentation. The training shall cover the key components of the equipment, the operating procedures and requirements, maintenance procedures and requirements and troubleshooting techniques.

STANDARD SPECIFICATION

SSE01 – MEDIUM VOLTAGE REV1

INDEX

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1. BULK ELECTRICAL SUPPLY TO SITE

The Supply Authority must be identified per project. The following work is required under this section of the project:

- As per project specification requirements

1.1 STANDARDS

The installation must comply with all respective Standards as set out in Section 1 above, including but not limited to:

- SANS 780 /IEC 60076: Transformer
- SABS 555: Mineral oil for transformers and switchgear
- SANS 137: Bushings
- SANS 1507 / 1339 – 3.3kV and 6.6-22kV XLPE MV Cables
- NRS 003&006/SANS 1885&1874 and IEC 62271-100/200 – MV Switchgear standards
- NRS 022: Electricity distribution – stays and associated components
- NRS 033: Electricity distribution - guidelines for the application, design, planning and construction of medium voltage overhead power lines up to and including 22kV using wooden pole structures and bare conductors
- NRS 039: Surge arrestors for use in distribution systems

1.2 NEW OVERHEAD MV-LINES

This section of the scope comprises the construction of a new section of 11kV wooden-pole overhead-line.

1.2.1 Material

1.2.1.1 Poles

Poles must be of the wooden, Creosoted Eucalyptus type, with a total length of 12.3m and a planting depth of 2m. Pole top diameters may not be less than 160mm for intermediate poles and 185mm for termination and strain poles. Poles must be of the group strength ‘A’, comply with SABS 753 and must bear the SABS mark of quality.

1.2.1.2 Anchors and Stays

Stays must be used to anchor and support the overhead assembly and installation. Stay rods must supplied complete with all equipment required for a fully functional installation. This must include, but not limited to, rods, thimbles, washers and guy grip bow heads. All required anchors, baseplates, tensioning and excavations must be provided as part of the tender offer.

Stays rods must be made from mild steel and malleable cast iron and galvanised to SANS 763. Stay wires to be galvanised and of the stranded conductor type, with minimum conductor size of 22m for maximum breaking load.

1.2.1.3 Overhead Conductor

Conductors must be ACSR Fox type, with rates given for Weasel and Ferret. Conductors must comply with SABS 182 Part 2.

Note that for sake of pricing, conductor linear length will be measured and paid for. All sagging, off-cuts and terminations must be provided for in the final item rate. The BOQ length is provisional for tender only and final lengths must be confirmed by the Surveyor, as per Section 1.2.2 below.

1.2.1.4 Support Structure

1.2.1.4.1 A-Frame Configuration

A-frame configuration, including cross-arms, must be used for this installation, conforming to the Supply Authority's standards. All frames, nuts, bolts and cross-arms must be hot dipped galvanized.

Insulators must be rated for 11/22kV, compliant with SABS 177. Intermediate support insulators must be of the Cullinan Class A, 4kN porcelain or silicon line-post type. Strain insulators must be of the silicon (Elbroc) type. For a road crossing, the intermediate structures must be equipped with special road crossing twin ties on Class A 10 kN insulators.

Depending on the application, various configurations of A-frame and cross-arm assemblies are required for this installation, as per the attached layout drawing. The A-frame type is depicted by a letter, as set-out below:

- Type A: For an intermediate assembly, comprising A-Frame and three support insulators, complete with conductors tied in.

- Type B: For an intermediate strain assembly, comprising A-Frame and six strain insulators, one support insulator, conductors terminated (and tied-in) with through links.

- Type C: For an intermediate strain assembly, but with a 90-degree directional change, comprising A-Frame and three strain insulators, one cross-arm with three strain insulators and one support insulator, conductors terminated (and tied-in) with through links.

- Type D: For a line-end strain termination, comprising A-Frame and three strain insulators with conductors terminated. Note for a road crossing provision must be made for a yoke plate (six strain insulators total).

- Type E: Intermediate strain assembly for a road crossing, comprising A-Frame and nine strain insulators (includes yoke plates), conductors terminated (and tied-in) with through links.

1.2.1.5 Drop-out Fuses

The fuse links must be rated for the total load of equipment supplied from the new overhead line. The set must be mounted on a hot-dipped galvanized steel cross-arm, of estimated dimensions 1000mm x 160mm x 65mm, to be confirmed with the Engineer before ordering.

The price for the fuse link set must include fuse carrier and fuse, cross-arm fixed to the pole, all ancillary hardware and conductors links connected through.

1.2.1.6 Surge Arrestors

Surge arresters must be of the silicon-housed type, rated for distribution class at 11kV. The set must be mounted on a hot-dipped galvanized steel cross-arm, of estimated dimensions 1000mm x 160mm x 65mm, to be confirmed with the Engineer before ordering.

The surge arrester set must be suitably earthed to the ground at each point to create a low resistance in order to protect both the overhead line and the underground cable installation. Note the earthing cable must be protected against the pole in the same way as the MV cable.

1.2.2 **Surveyor**

As the MV overhead line route is provisional, it is imperative that a Local Surveyor be included with this project, before any construction work on site is started. The surveyor must will be responsible for surveying the complete new overhead line route, with the following main components required:

- Route selection and fixing
- Profiling
- Pole pegging
- Optimization of design
- Providing the Engineer with final route drawings (DWG and PDF), including geo-referencing and spanning-sheets
- Pricing to include all travel, material, labour and accommodation

Note that the responsibility remains with the Contractor to coordinate with the Engineer and Supply Authority regarding when going to site and determining the final route for surveying. No claims in this regard will be entertained due to a lack of coordination.

1.2.3 **Construction**

1.2.3.1 Conductor Work

1.2.3.1.1 Installation

Conductors must be run out using freely rotating drums on jacks and axles, but care must be taken to provide braking so as to not put unnecessary tension on the conductor. At no point may the conductor run on the ground.

Note that the manufacturer's installation requirements must be met at all times.

Tensioning and regulation of the conductors must be by means of suitably sized and rated line grips, with all lines tensioned simultaneously.

Note that the conductors may not be tensioned at more than 25% of their breaking strength.

1.2.3.1.2 Connection

Pistol-grips are the only means allowed for overhead conductor connections and terminations. Tying-in of conductors must be by means of a pre-made suited type binding for the conductor and insulator used.

No slipping or damage to the conductor is permitted in using tension clamps. The clamps must be suited for the thimble clevises to be utilised and no adaptors are permitted.

1.2.3.2 Structure Earthing

Only structures containing cable connections, fuses, surge arrestors and transformers must be suitably earthed. All metalwork on these structures must be bonded by $10mm^2$ bare stranded copper. One $35mm^2$ common bare stranded copper must run down the applicable pole, stapled every 500mm. two trenches of 10m in opposite directions must dug, with a 1.8m earth spike provided at each end. These spikes must be connected to the earth cable running down the pole, with all bonding to be provided to ensure a suitable earth.

1.2.3.3 Excavations

Excavation openings for all poles and stays must be open for as short a period as possible. Due to the depths of these excavations, H&S concerns are very real and must be treated with critical importance. All required signs, demarcation tape and lights at holes and spill piles must be provided.

Backfilling of the holes must be done at no more than 200mm at a time and each layer must be rammed as solidly as possible. In the instance where the backfill material does not properly consolidate, then a 1:8 ration of cement may be used, at the Engineer's approval.

Holes will be paid per unit, regardless of the soil type. Only in the instance where hard rock is encountered, will a pro-rate amount be paid, based upon the rate as included in the document. Note that suitable proof must be recorded and provided to the Engineer

regarding this hard rock claim (and applicable hole) and no work may commence if not approved. Failure to comply in this regard will result in no additional payment.

1.3 MV SWITCHGEAR

1.3.1 Configuration

The MV switchgear must be of the indoor, vacuum insulated type, similar or equal to the Actom or ABB type.

The switchgear configuration must be as per project specification requirements.

1.3.2 Technical Requirements

The switchgear must comply with the following minimum requirements, for a 3.3-11kV system:

- Voltage : As per project specification (3.3-11kV)
- Frequency : 50Hz
- Internal arc withstand AFLR (3s) : 21kA
- Nominal Current : 1250A (Busbar/Incomer), 630A (CB feed)
- Short time current r.m.s. : 31.5kA
- Peak withstand current : 65kA
- Insulation level : 24kV
- Peak lightning withstand : 95kV

All panels/sections must include integral cable earthing facilities and any access to the cable compartment must be interlocked with earthing switch and/or isolating circuit breaker or switch. The isolating device and earth switch may not be able to be closed at the same time (mechanical interlock). Note that all external operating devices/facilities that are capable of being switched must be lockable.

The status of each tier/panel must be displayed on the front by means of a mimic panel on the operating plate, taken from the actual switching contacts. Opening and closing pushbuttons must be provided for the circuit breakers, with the mechanism being of the wound-spring operated type. Note both electrical motor and manual spring charge facilities must be available for respective manual opening/closing and tripping condition.

Each circuit breaker must be provided with a lock-out pressure switch for insufficient gas pressure, with outputs for both alarm and lock-out conditions. All circuit breakers must be fitted with operation counters.

The cable boxes must further be air insulated to accommodate heat shrink terminations in accordance with the cable type specified below.

Each panel/tier must be provided with a clear indicator (neon or similar and equal), per phase, for live phase identification.

Note that provision must be made for a remote switch for opening and closing, with 10m cable and the necessary facilities provided accordingly on each tier/panel.

Each tier must be clearly and permanently labelled as to its feed and function.

1.3.3 Protection

All required CTs, VTs and protection relays must be provided for full protection of both the incomer and outgoing feeds. In principle, CTs must be installed for every phase, with VA rating no less than 15VA. VTs must be busbar mounted and must be separated by an earthed screen.

Provision must be made for transformer oil and winding over-temperature protection, as well as primary winding earth fault. The relay must be able to protect the system against over-current, short circuit and over/under voltage conditions.

The protection relay provided must be able to incorporate these necessary system and transformer protections and accordingly the protection design must be done by a specialist party and signed off by the Supply Authority, before final implementation. Special focus must be placed on CT/VT ratios, load burden and respective protection classes of CTs and VTs. The cost of this specialist activity must be included in the final price offer and no additional claims in this regard, including Supply Authority coordination, will be entertained.

1.3.4 DC Power and Batteries

A DC power supply with a nominal voltage of 110VDC must be provided, with a capacity to drive the base-load of the MV switchgear for at least one week.

The DC power supply (charger) system must be of the Blue Ginger type. It must be able to re-charge a depleted battery to 80% nominal within 7 hours, whilst supplying the running load. The system must further provide an alarm when the battery voltage is below 90%, when the AC supply fails or when there is a battery earth fault. Indications such as battery voltmeter and ampere meter for (dis)charge current must be provided, along with the functionality to test the system voltage. The unit must further be equipped with a boost function, with over voltage and current protection.

Batteries must be of the NiCad type, with latest technology designs applicable. The ampere hour rating must further be sized to be able to trip all CBs twice and open all of them once., as well as the base load requirement as mentioned above. Batteries must be protected by means of suitably rated fuses at both positive and negative supply rails. Note that dual-fuses must be used throughout, to provide redundancy to the system.

1.3.5 Alarm and Status Indication

The following status indications must be provided as voltage free contacts in the MV switchgear LV compartment, for potential future remote monitoring:

- AC Power Available / Fail

- DC Output Fail (common from charger)
- DC Voltage Low Alarm

1.4 DISTRIBUTION TRANSFORMERS

The oil-filled transformers offered must bear the SANS or IEC marks, in compliance with SANS 780 /IEC 60076 and nominally comply with the following requirements:

- Rating : As per project specification
- Rated (nominal) voltage ratio : 11 or 3.3kV / 400V
- Vector Group : DyN 11
- Cooling : ONAN
- Type : Hermetically sealed
- Neutral earthing : Solid
- Tap-changer (voltage control) : Manual off-load
- Cable Terminations : Air insulated cable boxes
- Mounting : Removable roller wheels

1.4.1 Material

The transformer must have copper windings and the tank made of sheet metal.

All surfaces (internal and external) must be properly treated to prevent corrosion, including approved paint or varnish for the internal tank against transformer oil corrosion. Zinc spray must also be applied before the final paint finish.

Any welding in the manufacturing process must be of the same or better quality than the base metal.

The final transformer finish must be achieved by means of using an electrostatic epoxy powder process, with the colour as mentioned above. All oil and air heat exchangers must be galvanized to SANS 763, with the paint finish as per above.

Provision must be made on all sides of the transformer, at a height of 500mm above the base of the tank, for earthing positions.

1.4.2 Core

The electrical continuity of the core laminations shall not be interrupted. Adequate mechanical strength must be provided in its design to withstand all potential mechanical forces acting on it during transport and the occurrence of electrical faults.

The noise and vibration levels may also not exceed the local authority's requirements, in conjunction with NEMA.

1.4.3 Oil

The transformer must be filled with oil in compliance with SANS 555.

1.4.4 Terminations

MV bushings must be of the type C.

1.4.5 Protection Components

- Oil and Winding Over-Temperature, with displays (if possible) and contacts
- Oil over-pressure relief valve
- Primary winding earth fault
- Buchholz relay (where specified)

1.4.6 Terminal Strip

The terminal strip, with voltage free contacts, must be securely mounted against the transformer for all alarm and trip signals. These signals must be taken across to the respective protection relays at the MV switchgear. 600V stranded conductors with PVC isolation must be used for this purpose, fully numbered at both ends and neatly tied together. Crimp lugs must be used for terminations at both ends.

1.5 MINIATURE SUB-STATION (M/S)

A new miniature substation in accordance with the project specification must be supplied and installed. The general specifications above also apply to the individual components, namely RMU switchgear and/or transformers.

The M/S must comprise a MV compartment, complete with 3-way Ring Main Unit (RMU), transformer and LV compartment, all manufactured from 3CR12 sheet steel. All ancillary equipment such as handles, hinges, locking mechanisms, nuts, bolts and washers must be made from 304 stainless steel. The unit must be suited to coastal conditions and be equipped with heating elements.

The unit colour must be avocado green, with all final paint touch-ups to be completed on-site in line with the manufacturer's recommendations.

Provision must be made for lifting of the unit by means of four lifting hooks and no tilting of the unit is allowed during this lifting process.

A suitably protected daylight photocell must be mounted on the outside of the M/S, wired to the street lighting section.

1.5.1 MV Switchgear

In compliance with standard specification above. Note that switchgear must be of the compact, non-withdrawable type, with SF6 insulation medium, similar and equal to the Schneider, Actom or ABB type.

Note that the switchgear must be arc vented to the top of the M/S, complete with type tested riser vent duct(s) and weatherproof flap, all forming part of the M/S design.

The switchgear configuration must be as per project specification requirements.

1.5.2 **Transformer**

Voltage and rating as per project specification.

1.5.3 **Low Voltage (LV) Compartment**

The LV compartment must be fitted with an adjustable main Circuit Breaker (CB), distribution CBs (motor starting-type moulded-case CBs) rated per project as well as site lighting feeds. CBs over 500A must be of the Air Circuit Breaker (ACB) type.

- Main CB (adjustable)
- Plant feeds (motor starting type, adjustable)
- Site lighting:
    - 20A Three Phase (TP) circuit breaker
    - 30A AC1 contactor complete with daylight photocell control and bypass switch
    - 3 x 15A Single Phase (SP) outgoing feeds
- Spare positions : 4 x 60A TP outgoing feeds

All circuits, CBs and cables must be clearly labelled. Adequate support must be provided for the cable to be secured against, as they must not 'hang' on the CB terminals.

1.5.4 **Ancillaries**

1.5.4.1 Signage

All signage as required by the OHS Act must be provided as part of the offer, both outside the MS and within. The unit must further clearly be marked by its designated name, weight, size (kVA) and voltage (V).

1.5.4.1.1 Name Plate

The transformer and tap changer must both be provided with clearly visible name plates in line with SANS 780/IEC 60076, mounted within the main LV compartment. The RMU name plate must clearly be mounted within its dedicated compartment.

1.5.4.1.2 Drawings and Installation

The following detailed drawings must be submitted as set out in Section 1 of this document:

- Dimensions of the M/S, all associated equipment and final civil requirements

- Plinth sizing and arrangement
- Single line diagrams of M/S
- RMU single lines, including protection configuration and equipment detail
- Transformer name plate details, including protections offered

1.5.5 **Plinth and Mounting**

A suitably sized pre-cast plinth must be provided as part of the tender offer, in line with the manufacturer's recommendations. All required soil excavation, preparation, levelling and compaction must be included within the plinth price.

The plinth must be supplied complete with either sleeves or pre-case openings, at suitable positions and in suited size for all required MV and LV cable installation.

1.6 **MV CABLE**

1.6.1 **Type**

The MV cables rated at 6350/11000V must be of the Cross-Linked Polyethylene (XLPE) type. The cable must consist of three insulated cores with copper conductors, in accordance with SANS 1339, Table 19, and must carry the SABS mark.

The MV cables rated at 1900/3300V must be of the Cross-Linked Polyethylene (XLPE) type. The cable must consist of three insulated cores with copper conductors, in accordance with SANS 1507 and must carry the SABS mark.

The cable must be rated for a high earth fault and must be of the armoured type. The armouring of the cable must be multi-wired galvanised steel.

The installation of the cable must be in-line with SANS 10198, NRS 013 and other Supply Authority requirements.

1.6.2 **Installation**

Cable drums must be carefully transported and offloaded to prevent damage to the cable. A suitable cable-drum trailer and horizontal beam must be used when installing the cable. The drum may not rotate freely when the cable is rolled off, as this could potentially twist the cable and loosen the windings and armouring.

Rollers must be used for the installation of the cable, with a suitable cable grip utilised. The maximum tension, as specified by the manufacturer, may not be exceeded.

A minimum 3.5m galvanised steel sleeve or pole must be securely fastened, with stainless steel bandit straps, to the bottom overhead line poles. At least 300mm of the pipe must be installed under final ground level, to protect the cable.

1.6.3 Connections

All MV cable work and connections must be done by a skilled, proven and approved artisan. Note that the electrical continuity, screening and armouring may in no way be affected by working, glanding, jointing or connecting a MV cable.

1.6.3.1 Supply Authority Overhead Line

The new MV cable must be connected to the new set of drop out fuses, mounted on the new cross-arm at the top of the pole. All overhead line work must be coordinated with the Supply Authority, as the connection must be done with them present. They are also the sole Authority for any switching and adequate notice must be given to them in this regard.

All required material, outdoor cable termination kit, lugs, cable support and labour required for the installation must be provided as part of the project scope and price offering.

Note that the outdoor termination kit must specifically be designed to prevent arching and water ingress under any pollution or weather conditions it may be subjected to.

1.6.3.2 Ring Main Unit

The MV cable must be provided with a heat shrink dry-type connection, with the cable properly earthed at both ends. Note that the cable shoe must be pressed onto the cable with a purpose made tool. The shoes must be encased in a heat shrink sleeve, of which the colour corresponds with the phase of each cable core.

Cable clamping blocks made of hardwood must be provided for the air-insulated cable connections.

1.7 EXCAVATIONS

1.7.1 General

The MV cable must be installed at a minimum depth of 1m, with the trench made wide enough that it does not fall in on itself while introducing the bedding, cable and backfilling and compaction.

No bedding may be provided until the trench has been approved by the either the Engineer or Municipality.

Note that all OHS Act requirements must be met, specifically relating to an open trench and barricading and signage for the public and other workers' protection and safety.

1.7.2 Cable Installation

A minimum of 150mm bedding must be provided for the cable, with the material having a low clay content and a maximum resistivity of 1.2Km/W. After the cable is installed, in as straight a line as possible, an additional 150mm cover must be provided.

Thereafter a 400mm backfilling section is to be provided, properly compacted.

Two runs of danger tape must be installed on top of this layer, ensuring that the tape is installed directly above the cable. The tape must be polyethylene, nominally 230mm wide and imprinted with a triangle and electrical flash symbol, as well as the words “DANGER”, at no more than 1m intervals.

The final round of backfilling must be provided and the entire trench properly compacted as per 1.5.4 below.

Cable route markers must be provided at every cable turn and every 100m along a straight run.

1.7.3 Bedding, Grading and Backfilling

Both the bedding and backfilling material must be free of all plant materials, stones and clots larger than 15mm and any other foreign objects that could potentially damage the cable. Sea and/or river side is not acceptable due to their high thermal resistivity values.

In light of the material requirements above, as much as possible of the excavated material must however still be used. The excavated material must be sifted to ensure compliance. Only in the instance where there is not enough suitably graded backfilling material on-site, can suitable imported material be sourced. Payment for bedding and backfill material will only be done for sourced material, with the excavated material paid as part of the cable excavation’s labour component.

1.7.4 Compaction

Note that backfilling must be done in sections of no more than 150mm at a time (after compaction). Compaction must be done to an AASHTO-density percentage of 98% and record must be kept and supplied to the Engineer for each layer of compaction done.

1.8 COORDINATION AND SHUT-DOWNS

1.8.1 Supply Authority

It is the responsibility of the Contractor to make all necessary connection, switching, installation and approval arrangements timeously with the Supply Authority. No switching may be done by the Contractor and all MV connections must be done in the presence of a Supply Authority representative. Once connected, the Contractor must ensure that the supply and connections in terms of earthing, voltage and conductivity are in order before requesting the Supply Authority to switch power onto the system. Damage claims as a result of non-compliance in this regard will not be entertained.

1.9 ROAD CROSSING

A detailed method statement must be compiled as part of this contract, to be approved by the Engineer, Supply Authority and traffic authority. The method statement must address the following items as a minimum:

- how the work will be done
- what up front preparation must be in place,
- how long the work will take

- what contingency plans are in place in case an unforeseen event occurs
- traffic management plan, including road closure and traffic department coordination

It must further be noted that this section of the work must be priced to take place over the weekend, either very early just after daybreak, or late before sundown, in order to impact the amount of traffic as little as possible.

1.10 EARTHING

All earthing must be done in-line with the applicable SANS and IEC standards.

The transformer and switchgear must be properly earthed at both its MV and LV points, to provide an earth resistance of not more than 1 ohm. The transformer neutral and cable armouring must also be connected to the respective transformer earthing points.

The transformer earthing must be done by means of a copper earth mat, with all joints Cadwelded. The mat must be a minimum of 1m x 1m in dimensions, comprising an internal grid of no more than 100mm x 100mm. All conductors must be 70mm2 bare copper, including the cable between the transformer earthing point and the earth mat.

Should the required earthing resistance be more than accepted, then additional 1.2m copper earth spikes (rods) must be installed, complete with cables and connections to the earth mat.

All required excavations, earth resistivity testing, compaction and final earth readings and certification proof must be provided as part of the Contractor's offer.

1.11 TESTING AND COMMISSIONING

The Contractor, by means of the manufacturer, must be provided all required type tests certificates, in line with the applicable SANS and IEC standards. These must be verified and tested, before confirming in writing to the Engineer that all documentation is in place and the testing can take place.

All the above-mentioned documentation must be included in the Operational and Maintenance Manuals.

1.11.1 MV Switchgear

The following tests must be conducted:

- Testing of all alarms, remote inputs and voltage free contact outputs (relay and transformer)
- Testing and checking of all status indications
- Operational tests of all isolator and circuit breakers switching and operation, including functional verification of the spring charge mechanism
- Polarity and phasing for all VTs
- Polarity and magnetizing curve tests for all CTs

- Secondary current injection, at rated current, for tripping time and operational confirmation of overcurrent and earth fault protections
- Low voltage circuit pressure test
- High voltage pressure tests between phase-phase and phase-earth, for all possible combinations

1.11.2 **Transformer**

The following tests must be conducted:

- Winding ratio
- Megger
- Tap changer mechanical operation
- Leakage current
- Vector group
- Oil and winding temperature indication and functional tests
- Current transformer (where specified)
- Buchholz functionality (where specified)

1.11.3 **MV Cable**

Phase identification tests must be done to confirm that the connections between the end points are correct. All cables must be phased out before being connect.

DC tests must be performed, at the rated voltage, in accordance with SABS 540 and SABS 97. All test results must be recorded on formal test certificates, which must be included with the final documentation manuals. Special attention must be given to any dangerous leakage currents.

1.12 **DRAWINGS AND MANUALS**

The Contractor must provide the Engineer with a draft manual for review, prior to any taking-over arrangements being done. Three final copies must be provided.

Operational and maintenance manuals must include, but not limited to:

- System description and diagrams
- Circuit diagrams, per component
- Detailed drawings of component
- Maintenance and setting up instructions

- All factory test certificates
- All routine site test certificates (cold and hot commissioning)
- Final As-Built drawings
- PVC laminated schematic diagrams, for substation wall-mounting

STANDARD SPECIFICATION

SSE02 – LV AND CONTROL

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1. MOTOR CONTROL CENTRES (MCCs)

1.1 STATUTORY REQUIREMENTS

MCCs must be provided as detailed below and fully conform to the requirements of SANS 10142-1 (latest edition). All material, components and equipment installed within the respective MCCs must also comply with SANS 10142-1, specifically Section 4.3, which details further specific compliance requirements per specific item.

Specific SANS standards such as 1973-1 and 1973-3/8 are applicable for MCCs above and below a 10kA fault rating. For SANS 1973-1 (MCCs above 10kA), a Type-Tested Assembly (TTA) must be provided and the populator of the assembly (if different entity from the one providing the TTA) must complete the work in strict accordance with the required standards of the TTA design. MCCs equal to or less than 10kA must strictly comply with SANS 1973-3 or 1973-8.

Note that the specifications and requirements in the document act as guidelines only in terms of legislative compliance. Final legislative compliance, in terms of the Act, remains that of the Contractor and in case of a conflict, the SANS requirements shall apply.

During the tender stage, the relevant tendering party must specify in the data sheets whether and how the MCCs and equipment offered comply with the legislative requirements. Note this is a legal requirement and the tenderer must categorically acknowledge that they have acquainted themselves fully with the applicable SANS standards and that the offered equipment will comply as such.

1.2 GENERAL

1.2.1 Ratings

The MCCs and associated equipment and switchgear must be rated for the applicable fault levels as indicated in each MCC's section below.

CB and busbar sizes are only provisional during tender stage, as some of the plant and field equipment could change in sizing, depending on the final equipment offering by the tenderer.

MCCs must be rated to operate under at least a maximum ambient temperature of 50°C and a minimum of -1°C, in relative humidity of 90%.

MCCs must be rated to a minimum protection degree of IP44 within buildings and IP54 for outdoor installations.

All MCC distribution sections must allow for 30% physical spare capacity in their design, for future expansions or changes during construction.

As such, any and all ratings provided for the MCCs must be seen as applicable for tender (quotation) stage only. All sizes must therefore be confirmed with the Engineer, before construction commences. Any changes during construction stage, due to a lack of compliance in this regard, will be for the Contractor's account.

1.2.2 General Construction

1.2.2.1 Material and configuration

The MCCs are intended for industrial application for control of motor loads such as pumps, compressors, conveyors and equipment typically encountered in the water and waste water industries, as well as distribution to sub-DBs and dedicated control panels provided by others.

The MCCs must be floor-standing units, manufactured from 3CR-12 sheet steel, not less than 1.6mm thick. Where trenches are provided over which the MCCs must be installed, and all required plinths (minimum 50mm x 100mm hot-dipped galvanized U-Channel) and supports to stabilize and install the MCC over the trench must be provided as part of the MCC pricing.

Painting of the complete unit must be done strictly in compliance with the manufacturer's recommendations, with uniform thickness without. The final coat must be orange B24 enamel baked or powder epoxy, to be confirmed by the Client and Engineer before manufacturing.

MCCs must be constructed in tiers, with all tiers and panels compartmentalized (above and equal to 10kA). All required doors must be hinged and fitted with rubber door seals, so as to provide a continuous sealing edge along the gasket. All panels and doors must be removable with square-key locks used for securing them and a minimum of two per door.

The grouping of the MCC and associated equipment and feeds must be structured in a logical way, taking both the process flow of the feeds into account, as well as the grouping of respective and associated equipment. The following main components are required for the general MCC layout:

- Incoming section, with main incoming Circuit Breaker (CB), separate copper neutral and earth bars, metering, E-Stop and indication light (I/L), surge arresters, phase failure relay and main incoming cable access.

- Dedicated and enclosed air-insulated busbar chamber (both vertical and horizontal, where required by the MCC manufacturer design philosophy), running the length of the MCC

- Outgoing feeds to motor driven equipment and various other each with dedicated door-interlock handle.

- Distribution section for feeds to sub distribution boards.

- Section for local lighting and power if required.

- Dedicated power and control terminal compartments for field-cable connections

- Where required, voltage-free terminal compartment for remote monitoring and control signals, fully enclosed (even in open-compartment construction). Monitoring must be provided of signals within the MCC such as selector switch status, indication lights, common trips (separate E-Stop), main and pump CB status (ON/OFF/TRIP) as well as incoming telemetry signals for monitoring and control and

other as specified in the Project Specification.

- Flashing, protected strobe light, activated by any common fault alarm (fixed to MCC on outdoor applications, and bracket wall-mounted on indoor MCCs)

All live parts must be arranged to allow for front-access only.

Note that all busbars, including the neutral, must be of solid copper. These busbar assemblies must be fully type tested and compliant along with the steelwork configuration, to form one fully compliant TTA. A dedicated copper earth bar must run the length of the MCC, with pre-drilled holes at each tier/panel section.

The MCC must be designed that for the purpose of transport, it would be easy to disassemble the unit into moveable parts. This includes providing multi-pin sockets at each panel split for control wiring between two sections.

1.2.2.2 **Motor control cubicles and equipment**

Motor control cubicle assemblies must be configured as described below. Any additional requirements will be stated in the Project Specification. The form of separation will be specified in the project Specification, but for MCCs rated at 10kA or higher, default will be Form 3b.

The assembly must be configured as described below. The standards and technical requirements of the various components are addressed under the relevant sections covering such equipment:

a) **Incoming circuit breaker**.

The circuit breaker must serve as isolator and provide overcurrent and short circuit protection for the outgoing feed circuit. The short circuit rating may not be less than the related MCC fault level. Short circuit and overcurrent tripping curves must be coordinated with the motor controller starting current characteristics and purpose designed for motor starting application.

It must be fitted with sufficient NO and NC auxiliary contacts to provide for the specified control and remote monitoring requirements. Contacts current rating must be adequate for the required control function burden at the control voltage specified in the Project Specification.

Note that separate NO contacts for circuit breaker isolated (off) and tripped condition must be provided.

The circuit breaker handle must be pad-lockable in the open position.

b) CT operated ampere meter, center phase;

c) 6-digit running hour meter;

d) Motor Controller as specified in the Project Specification. The detailed requirements are given in the section covering the various motor controller types.

e) Protection devices:

Protection devices directly related to a specific motor controller type are detailed in the motor controller section. The following is a brief summary of the protection facilities required:

- Phase failure (loss of phase, phase rotation).
- Motor overload with adjustable trip settings;
- Motor thermal protection (overheat) in accordance with the type specified in the Project Specification, thermistors (two per phase) and/or PT 100 temperature sensors, embedded in the motor windings.
- Earth leakage protection (350mA) for motors liable to flooding, i.e. installations below ground level and submersible pump motors.
- Moisture sensing probes for submersible pump motors in an oil bath (sewage type).
- Bearing over temperature and excessive vibration protection for large motors only as per Project Specification.
- Protection for driven equipment as per Project Specification.

Protection devices must trip the related motor with trip status indication by means of indication lights on the control panel as well as auxiliary contacts for remote status indication, wired to a PLC or direct remote indication. Devices which are not mechanically latched in the trip condition must be electrically latched with a manual reset push button.

f) **Control facilities**:

- Manual/Off/Automatic function selector switches as per Project specification.
- Manual start (green) and stop (red) spring return pushbuttons. Provision must be made for manual starting and stopping from a remote field control station.
- Terminals must be provided for an automatic start and stop control signals as per the Project specification.
- A red mushroom head push-lock twist unlock emergency stop switch.

g) **Status indication**:

Status indication lights must be provided for:

- Motor run status.
- Motor trip (individual for all protection facilities).
- Any other status indication as per Project Specification.

A lamp test push button must be provided to energize all indication lights simultaneously.

1.2.2.3 **Field and cable accommodation**

Adequate space must be provided between the MCC base, gland plate and main incoming CB terminals to accommodate the main supply incoming cable. The permissible bending radius of the cable must never be exceeded. The minimum distance between the base and gland plate may never be less than 300mm. Further note that the gland plate must be suited for the type of main supply cable being installed, with a non-ferrous metal gland plate to be used for single-core cables. In the case of parallel cables, or where required for the termination of a large incoming cable, then adequately pre-drilled busbar extension stubs must be provided, securely fastened to the CB. These stubs must be offset, so as to provide adequate space between them and allowing adequate space to install and fasten the cables and all requirements as such must be provided as part of the tender offer.

Each tier must be provided with a dedicated terminal compartment at the bottom off the tier, fitted with terminals above the gland plate (unless the tier is a dedicated feed for one drive). The terminals must be suitably sized for the equipment fed, and adequately labelled on the backplane and terminal itself. All cable connections from the field may be done in this terminal compartment only, with all wiring from the terminals to the respective CBs and other feeds done in the factory. All other spatial, height and material requirements as per the incoming section are also applicable here.

Wireways may also be utilised, but then these must be dedicated wireways the full height of the MCC, with a minimum of 250mm wide. Note that for fully compartmentalized MCCs wireways are a requirement as no through-wiring from one compartment to another is permitted. Should field terminals be installed within these wireways, then dedicated supports must be provided for securing the cables. No cable may simply ‘hang’ on its terminals, regardless of being glanded in the bottom. Terminals must further be staggered in the horizontal, so as to prevent cables lapping over one another when being installed from the field.

All wiring must be installed where possible within PVC trunking throughout the MCC, including the wireways. Trunking must run neatly in vertical and horizontal sections where required. Note that wiring not installed in trunking must be installed in wire looms laced together by means of cable ties or other similar and equal material and fixed to dedicated rails, with the rails being part of the steelwork design and construction. Note that no self-adhesive straps will be allowed within the panel and it is therefore critical that any potential support rails be accommodated during the design stage.

1.2.2.4 **Labelling**

Any and all MCC and/or plant labelling must be in ENGLISH ONLY.

Each MCC must be clearly labelled and fastened to the panel by means of screws. In addition, each section must be labelled with externally mounted labels, below the equipment served. All CBs (incoming and outgoing) and other plant feeds must be provided with labels depicting either where they are fed from or what loads they are feeding, and what the applicable supply and cable earth size is.

All internal equipment and switchgear must be labelled with plastic engraved labels in clearly identifiable positions, and not on the trunking itself.

The main point of isolation must be provided with adequate 'Main Point of Isolation' labels as well as required 'in case of emergency' label.

Note that all internal wiring, cables, terminals and relays must be numbered, with the numbering to match the final As-Built documentation.

1.2.3 Switchgear And Equipment

1.2.3.1 Phase-failure protection

A suitable phase-failure relay (with adjustable switching points and sensitivity) must be installed within the incoming section, for the protection of the equipment. The relay must be provided with an additional dedicated and adjustable delay-on timer. After the identification of a phase failure condition and after the condition has fallen away, the power onto the MC may not be energised until this dedicated timer has timed out.

The relay must provide protection against phase loss, phase rotation and under/over voltage.

1.2.3.2 Surge protection

The incoming section of the MCC must be equipped with surge protection in accordance with SANS 10142-1. Both Class 1 and Class2 coordinated protection must be provided, adjacent to one another. Curve C backup protection CBs must be provided, with final ratings and positions to be determined by the supplier of the surge arresters.

Note that Surgetek, ABB or similar and equal equipment must be provided, being of the clip-in type and having visual displays and contacts for remote monitoring. The arresters must be mounted in a vented, see-through enclosure.

1.2.3.3 Circuit breakers

As this application is industrial by nature, circuit breakers must be rated accordingly (moulded case type), with sizing, tripping curves and protections taking into account for the applicable motors. Residential type equipment is therefore not accepted, except within the dedicated small lighting and power distribution feeds.

All CBs must carry the SABS mark.

CBs must be equipped with thermal devices for tripping in over-current situations and magnetic devices for instantaneous tripping in fault current conditions.

Single and double pole CBs may be rated at no less than 240V, with 420V the minimum voltage for three-pole CBs.

1.2.3.4 Current transformers (CTs)

CTs must have Class C accuracy, suitable for a 10VA secondary load and comply with SANS 60644-1. Note that the final CT design must however be presented to the Engineer, as field equipment and loading could potentially change during final equipment offering stage.

CTs must be of the air-cooled type, with suited mounting facilities. Split-core units will not be accepted.

1.2.3.5 **Indication lights**

They must be of the LED type, with dedicated colours as follows:

- GREEN: General run, start demand and enable levels
- YELLOW: Suction low level, process signals not being faults
- RED: General trip, alarm and emergency levels
- BLUE: Special status such as SCADA CONTROL

1.2.4 **Metering And Indication Equipment**

All meters must be able to measure, display and record the following parameters as instantaneous and monthly averages:

- Line and phase voltages
- Line currents
- kW per phase
- kVA per phase
- kVar per phase
- Power factor
- Total energy demand (kWh)
- Voltage and current harmonics

The main incoming meter, where specified, must be provided with CTs and display module included as part of the final offer. The display must be flush mounted with the MCC front-plate, but care must be taken to remove this unit during transport and installation.

The meter must be equipped with storage capacity, either on-board or expandable, so as to log the usage of the site over a daily, weekly and monthly cycle.

The meter must be of the Landis & Gyr, Lovato, ABB or similar and equal type, with Class 1 accuracy.

1.2.5 **Ancillary Items**

1.2.5.1 **Drawings**

All drawings must be submitted to the Engineer in electronic format. All drawings must contain gridlines, or referencing grid-blocks, so as to be able to comment on specific sections.

Construction may not commence until drawings have been commented on by the Engineer. Any modifications as a result of failing to comply with this requirement will be for the account of the Contractor.

Note that all revision must be listed on the drawings as the revision process carries out. Note that no additional payment will be made for revising drawings.

1.2.5.2 **Civil requirements**

As part of the drawings stage in the project, detailed civil requirements as a result of the equipment must be provided as soon as possible. This relates to items such as cable

trench depths, width and location, sleeves and other entry/exit points from the MCC room (size, amount and location, where applicable), applicable MCC dimensions, ventilation and heat exchange, cable racking routes and any other electrical requirements that could have an impact on the civil design and construction.

1.2.5.3 **Payment**

As a MCC is considered a complete and functional unit, interim payments will not be made. Only after a factory inspection and test has been carried out on the unit, and it has been found satisfactorily in line with the specification, will payment be certified for the unit in line with the contractual arrangements.

2. PLC

2.1 General

Where specified, a PLC will be required for control and protection functionality. The system must still be functional in manual should the PLC be off or faulty.

The PLC must be of the compact rail-mounted type, provided with inline surge protection as well as a back-up in-line UPS to provide 'clean' power to the PLC. Care must be taken in the design that the control voltages and power are correctly designed so there is no back-feed and potential live parts even after normal power has been switched off for maintenance purposes. Any cooling requirements must be provided for in the design of the pump station.

The PLC power supply must be capable of dual voltage supply, namely 220V and 24VDC nominal.

All required I/O must be installed on a common networked back-plane. Spare capacity of at least 20% must be provided for all digital and analogue cards.

Provision must be made for remote network communication with the telemetry outstation, or on-site industrial network, via Ethernet and Modbus TCP. A RJ45 connection point (weatherproof) must be provided on the MCC door.

All field terminations must be brought to terminals at a dedicated terminal section at the back of the MCC. These terminals must be permanently wired through to the PLC, including all spares. All terminals and wires must be clearly numbered for tracing from PLC to source.

2.2 SYSTEM TIE-IN

The PLC, hardware and engineering software must be, complete with all ancillary equipment to communicate with the associated field equipment, Industrial PCs and telemetry RTU, on an Ethernet/Modbus network.

All I/O must be surge protected. Digital inputs must be galvanically isolated and both digital inputs and digital outputs must be fitted with buffer interface relays.

Communication with field devices must be via the Ethernet and/or Modbus TCP network and discrete digital and analogue I/O only used where devices are not equipped with network communication capabilities.

Remote I/O modules must be supplied from a 24VDC power supply with a secondary one hour battery backup. The DC power supply primary supply will be 230VAC from a CB within the related MCC PLC section. The power supply must be complete with battery charger and regulator, installed within a separate compartment of the main equipment enclosure or within a separate adjacent enclosure as applicable. The I/O must remain active after a power failure and shut down automatically when the battery driven DC supply voltage has dropped below a determined minimum threshold.

2.3 INDUSTRIAL PC

The touch-screen industrial PC must be specifically suited for abrasive conditions (IP65), being fan-less and stainless. The screen must be a minimum of 21", with PC equipped with 3rd Generation i7 Core processor, 16GB RAM and 500GB SSD drive. The operating system must be as per the central server working station, including all layout configurations.

For more detail refer Industrial Communication Network and SCADA Section.

2.4 TENDER OFFER

Note: That the above-mentioned equipment schedule is nominal and the Tenderer must provide for all ancillaries and equipment not listed above to suit his specific design and configuration.

The basic equipment configuration is shown on the Proposed System, Control and Communication Topology drawing. This layout is nominal, showing the functional requirements and may vary in detail between different vendors/equipment suppliers. It will be the responsibility of the system integrator to, provide a detailed system topology drawing for his proposed system design, in accordance with the specific hardware offered.

3. INDUSTRIAL NETWORKS

3.1 GENERAL

Where specified for plant control and monitoring, an Industrial Ethernet backbone must be provided, in compliance to the various sections below. The designed network must further be compatible with other network protocols for lower structure components, and be expandable without having to replace equipment.

3.1.1 COMPLIANCE

The design components must comply to all legislative standards, as well as those listed for electrical and surge protection purposes, including but not limited to:

- SANS 61000 – EMC
- SANS 60950 – IT Equipment Safety
- SANS 62103 – Electronic Equipment
- IEC 61158 – Industrial Communication Networks
- SANS 60793/4 – Fibre Optics

3.1.2 RESPONSIBILITIES

The Specialist Sub-Contractor (as an extension of the Main Tendering entity) is responsible for the implementation and communication between the MCCs, media converters, network switches, PLCs and SCADA system. Both copper and fibre networks must be installed in such a way that a ring is created, with self-healing capability according to the Rapid Span Tree Protocol (RSTP).

The network drawings provide as part of the tender document are in indication in terms of functional requirements relating to control required and established positions of the respective equipment. The Contractor however remains responsible for the full design of the network system in terms of the equipment sizes, types offered and overall design and functionality of the system. The Contractor must determine the exact amount of I/O cards (Digital/Analogue, as well as Inputs/Outputs), and the switch, media converter and patch panel sizing based upon all available information provided in the project specifications and respective drawings. Note the mechanical and process specifications must also be read and complied to in full.

3.1.3 POWER SUPPLIES

All PLCs, Industrial PCs, remote I/O modules and network switches must be supplied from a 230VAC point of supply within the MCC. 24VDC components and modules must be provided with additional power supply backup for at least an hour, from a central supply point (whether it be UPS or battery/inverter configuration). The complete network must remain live during a power failure (for at least an hour, or until the backup generator take over).

3.1.4 EARTHING AND BONDING

The network must be designed with a suitable and effective earthing and equipotential bonding system. This will ensure less static interference on the network and prevent any earth potential and unwanted current flows on the screens. Refer in detail the sections below relating to the earthing of cable sheaths and devices in line with manufacturer requirements.

3.1.5 FINAL DOCUMENTATION

Note the general specifications relating to documentation requirements that must be provided and complied with during the commissioning and taking-over period of the project. This includes, but is not limited to final As-Built drawings, testing and calibration documentation, operating and maintenance manuals, training compliance, etc.

Note that it is vital that all IP and gateway addressed are fully updated and included into the required documentation. All equipment information, part numbers, etc must also be included, so that in the event of a failure, the Client would be able to replace the part as a matter of urgency. As-Built cable and connection schedules must be provided for industrial network.

These requirements must be met prior to taking-over inspections of the Works commences.

3.2 COPPER (1000BASE-T)

3.2.1 CABLE WORK

All copper cable work required in the site network must be of the CAT5e overall shielded twisted-pair type (S/UTP), minimum IP65 and the colour grey. Note the importance of the bending radius of a minimum of 4 x times the cable diameter, which may not be exceeded. If not complied with during installation, a new cable for that complete run must be provided. No re-routing or splicing will be accepted.

The cable transmission performance must comply with TIA/EIA 568, and the cable marking requirements in compliance with the EC VERIFIED requirements.

No cable runs may exceed 90m in length. In the instance where there is a distance longer than that, an additional housing box and repeater/switch, as per 3.2.2 below, must be provided as part of the tender offer. No joints or splices will be accepted.

The exact final routing on-site will remain the Contractor' responsibility. The drawings provided indicate functional requirements and positions. Final routes must be carefully planned so that network and power cables do not run close to one another, and if at all possible, do not cross. In the instance where a power / network cable crossing must take place, it must be at right angles, and the network cable to run in a section of steel conduit (bosal). In all other instances, S/UTP cable must run on its own cable tray or steel conduit. All external cable tray routes against structures must be provided with additional cable tray cover, fastened with stainless steel bandit straps. No S/UTP cable may be buried in the ground.

For horizontal runs, S/UTP cables must be strapped together every 1m (max) on the cable tray. All vertical S/UTP cable runs must be securely strapped every 300mm (max). Care must be taken that the cables aren't strapped too tight, placing unnecessary strain on the cables.

All S/UTP cables must be clearly marked at both ends with both source and destination labels (for example, patch panel switch number as source and remote I/O module as destination). Cable connections at the various switches and modules must be via industrial RJ45 connections, in accordance with the TIA/EIA-568 standards. Only shielded RJ45 connectors may be used.

Note that the shielding must be connected to the network switch and not the field device, which in turn must be properly earthed in order to prevent any ground potential differences.

Any additional access openings must be communicated with the Engineer in writing, and no core-drilling may be done until approval has been provided. The Civil Contractor may decide to provide all access openings themselves. In this instance, all coordination for correct opening positions to form part of this tender offer.

3.2.2 SWITCHES

Switches must be of the managed, Level 2, Gigabit-Ethernet type, in order to provide for the RSTP, ring-redundancy functionality, in compliance to IEEE 802 and the applicable sub-regulations. Each switch must act as a ring-manager, checking the integrity of the

ring and opening and closing where required. Precise time synchronization of the network(s) must be possible. The switches offered must have an industry-high MTBF.

Switches must be of the industrial type, robust against rust, vibration and Electro Magnetic Interference (EMI). The amount and type of ports required must be evaluated by the Contractor in conjunction with the functional specifications and drawings, with an additional 20% spare capacity there after.

Where possible industrial switches must be installed within the respective MCC's dedicated PLC sections/tiers. Where there is no MCC and/or PLC, the switch must then be installed within the fibre patch panel (termination cabinet). A clear earth path must be created with the S/UTP cable, to prevent any ground potential differences. Switches must either be DIN-rail (MCCs), or rack-mounted (server/fibre cabinets). DIN-rail will also be accepted in the latter's case, provided that the switch is brought forward in the cabinet for ease of access and maintenance.

Note that should a switch and media converter be one combined unit, the same philosophy must be applied throughout the plant. Refer media converters below.

Switches must finally be labelled in a logical manner, in conjunction within the areas that they are located. These numbers must conversely correlate with the S/UTP cables running to and from.

3.2.3 REMOTE I/O

At certain sections within the plant, remote I/O modules must be provided (where specified). Remote I/O modules must be of the same manufacture and type as either PLC or network switches. These modules must be connected to a local switch via a S/UTP cable and must therefore be compatible in terms of communication requirements.

All field equipment must be wired to interface terminals within the enclosure housing the dedicated remote I/O module. These interface terminals must be permanently wired to the respective remote I/O cards, based upon the requirements as per the instrumentation and control specifications. Spare space provision of 20% must be allowed for at both the terminals and within the I/O modules. These spare terminals must be fully wired-through to the I/O modules.

All terminals and wires must be clearly and logically labelled. All wire numbering must be included onto the final wire diagrams, which must be submitted with the operating and maintenance manuals.

3.2.4 PLC INTERACTION

The various sections of the Works, where specified, must be provided with PLCs, to provide for the required monitoring and control as per the functional specifications. The interaction between the PLC and network backbone is critical in maintaining data integrity, to prevent loss of data through logging on the central SCADA system and for inter-connected control signal relaying.

3.2.5 TESTING AND CALIBRATION

Every live circuit (live and redundant) must be tested by the Contractor during the commissioning stage of the project. The testing must be carried out with a field tester conforming to TIA/EIA 568 criteria. Each circuit must be tested end-to-end, including all leads. All results must be clearly documented and included as part of the final manuals (system health check).

A full system diagnostic test and report must also be compiled, to confirm network speed complies with design, that redundancy and fall-back has been tested and that no interference (active harmonics with equipment running, EMC, etc) is present.

Note that all testers used must be accompanied by their respective calibration certificates from the manufacturer, to be presented to the Engineer (if so requested). No calibration certificate, at the time of cold commissioning, may be more than one year old.

3.3 FIBRE-OPTIC (1000BASE-SX)

3.3.1 CABLE WORK

3.3.1.1 Cables

Fibre-Optic (FO) cables must be of the 50/125µ armoured, multi-mode type consisting of a minimum of 4 pairs. Final cable sizing is however dependent upon the final site conditions and must be supplied and installed as specified and indicated in the BOQ. For cable lengths longer than 550m, single mode cables and associated equipment must be offered as part of the design solution.

3.3.1.2 Installation

All outdoor FO cable must be installed in a 110mm PVC sleeve, which in turn must contain micro-tubes for blowing the fibre cables through. All other FO cables must be installed on either a separate section of cable tray, or combined with the copper network tray. For horizontal runs, fibre cables must be strapped together every 1m (max) on the cable tray. All vertical fibre cable runs must be securely strapped every 500mm (max). Care must be taken that the cables aren't strapped too tight, placing unnecessary strain on the cables.

A manhole (draw-pit) must be provided at each bending point along the route, and after each 200m straight run along the route (Contractor to confirm maximum permissible distances between the manholes depending upon cable offered, and adjust the distances accordingly). The manholes must be min 600x600mm concrete ring-type structures, with lockable lids and completely sealed to any water or particle ingress. All manholes and associated civil works must be priced for under this contract, including construction design and monitoring. Final quality oversight must be provided by the FO installer. All civil designs must be submitted to the Engineer for approval before installation may commence.

The cable must be installed in maximum continuous lengths, to minimise joints, delivered in drum lengths. No joints will be accepted for cable runs less than permissible, depending on the cable type (multi-mode versus single-mode). The route drawings indicate functional routes on scale, from which distances can be determined

for tender stage. Final installed distances must be determined on-site, making provision for all required slack and loops. Remuneration will be for the installed length at the tendered rate per meter, measured linearly between points, including loops at agreed lengths per loop. Slack must be allowed for in the rate per meter.

All ancillaries such as cable tray, brackets and supports must be priced under the respective BOQ items. Note that the requirements in 3.2.1 above, relating to building, routes etc. applies in this instance.

All FO cables must be clearly marked at both ends with both source and destination labels (ie patch panel number #1, port 12 as source and patch panel number 2, port 9 as destination).

3.3.1.3 **Splicing**

Cable splices must be made within a purpose-made watertight jointing box, inside a jointing box. Splices may only be of the fusion splice type, complete with a protector, and no mechanical joints are allowed. Losses must be limited to 0.3dB or less.

The Contractor must provide the construction detail of this jointing chamber to the Engineer for approval, before construction. A 1m cable loop must be left at each draw-pit and 1.5m at each jointing chamber and end connection. Each manhole loop must be provided with a source and destination tag, as per the labelling requirements above. A warning label must also be provided, relating to access and possible danger of laser equipment.

Care must be taken, especially at the draw-pits and jointing chambers, when installing the FO cable. Minimum tension must be applied and rollers must be used, to prevent any damage to the outer sheath. The fibre installer must provide method statement for installation mechanism. Note the importance of the bending radius requirements of the supplier, which may not be exceeded. If not complied with during installation, a new cable for that complete run must be provided. No re-routing or splicing will be accepted.

An IP65 junction box for splicing and through-connection of the FO cables must be provided in each jointing chamber and wall-mounted against the chamber structure wall. A hanger must be provided for securing the redundant loop within the chamber.

3.3.1.4 **Inspections**

The cable must be inspected and quality tested at the factory prior to dispatch. After delivery on-site and prior to installation, the drum(s) must be visibly inspected for damage and OTDR drum tests must be done on all cores. The factory must provide the necessary quality and test certification and the Contractor/Installer must provide the on-site drum test certification. All certificates must form part of the formal submitted documentation.

Should any damage be detected then the drum must be replaced in whole. Protective caps must always be fitted to protect exposed fibres.

3.3.2 TERMINATION CABINETS

3.3.2.1 Patch panel and terminations

One patch panel (rack-mounted) must be provided per section of Works, as indicated in the functional specifications and drawings. Each patch panel must be installed within a dedicated fibre-optic termination cabinet (wall-mounted). The patch panel must be provided complete with adaptor plates suited to connectors, splice trays and fibre optic pigtails.

A minimum of a 0.5m un-jacked fibre optic pigtail must be provided at each fibre patch panel. The cables must be securely fastened, so that during maintenance, the cable cannot move. All the cores in the cables must be spliced and connected and all unused slots on the patch panel must be loaded with blanks so as to ensure the installation's IP rating. All unused fibres must be sealed with a mid-coupler end protection caps.

The ports in the panel must be numbered numerically from left to right. Each cable must be provided with a source/destination tag.

All patch panels must be assembled in the factory and inspected by the Engineer, before being taken to site. No assembly will be allowed on site.

3.3.2.2 Media Converter

The media converter must be of the DIN-rail type and spatial provision must be made within the termination cabinet. Switched media converter will not be accepted. Note that should a switch and media converter be a combined unit, then the same philosophy must be applied throughout the plant. Refer managed switches section above.

3.3.2.3 Cabinet

The cables must be terminated at each site/section onto a rack-mounted patch panel, housed within a purpose built wall-mounted steel cabinet, with lockable hinged glass door, IP65 rated. Long base brush panels must be installed at each cabinet. The mounting rails must be back and front adjustable. Two fans must be provided within the cabinet, with the Contractor design ensuring adequate airflow for the equipment. A main CB and the necessary distribution CBs provide for all equipment fed from the cabinet must be provided (note the COC requirements here in terms of SANS 10142-1).

Adequate space must be provided within the enclosure for ease of access and maintenance and all required equipment for that specific section of works. Note that an additional 25% spare space capacity must be allowed for in the final sizing of the cabinet. Note the requirements with regards to the housing of network switches, as per the section above, when there are no local MCCs in the area.

Each enclosure must be suitably and permanently labelled, with consistency provided throughout the works. In addition, each enclosure with a laser light warning label.

Size 0 compression glands must be used for fibre cable entry into the cabinets (onto gland plate), and size 00 for copper ethernet cables. All drilling and taping must take place on the backing/mounting plate of the enclosure. No double-sided-tape or side-panel taping will be allowed.

3.3.2.4 **Testing and calibration**

On completion of the installation, the final FO cable tests must be done for all the cores (for example, dB losses and ensuring optical continuity throughout), by means of a PMLS light source test. Note that cable and core testing must be done in both directions.

Note that all OTDR testers used must be accompanied by their respective calibration certificates from the manufacturer, to be presented to the Engineer (if so requested). No calibration certificate, at the time of cold commissioning, may be more than one year old.

4. SYSTEM INTEGRATOR

The system integrator (SI) responsible for the PLC, SCADA and Industrial PC programming, must have proven capabilities in this field and have a track record of work previously done similar to the work covered by this project. Detail of this experience must be given in the relevant data sheets.

It will be the responsibility of the SI to familiarise himself with the Employer's standards and software configuration if not already and no claims for additional payment in this regard will be entertained.

The (SI) must be present at the factory simulation testing of the MCC control system, as well as the onsite commissioning and final acceptance testing. The SI will be considered an employee of the Contractor and no cost claims in addition to the normal contractual claims to which the Contractor is entitled, will be entertained and provision for these activities must be made in the tender price.

5. MOTOR CONTROLLERS

5.1 General Scope

This section covers devices intended for the starting, stopping and speed control of three phase asynchronous induction motors. Generally motor controller (MC) will refer to a device for connection/disconnection of a motor to/from the electrical supply with or without speed control facilities. Fixed speed devices will be referred to as starters and variable speed devices as speed controllers. It relates to the motor controller referenced in the section *Motor Control Cubicles and Equipment.*

The MCs must be rated for operation on a three phase electrical supply system of 400V (nominal), 50Hz. Systems operated on other voltages will be stated in the project specification and references to rating and other electrical parameters must be amended accordingly.

Standard MC types are covered in the subsections below. The MC considered best suitable for a specific application will be specified in the Project Specification, based on pre-tender design considerations. The tenderer is responsible to verify the suitability of the specified MCs in terms of the driven equipment offered by him and if necessary, to qualify his tender accordingly with an alternative MC and related financial implications. Should the Tenderer fail to do so, any changes required later to best serve the application/duty of the equipment offered, will be at the Tenderer's cost.

MCs offered for tender must be rated at minimum for the motor full load rating (kW). Ratings given in the project specification are provisional for pre-tender design purposes and serve as default value for tender purposes. MCs offered must be rated in accordance with the actual motors offered for tender. No cost adjustment will be made in the case where the tenderer has to uprate offered equipment, whether from the default or offered value, except where the driven equipment requirements have been changed on instruction of the Engineer. A corresponding saving must be given where ratings have been reduced from the tender offer due to reduced driven requirements.

5.2 DIRECT ON LINE STARTERS

The general requirements for a drive cubicle assembly as per *Motor Control Cubicles and Equipment* will be applicable, and the motor controller referred to will be a direct on line (DOL) starter as described below.

5.2.1 Application

DOL starters will generally be used for manual and automatic starting of equipment operated at fixed speed driven by smaller motors, or larger motors where there are no supply constraints and/or high torque requirements.

DOL Starters covered below comprise three types:

- An assembly comprising discrete elements, being an isolating circuit breaker, electro mechanical contactor and motor protection relay, used for manual and automatic control of equipment.

- A two element assembly comprising a compact combined isolating circuit breaker for short circuit and motor overload protection with integral manual start/stop facilities (manual motor starter) and a separate electro mechanical contactor for manual and automatic control of equipment. The starter must be provided with or without facilities for fieldbus communication to a PLC, as specified in the Project specification.

- A one element compact assembly comprising a combined isolating circuit breaker for short circuit and dedicated motor overload protection with integrated manual start/stop facilities (manual motor starter) for manual control only of equipment. The starter must be provided with or without facilities for fieldbus communication to a PLC, as specified in the Project specification.

The **discrete element assembly will be the default option for general implementation,** with the compact type only to be used if specifically stated in the Project Specification**.**

The various elements must comply with the separate specification sections dealing with the specific individual components.

5.2.2 Discrete Element Starter Configuration

The starter assembly must comprise an upstream circuit breaker, discrete contactor and discrete motor protection relay.

5.2.2.1 **Circuit breaker**

The circuit breaker must comply with the relevant clauses in *Motor Control Cubicles and Equipment* above.

5.2.2.2 **Contactor**

The contactor must be of the electro mechanical type comprising a base with fixed contacts and a moving spring-loaded pole piece assembly with the switching contacts, operated by a magnetizing coil. The contacts must be rated for the motor rated continuous current, and fault/short circuit current for the time the upstream protection takes to operate.

The Contactor must be rated for AC 3 (normal) duty, type 1 coordination. AC 4 duty must be used for heavy duty applications (high torque/plugging/inching).

The contactor must be closed/opened by energising/de-energising the operating coil manually via push buttons or automatically from a PLC or field control signal, as specified in the Project Specification. The default coil voltage is 230V AC. Other voltages such as 24V DC or 48 V DC will be specified in the Project Specification. The coil must operate under the following control voltage (U_c) limits:

- Operational range : 0,85 U_c to 1,1 U_c
- Drop-out : 0,35 U_c to 0,55 U_c

The contactor assembly must be of modular construction to provide for easy maintenance with regard to coil replacement in situ, without removing the contactor base and wiring. Large frame contactors must have replaceable contacts.

Starters for motor rotation direction change (reversing) applications must comprise two identical contactors arranged that two supply phases are reversed to effect reversal of the motor rotational direction.

Phase rotation must be maintained with wiring sequence RWB. Power cable colour coding must be maintained throughout the starter assembly as well as the outgoing cable connection. Motor direction must be determined within the motor terminal box connection.

5.2.2.3 **Motor protection relay**

Motor protection relays must be modular of the thermal bi-metallic or electronic type, as specified in the Project specification, purpose made for motor protection. The motor protection parameter trip setting must be manually adjustable to suit the motor specific rating and duty.

<u>Thermal bimetallic type</u>

The relay must be of the same manufacture as the contactor and selected in combination with the contactor and motor rating as per the manufacturer's selection charts. It must provide protection against overload current and single phasing (indirectly via overcurrent) with tripping curve to suit the motor type and application.

The relay must be fitted with a *TEST* facility to provide for manual tripping of the relay for simulation purposes.

The relay must be directly connected to the contactor up to the power rating provided for by the manufacturer and via current transformers for higher power ratings.

Electronic type

The relay must preferably be of the same manufacture as the contactor or as specified in the Project Specification. It must provide comprehensive protection for the conditions specified below (minimum) with adjustable /selectable tripping curves to suit the motor type and application.

a) Phase fail (loss of phase, phase reversal).

b) Motor overload.

c) Motor underload.

d) Successive start limitation.

The relay must be fitted with a *TEST* facility to provide for manual tripping of the relay for simulation purposes. Note that in *TEST SIMULATION MODE* there must be no reset delay after successive starts resulting in a trip.

The relay for low power applications must have built in current sensing and directly connected to the contactor as per the manufacturer's directive. For higher power ratings the relay must be driven via current transformers.

5.2.2.4 **Auxiliary contacts**

Circuit breakers, contactors and motor protection relays must be fitted with sufficient NO and NC auxiliary contacts to provide for the specified control and remote monitoring requirements. Contacts current rating must be adequate for the required control function burden at the control voltage specified in the Project Specification.

Note that circuit breakers must be provide with separate NO contacts for circuit breaker isolated (off) and tripped condition.

5.2.2.5 **Operator interface**

The operator interface must comprise two local discrete start (green) and stop (red) spring return pushbuttons on the MCC panel door and remote starting/stopping from a field control station as specified in the Project Specification switching the contactor coil. An emergency stop must be hardwired to the contactor coil.

Higher level interface to a HMI or SCADA will be detailed in the Project Specification.

5.2.2.6 **Rating summary**

a) System voltage : 400V (+10%-15%).

b) Power (kW) : Driven motor rating (min).

c) Duty : AC 3, AC 4 as applicable.

d) Coordination : Type 1

5.2.2.7 **Standards**

SANS 60947-4-1, 2, 3 as applicable.

5.2.3 **Compact Starters**

Compact starters have the circuit breaker and overload relay combined in an integrated package with on board mechanically latched start/stop push control and must conform to the general functional requirements of the discrete element starter specified above.

It is intended for small power application only and will be specifically specified in the Project Specification.

5.3 SERIES REACTOR REDUCED VOLTAGE STARTERS

Not part of this specification

5.4 ELECTRONIC REDUCED VOLTAGE (SOFT) STARTERS

The general requirements for a drive cubicle assembly as per *Motor Control Cubicles and Equipment* will be applicable, and the motor controller referred to will be an electronic soft starter as described below.

5.4.1 **Application (general)**

Soft starters are used for fixed speed application, with controlled starting ramp-up acceleration and stopping ramp-down de-acceleration to reduce shock loading on driven equipment or prevent water surges in pumping systems. Some applications will mainly be for reduced motor starting current where there are electrical supply constraints.

5.4.2 **Starter Configuration**

The starter assembly must comprise an upstream circuit breaker and soft starter.

5.4.2.1 **Circuit breaker**

The circuit breaker must comply with the relevant clauses in *Motor Control Cubicles and Equipment* above.

5.4.2.2 **Starter module**

The starter is a reduced voltage type starter which uses solid state electronics to increase the output voltage to the motor gradually from a threshold value to full value where it remains until the motor is stopped, at which the output voltage is gradually decreased to zero. The effect is that the motor gradually accelerates during ramp up stage (soft start) to full speed (steady stage) and gradually decelerates during the ramp down stage to standstill (soft stop). The start-up threshold voltage must be adjustable

to increase the motor pull away torque as required. A start boost facility must be provided for short time application of full voltage for high starting torque applications.

The Starter must have a selector to disable the soft stop facility for an uncontrolled stop if so required, e.g. high inertia loads or emergency stop.

Torque control

Ramp up and ramp down slopes must be linear for general application and separately adjustable to suit the load application.

The speed response is load type dependant and linear voltage ramps will not be suitable for all applications, resulting in poor speed regulation. The torque in the motor must be regulated to match the load type during acceleration and deceleration, to prevent unwanted rapid acceleration/deceleration and the motor parameters (current and voltage) must be continuously monitored during ramp up/down for instantaneous adjustment of the starter output to allow for changes in load conditions and the soft starter must incorporate a closed loop torque control system to achieve this. The speed-up/down ramps are thus effectively torque (not voltage) ramps.

5.4.2.2.1 **Configuration**

The power electronics comprise two back to back silicone controlled rectifiers (SCRs)/thyristors per phase fired appropriately to vary the output voltage. The control electronics comprise a microprocessor controlled SCR firing control circuit for varying the firing angle to provide the voltage control.

The starter must be installed in line with the motor (inside delta will not be acceptable).

Bypass contactor

The starter must be fitted with a by-pass contactor, which closes automatically when full speed has been reached, bypassing the starter during steady state operation and opening again when the stop ramp commences. This contactor must be an integral part of the starter module. External contactors must be clarified with the Engineer prior to implementation.

Since the starter and motor protection is internal to the starter, care must be taken that the protection remains active during bypass, especially for externally fitted bypass contactors.

Power factor correction capacitors

If power factor correction is required in the Project Specification the switching implementation must be determined in conjunction with the soft starter vendor with separate switching/isolation contactors. The capacitors may not be switched to the starter output terminals which must be isolated by means of a dedicated isolation contactor. Specific care must be exercised that the motor protection is maintained with the starter output isolated.

5.4.3 **Functional Requirements**

The following facilities must be provided:

5.4.3.1 **Centrifugal pumping application**:

Acceleration and deceleration must be smooth, especially deceleration during stopping to prevent surges and bring the pumped water column to a controlled standstill. Torque or any other variance causing pressure pulses during stopping will not be acceptable and cause for the starter to be rejected. This requires torque ramps which are not linear, but purpose designed for pumping applications.

5.4.3.2 **Control and monitoring**

Provision must be made for control demands via discrete digital inputs, operator interface keyboard and communication network (PLC, HMI or SCADA system).

Refer to the *Interface* section below for access to these facilities.

5.4.3.2.1 **Starting**

a) Acceleration ramp: Adjustable 1-90 seconds from a fixed threshold voltage.

b) Threshold voltage: Adjustable from 0,33 rated voltage to 0,6 rated voltage.

c) Start voltage boost facility: Switch selectable full voltage short-time boost.

d) Current limit: Adjustable 2-5 times motor rated current.

5.4.3.2.2 **Stopping**

Switch selectable:

a) Uncontrolled free-wheel stop by shutting off the supply to the motor.

b) Controlled stop with deceleration ramp, adjustable 2-90 seconds.

c) Current limit: Adjustable 2-5 times motor rated current.

5.4.3.2.3 **Addressable inputs and outputs (I/O)**

Addressable I/O that can be configured to provide the following functionality:

a) External start and stop signals, remote manual and automatic control.

b) Emergency stop.

c) Starter inhibit (interlock).

d) Motor run status.

e) Motor fault.

f) Starter fault.

5.4.4 **Protection Facilities**

The soft starter must have integral starter and motor protection facilities that will trip the starter when activated. All trip settings must be adjustable. Note that protection facilities must remain functional in bypass mode. The specific trip condition must be given on the starter LCD display (refer operator interface).

The following are minimum requirements:

5.4.4.1 **Motor protection**.

a) Motor overload in accordance with integral motor thermal protection curves, by measuring the actual motor current, including locked rotor (stalled /jammed motor).

b) Motor underload.

c) Successive start limitation, by means of a thermal memory taking previous starts into account. Once the thermal capacity has been exceeded and the motor shuts down, restart must be prevented until the motor has cooled down sufficiently.

d) Larger drives must provide for direct connection of external protection devices such as PT 100 RTD temperature sensors and thermistors, as per Project specification.

5.4.4.2 **Starter protection**

a) Phase fail (loss of phase, phase reversal, phase imbalance).

b) Over and under voltage.

c) Short circuit protection by means of fast acting fuses in accordance with the manufacturer recommendation (additional to the upstream circuit breaker) for phase and earth fault.

d) Thermal protection of the starter against overload and over temperature.

e) Cooling fan fail.

f) The starter must have a self-diagnostic facility for checking internal component faults.

5.4.5 **Operator Interface**

The following facilities must be provided for purposes of control and monitoring.

5.4.5.1 **LED status display**

The starter must have LEDs supplementary to the navigation keypad display for status indication as described below. The combination of LED indication and text status display will be manufacturer specific.

The minimum LED status indication is as follows:

a) Power on.

b) Controller run.

c) Alarm.

d) Fault.

The balance of statuses must be displayed in the LCD text display unit.

Note that the status LEDs must be visible through a panel door window, or mounted on the navigation display unit.

5.4.5.2 **Keypad display unit**

The starter must be provided with an operator interface module comprising a menu driven navigation keypad and alphanumeric backlit LCD multiline display to serve as operator interface and access point to program parameters and select display of specific parameters. The module must have navigation keys for scrolling through the display and selection parameters/options. Text information must be in plain descriptive English. There must be a *Help* menu to assist the operator. Operator access to defined levels must be password protected.

This module must be removable for remote installation on the MCC panel door, with cable link to the controller. The module must be interchangeable between various models within a specific range.

The display must provide for the following text information:

a) Motor operational status:

- Starting/stopping.
- Run.
- Fault (individual trip identification).
- Cooling down.

b) Motor dynamic parameters:

- Line and phase voltages (all three phases).
- Line current (all three phases).
- kW, kVA, kVAr, PF.

c) Starter operational phase:

- Acceleration/deceleration.

- Top of ramp.
- Steady state.

d) Starter protection:

- Internal fault (individual faults).
- Starter thermal fault.
- Starter cooling fan fail.

e) Fault history.

f) Motor data.

g) Starter setup parameters.

5.4.5.3 **Manual control**

Start and stop facilities must be provided by means of:

a) The keypad.

b) Local discrete start (green) and stop (red) spring return pushbuttons on the MCC panel door and remote starting/stopping from a field control station as specified in the Project Specification and an emergency stop hardwired to the starter.

5.4.6 **System Interface**

The starter must have communication facilities for a multi drop serial Modbus link and Ethernet connectivity for communication with the controlling PLC and SCADA system. Provision must be made for control via the network from a PLC, HMI and SCADA system.

The Soft starter must have programmable digital and analogue inputs and outputs to provide the facilities specified under *Functional Requirements* above. Provision must be made for extendable facilities. Specific provision must be made as shown (minimum):

- Digital inputs : 4
- Analogue inputs : 2
- Analogue outputs : 2
- Relay outputs : 4

Temperature sensor inputs:

- PT 100 RTD inputs : 4
- Thermistor inputs : 3

5.4.7 **Specification And Ratings**

a) Supply voltage: 400 V (- 15%,+10 %) three phase at 50 Hz.

b) Power: motor continuous rated load plus 10%.

c) Power de-rating above 1000m above sea level: 2% per 100m.

d) Noise level: ≤65dB.

e) Starts per hour: 12.

5.4.8 **Accommodation And Cooling**

The starter must be able to operate under the conditions stated below

Ambient temperature : 0 °C to 40 °C.

Humidity : 93 % at 40 °C.

The starter assembly must be installed in a MCC enclosure and sufficient space must be provided around the starters to ensure adequate air flow in accordance with the manufacturer's requirements. Forced cooling by means of a fan (1*) must be provided and hot air may not circulate within the enclosure, but vented to the outside of the enclosure. Short circuiting of air to adjacent enclosures must be prevented. The enclosure door must be fitted with an air intake at low level and exit at high level with air flow deflected upwards (not towards the front). Fully enclosed compartments must be ducted to the back or top with an extraction fan if the normal circulation does not provide sufficient cooling. The intake louvre must be fitted with a removable filter element.

The MCC manufacturer is responsible to confirm the cooling methodology with the starter manufacturer to ensure compliance.

Note (1*): The fan must only run when the starter is in active drive operation and then only when the temperature exceeds safe levels.

5.4.9 **Standards**

The starters must comply with the following standards:

a) SANS 60947-4-1, 2, 3 as applicable.

b) Radio electrical interference : IEC 801-3

c) Vibration resistance : IEC 68-2-6

d) Shock resistance : IEC 68-2-27

5.5 VARIABLE FREQUENCY SPEED CONTROLLERS

5.5.1 General

The general requirements for a drive cubicle assembly as per *Motor Control Cubicles and Equipment* will be applicable, and the motor controller referred to will be an electronic variable frequency controller (VFC) as described below.

VFCs must provide smooth linear acceleration and deceleration during starting and stopping, by means of increasing the motor supply voltage and frequency from zero to the desired operational speed on an adjustable time ramp during run-up and the reverse on stopping to standstill.

5.5.2 Application (general)

VFCs are primarily used for:

a) Dynamic variable speed application, to maintain a parameter set-point. Starting and stopping are with controlled ramp-up acceleration and ramp-down deceleration to reduce shock loading on driven equipment or prevent water surges in pumping systems.

b) Fixed speed applications at discrete different speeds for phased implementation over time, or serving different duty points utilizing the same motor and pump.

VFCs can also be used for equipment powered from a standby generating set, because of the reduced starting current characteristic of VSDs.

5.5.3 VFC Configuration

5.5.3.1 Principle of operation

The VFC is uses solid state electronics to gradually increase the output voltage and frequency to the motor from standstill to a controlled speed until the motor is stopped, at which the voltage and frequency are gradually decreased to zero and the motor is at standstill. The effect is that the motor gradually accelerates during ramp up stage (soft start) to a controlled speed and gradually decelerates during the ramp down stage to standstill (soft stop). The voltage control limits the inrush current during run-up.

5.5.3.2 Topology and technology

The controller comprises a full wave diode bridge rectifier input section, DC link and inverter section to convert the DC to a variable AC frequency, operating at rated voltage at the system frequency. A microprocessor controls the power electronics to convert the fixed frequency AC to variable frequency AC.

The rectifier section thyristors can be configured as a six or twelve pulse (trigger) unit. The six pulse unit is supplied from a normal three phase supply, whereas the twelve pulse unit will require a special phase shift input transformer to provide for the twelve pulse configuration. The default supply will be a standard three phase system and six pulse units will be considered the norm for tender, unless specified otherwise in the Project Specification.

The inversion section comprises actively switched IGTBs and must use pulse width modulation (PWM) technique to approximate a sinusoidal output waveform. The power modules must be protected against overheat, overload and short circuit.

VFCs generate harmonics and mitigation measures must be provided such as filters, passive front ends or active front ends. Passive front ends comprise high order pulse rectifier sections such as 12 or 18 pulse units which have inherent lower harmonics. It may be offered if it offers a more economical solution than a six pulse units with matching additional mitigation measures, but the offer must include the phase shift input transformer. An active front end IGBT rectifier section in place of the thyristor rectifier, nominally in mirror of the invertor section, will significantly reduce harmonic generation (and footprint), but is generally only cost effective in high power drives. This is the preferred option for larger drives in a phased application, where motors will initially run at reduced load (refer to load effect in the section on Harmonics).

The VFC functional characteristics must be matched to the specific load, especially torque control during starting and stopping. VFCs main application for purposes of this specification will be for centrifugal pumping systems and VFCs must employ Vector torque control, in most cases single quadrant operation. If deceleration or reverse braking is required, four quadrant control must be used (active front end) and not resistors for braking energy dissipation.

5.5.4 **Functional requirements**

The following facilities must be provided:

5.5.4.1 **Control and monitoring**

Provision must be made for control demands via discrete digital inputs, operator interface keyboard and communication network (PLC, HMI, SCADA system).

Refer to the *Interface* section below for access to these facilities.

The following requirements must be met:

a) Starting and stopping acceleration and deceleration ramps must be separately adjustable.

b) Emergency stopping or stopping under fault conditions must be selectable as controlled, or freewheel stopping.

c) Sixteen (minimum) pre-programmable speeds for fixed speed operation.

d) Addressable inputs and outputs that can be configured to provide the following functionality:

- External start and stop signals, remote manual or automatic control.
- Emergency stop.
- Controller inhibit (interlock).
- Motor run status.

- Motor fault.
- Controller fault.

e) On loss of a controlling parameter, e.g. an analogue reference value, the VFC must revert to a user defined safe speed, with alarm.

f) A communication facility must be provided whereby the setting up of the controller can be done remotely and downloaded, as well as to provide for copying the drive set-up to external storage devices, such as a laptop.

5.5.4.2 **Selectable facilities**

a) Speed or torque ramp control.

b) Ramp torque curve profile selection best suited to the application (e.g. S, linear/custom torque curve).

Note for centrifugal pumping (variable torque) application:

Acceleration and deceleration must be smooth, especially deceleration during stopping to prevent surges and bring the pumped water column to a controlled standstill. Torque must be controlled to prevent pressure surges by means of Vector control with torque ramps purpose profiled for pumping applications.

c) PID control functionality for dynamic speed control to maintain a set-point value.

d) Master/slave functionality to allow multiple drives to be locked onto a specific frequency.

e) A frequency skip function that will prevent the controller to operate at resonant or other critical speeds.

f) PLC programming capability (*).

g) Short time power interruption ride through capability using the motor set rotating inertia.

h) Restart on the fly facility during stopping ramp down without first speeding down to standstill, to allow the motor to accelerate to a new operational speed synchronizing with the rotating motor.

i) Manufacturer Standardized Application algorithms and provision for User Configured algorithms.

The abovementioned requirements are nominal and must be amended to provide for additional facilities as per Project specification.

(*): The functional standards can be lowered for controllers <15kW to meet Project Specification requirements only, but must be qualified accordingly in the Tender Data Sheets or a covering letter as a deviation from the specification.

5.5.5 **Protection Facilities**

The VFC must have integral motor and controller protection facilities that will trip the controller when activated. The specific trip condition must be given on the controller LCD display (refer operator interface).

The following are minimum requirements:

5.5.5.1 **Motor protection**.

a) Phase fail (loss of phase, phase reversal, phase imbalance).

b) Motor current overload by means of entering the motor parameters and setting an alarm and trip values, matched to a motor thermal protection curve.

c) Motor current under-load, for low flow detection in centrifugal pumping application.

d) Successive start limitation, by means of a thermal memory taking previous starts into account. Once the thermal capacity has been exceeded and the motor shut down, restart must be prevented until the motor has cooled down sufficiently.

e) Input facilities (large drives, as per project specification) for direct connection of protective sensors for:

- Motor winding thermal protection by means of PT 100 RTD temperature sensors and/or thermistors.
- Bearing over-temperature by means of PT 100 RTD temperature sensors.

<u>External protection and precautions (not covered under this section):</u>

Note that PWM controllers can generate high frequency stray currents which can cause severe bearing damage if grounded through the bearings and proper preventative precaution must be taken. This is external protection covered under the section for motors.

Motor feed cable lengths must be kept as short as possible, since long cable runs can result in high voltage spikes that can damage motor insulation. Motors must be rated for inverter fed duty due to the higher voltage stresses on windings.

5.5.5.2 **Controller protection**

a) The controller must have a self-diagnostic facility for checking internal component faults prior to start-up and during running.

b) The controller must be protected against over-and under supply voltage for extended periods. It must be able though to provide continuous operation during short time voltage fluctuations without damage to the controller:

- Total loss of one or more phases for 300ms.

- Reduced voltage of up to 30%.

c) In addition to the assembly incoming circuit breaker protection, short circuit protection must be provided for the power electronics such as fast acting fuses in accordance with the manufacturer recommendation.

d) Thermal protection must be provided for controller overload by means of current sensing devices and over temperature with temperature sensing devices. Early detection must be given by means of an alarm and shutdown at the appropriate protection levels.

The controller must be fitted with a cooling fan with own motor protection. Failure of the fan must shut the controller down with remote alarm facilities and fault indication on the controller operator interface.

Refer to the section on accommodation requirements for further physical cooling requirements.

5.5.6 Operator Interface

The following facilities must be provided for purposes of control and monitoring.

5.5.6.1 Status LEDs

The controller must have LEDs supplementary to the navigation keypad display for status indication as described below. The combination of LED indication and text status display will be manufacturer specific.

The minimum LED status indication is as follows:

a) Power on.

b) Controller run.

c) Alarm.

d) Fault.

The balance of statuses must be displayed in the LCD text display unit.

Note that the status LEDs must be visible through a panel door window, or mounted on the navigation display unit.

5.5.6.2 Keypad display unit

The controller must be provided with an operator interface module comprising a menu driven navigation keypad with alphanumeric backlit LCD multiline display to serve as operator interface and access point to program parameters and select display of specific parameters. The module must have soft and hard navigation keys for scrolling through the display and selection parameters/options. Information, other than numerical parameters, must be in plain descriptive English text. There must be a *Help* menu to assist the operator. Operator access to defined levels must be password protected.

This module must be removable for remote installation on the MCC panel door, with cable link to the controller. The module must be interchangeable between various models within a specific range.

The typical drive will have numerous display parameters and navigation facilities as standard, of which only a few salient items are noted below as minimum requirement. No attempt will be made to give a comprehensive listing.

The display must provide for the following information:

a) Individual trip identification.

b) Fault history.

c) Input dynamic parameters:

- Line and phase voltages (all three phases).
- Line current (all three phases).

d) Motor dynamic parameters:

- Line and phase voltages (all three phases).
- Line current (all three phases).
- kW, kVA, kVAr, PF.
- Frequency.
- Speed (r.p.m).

e) Motor Status

- Starting/stopping
- Motor accelerating/decelerating
- Motor run at setpoint.
- Motor fault.
- Motor cooling down.

f) P & ID parameter setpoint and actual reference value.

g) Starter internal fault.

h) Starter thermal fault.

i) Starter cooling fan fail.

Note that the status display LEDs must be visible through a panel door window, or be on the keypad.

5.5.6.3 **Manual control**

Start and stop facilities must be provided:

a) On the keypad.

b) Discrete start (green) and stop (red) spring return pushbutton on the MCC panel door and remotely from a field control station as specified in the Project Specification.

c) An emergency stop hardwired to the controller.

5.5.7 **System Interface**

The VFC must have the following communication connectivity:

- Modbus TCP multidrop serial link for communication with controlling PLC and other VFCs.
- Ethernet IP for direct link to the Ethernet communication network.

Provision must be made for control via the network from a PLC, HMI and SCADA system.

The VFC must have programmable digital and analogue inputs and outputs to provide the facilities specified under *Functional Requirements* above. Provision must be made for extendable facilities. Specific provision must be made as shown (minimum), with extended facility in brackets (total):

- Digital inputs : 6 (14)
- Digital outputs : 4
- Analogue inputs : 2 (4)
- Analogue outputs : 2 (4)
- Relay outputs : 4

Temperature sensor inputs:

- Four PT 100 RTD inputs.
- Three thermistor inputs.

5.5.8 **Specification and Ratings**

The VFC must be rated as follows:

a) Supply voltage : 380V-460V (- 10%,+15 %) three phase, 400V nominal at 50 Hz.

b) Supply frequency : 48-63Hz.

c) Input power factor : 0,97.

d) Output voltage : 0 to supply voltage.

e) Output frequency : 0 to 60Hz, rated speed at 50Hz.

f) Power rating : connected motor rating plus 10%.

g) Overload capability : 110% x rated current for 60s every 10 min.

h) Over-torque capability: 170% of motor rated torque for 60s.

i) Starts per hour : 12

j) Protection class : IP54

5.5.9 **Harmonics**

The non-linear switching elements of VFCs generate voltage and current harmonics which are multiples of the fundamental (50Hz) voltage and current waveforms. This distortion effect is referred to as Total Harmonic Distortion (THD) expressed as a percentage value at a reference point. THD relates to voltage THDu or current THDi.

The harmonic currents cause additional heat losses in equipment such as transformers cables, motors and PF correction capacitors, which can lead to overheating and failure. It has a detrimental effect on the supply infrastructure and as such affect the Quality of Supply to other users connected to the supply system. Generation of harmonics must be controlled at source to ensure compliance with SABS 61000-3-4 upstream and downstream of the VFC installation. Measures must be taken to reduce the harmonic content generated in accordance with the guidelines in IEEE 519, tables 10.2 (voltage harmonic distortion) and 10.3 (current harmonic distortion).

Tenderers must guarantee compliance and state the measures taken. Various technologies are available, e.g. passive and active filters, passive and active front ends. Passive front end (higher order rectifier sections as noted under the *Technology* section above) will only be considered as an exception, unless otherwise noted in the Project Specification.

Note:

- Mitigation measures must be provided per individual controller and is considered part of the controller assembly, irrespective if supplied as an integral unit or modular assembly.

- For large drives the mitigation method has a direct impact on footprint (accommodation space). In choosing the most cost effective solution, space constraints and related cost implications must be taken into account.

Tenderers must guarantee the maximum harmonics at a reference point, which unless noted otherwise in the Project Specification will be the point of common coupling (PCC) to another network. In a LV distribution network shared by other consumers, it will be at the point of connection to the network (usually the Supply Authority metering point). Note that this also applies to a distributed network on a plant/site of a consumer where the PCC will be the distribution point feeding other MCCs.

Note that the relevant requirements of IEEE 519 must also be met downstream of the defined PCC at any point of consumption and the Contractor remains responsible to ensure that the harmonics generated by equipment provided by him does not detrimentally affect other users/equipment connected to the same internal network. The safe approach would be to use the relevant MCC busbars as the effective PCC, since if the harmonic limits are met at this point, it will also conform at the upstream defined PCC due to the added upstream circuit impedance.

Tenderers must determine the voltage and current harmonic limits from IEEE 519 tables 10.2 and 10.3 respectively and base their design on the supply system parameters given in the Project Specification.

The current harmonic content limits as per table 10.3 is referenced as Total Demand Distortion (TDDi), which is based on the full rated load of the drive motors. The duty point is usually less than the rating and tenderers must base their calculations on the duty load and the specific equipment such as transformers, offered. In the case where the project is built in phases, the mitigation measures must be designed for the ultimate load and calculations provided for the applicable values for the related phase duty load.

If all supply system parameters are not known at time of tender, Tenderers must use the information at hand and allow for the cost of redoing the calculations after appointment when the parameters are known. Allowance must be made in the overall price if there is no specific Price Schedule measurement item.

If no specific design guidelines are given in the Project Specification, the *GENERAL* Classification values in tables 10.2 for THDu (5%) and in 10.3 for TDDi (10%), will be applicable.

The Tenderer must guarantee that the mitigation measures offered will limit the harmonic distortion to the required values. To substantiate this claim, the Contractor will have to do a comprehensive harmonic analysis at the site after award of tender as part of the detail design, whether it is a Greenfield site or extension on an existing site and analysis on completion of the installation. This analysis must be done with calibrated instrumentation, by a party that specializes in this type of testing, certified as correct.

Should the maximum design load not be available on site at the time of testing, the Contractor will have to prove by theoretical analysis that the measured values applied to the design load will meet the requirements.

Tenderers must allow for these tests as part of the inclusive price if there is no specific price schedule item for this.

Capacitor banks:

Harmonics and harmonic mitigation measures, depending on the technology used, can detrimentally interact with capacitor banks and cause equipment failure. Caution must be exercised in the design and planning of harmonic mitigation and capacitor banks. Cognizance must be taken of existing capacitor banks where the installation is done on a site with existing plant.

5.5.10 **VFC Assembly: Components And Enclosure**

The VFC assembly must comprise the standard components as per *Motor Control Cubicles and Equipment* and the default assembly will be built into an enclosure forming an integral part of the MCC, comprising a single or multiple VFCs. As such the VFC is considered part of the MCC and subject to the requirements of SANS 10142 relating to MCCs.

In high power applications, or where each VFC is provided with its own transformer on a modular basis, the VFC can be a standalone unit, provided it complies with the requirements of SANS 10142. The MCC will then comprise an incoming section, feeding a distribution section in turn feeding the individual modular standalone VFCs. Each VFC feeder enclosure will comprise the standard assembly components referred to above, including control switches and indication lights. Each standalone unit must be provided with an incoming isolator. Single core cable connections can be used to link the MCC distribution and VFCs up to 450kW. Solid copper epoxy insulated enclosed busbar must be used for higher ratings. Note that this modular application must be covered by the COC and include the controller(s) as part of the MCC.

In the case of large VFCs where the harmonic mitigation equipment is housed in a separate adjacent enclosure with own door, the doors must be mechanically interlocked that the related VFC supply circuit breaker must be switched off to open any panel door. The specific arrangement must be approved by the engineer prior to implementation.

5.5.11 **Ventilation And cooling**

The controller must be able to operate under the conditions stated below.

Ambient temperature	:	-10 °C to 50 °C.
Humidity	:	93 % at 50 °C (no condensation).

The VFC assembly will be installed within an enclosure and sufficient space must be provided around the equipment to ensure adequate air flow in accordance with the manufacturer's requirements. Hot air may not circulate within the enclosure. The enclosure door must be fitted with an air intake at low level and exit at high level with air flow deflected upwards (not towards the front). Short circuiting of air to adjacent enclosures must be prevented. High power and/or multiple drive compartments must be ducted to the back or top with an extraction fan (additional to the VFC cooling fan). The exit air must be ducted to atmosphere with extraction fans at the point of exit, covered with a cowl facing downwards.

The MCC manufacturer is responsible to confirm the necessary cooling methodology with the controller manufacturer to ensure compliance with the above and to determine whether the heat load and/or specific site conditions will require air conditioning (AC). Provision for AC must be made in the tender price irrespective whether itemized in the price schedule or not, unless specifically excluded in the Project Specification. No cost adjustment in this regard will be made after award of tender.

The normal air cooling as described above must be provided by default and the AC is supplementary when ambient conditions exceed set parameters. I.e. the installation

must not be dependent on the AC for normal ambient conditions and only operate when required.

5.5.12 **Spatial Requirements**

Building spatial accommodation for MCCs is determined during design stage based on equipment to provide a workable solution. The footprint of large VFCs and associated harmonic mitigation equipment can be substantial. Due to the various mitigation technology options available, the pre-tender spatial provision made may be insufficient for the equipment offered. It is a requirement that tenderers confirm as part of the tender whether the spatial provision made is adequate for their equipment offered and must also provide the footprint of the offered equipment. This information must be given in the data sheets or separately as an addendum to tender.

This information with related financial implications forms part of the tender evaluation and the Contractor will be held accountable for any cost that need be incurred during construction to provide additional accommodation space not qualified at tender stage.

5.5.13 **Standards**

The VFCs must comply with the following standards:

a)	Vibration resistance	: IEC/EN 60068-2-6
b)	Shock resistance	: IEC/EN 60068-2-27
c)	EMC	: SANS 61800/61000 (latest editions), as well as NRS 048-2 (latest edition)
d)	Harmonics	: SABS 61000: Quality of Supply.
		:IEEE 519 1992 (as revised): Harmonic suppression.

6. POWER FACTOR CORRECTION

Power factor correction must be provided as stated in the Project specification, as either of the fixed capacitor type per individual drive, or the bulk variable capacitor type comprising capacitor banks with automatic stepped control.

6.1 RATING

The final design of the active PFC system remains that of the Contractor, conforming to the framework provided hereunder.

The rating of the equipment must be so as to provide a power factor of no less than 0.98 lagging at any time.

Assume that the equipment being installed will mostly be of the inductive motor type, with a combined power factor (PF) of 0.8. Note that there are numerous combinations in which motors can stop and start for the various areas of a plant, as well as possible phasing of the plant and all of this will have a dynamic effect on the actual PF of the plant and total capacitance.

6.2 CONTROL RELAY AND CTs

The reactive power control relay must be capable of on-line monitoring of the associated plant and automatically switch capacitor banks in and out to manage the plant power factor within a very narrow band.

The relay must be capable of measuring all main electrical components such as individual switch status and counter-mechanism, power factor (cos ø), voltage and current harmonics, and the respective active and reactive currents. An additional temperature input must be provided and wired to the control relay to prevent the compartment (and unit) from overheating.

The relay must be further be provided with the functionality to provide Supervision with advanced warning in the case where a safe number of switching actions has taken place at a specific bank. The amount of safe switching actions must be provided by the equipment supplier.

The control relay must be of the industrial type and must be solely and specifically designed for power factor correction. It must consist of a Led-display (minimum), capable of displaying most of the required on-line parameters on one page, including the PF setpoint parameter and number of banks in operation. It must be capable of automatic and manual control, with manual solely for the purpose of testing of individual banks.

The relay must be able to be programmed to provide several specific alarms outputs, with protections to be provided such as:

- System over-temperature from the internal temperature sensor
- Under-performance in terms of under-compensation (provisionally less than 0.92)
- CT fault (current too high or low)
- Harmonic alarm
- Switching counter high
- No-load condition (voltage)

Delay timers must further be adjustable within the unit, to adapt to the changing plant conditions and this must form part of the on-site commissioning and optimisation exercise by the Contractor.

The CTs must be installed directly downstream of the associated main LV supply main CB terminals, with ratio and final position to be confirmed by the PFC supplier. Note that the CT ratio and accuracy class must be compatible with the control relay offered.

6.3 CAPACITORS, SWITCHING AND DISCHARGING

The capacitors must be divided into dedicated capacitor banks, with the banks to differ in size (kVar) so as to increase the potential accuracy in meeting the PF setpoint at all times.

Capacitors must be of the industrial MKP-type, suitable for continuous operation at an r.m.s. line current of 1.3 times the fundamental current. They must also be rated for the required over-voltage withstand, as set-out in IEC 60831-1/2 and EN 60831-1/2, revised editions (national standards that the offer must fully comply to).

The capacitor temperature ratings must be a Class D (highest temperature), due to the location of the plant.

The various capacitor banks must be switched in and out by means of fuse-protected contactors. Fuses must be selected in-line with VDE 0100:523, at the same temperature constraints and Class as per the capacitors above. The contactors used must be purpose designed and built for multiple switching cycles, as required for this PFC application.

All required discharge resistors (note required discharge time period of less than 50V in less than one minute), cabling sizing (including derating factors), warning labels, fans and heat dissipation must be provided as part of the PFC compartment design.

7. GENERAL ELECTRICAL INSTALLATION

The general electrical installation covers the supply, installation and connection of equipment provided under this contract, as well as the connection of other MCCs and control panels provided by others.

All electrical work must be done in strict compliance to the OHS Act, with legislative standards such as:

- SANS 10142-1 – LV Wiring Code
- SANS 60204 – Safety of Machinery

7.1 CABLE WORK

7.1.1 Cables And Sundries

The Contractor must allow for the supply and installation of all required electrical and control cables outside and within the plant as per the schedule in the Bill Of Quantities (BOQ).

7.1.2 Technical Requirements

General LV cables must be of the 600 / 1000V PVC insulated, steel wire armoured, overall PVC contained type, in compliance and accordance with SANS 1574.

All unarmoured cable being installed in trenches must be provided with protective concrete slab, or similar and equal type, covers. The slabs must completely cover the length of the cable, installed a minimum of 300mm above the cable. The slabs must also extend a minimum of 100mm on either side of the final cable width.

7.1.3 Pricing

Note that the cable sizes and distances are provisional for pricing only. All final cable distances must be measured on-site by the Contractor, in line with the final agreed-upon cable route. Only after the final cable route distances have been provided to the

Engineer, can the final cable sizes for ordering and installation be determined. All cable distances are therefore re-measurable and payment will only be made for final installed distances measured from point to point. Allowance for slack along the routes must be made within the rates. Note that 1m cable slack must be provided for in the final measurement at each cable end and that the termination rates must include provision for any further wastage at these cable ends.

7.1.4 Installation Schedule

A detailed cable, wiring and tray schedule must be compiled and maintained by the Contractor. The purpose of the schedule is to log and monitor all re-measurable items. The schedule must be complete with sections stating to and from feeds and broken down into the specific components, so as to be able to trace and audit all re-measurable components installed. The schedule must remain live and up to date throughout the installation procedure.

7.1.5 Labelling

Every terminated cable must be provided with a robust and weatherproof label, fixed to the cable just below the panel gland, describing where the cable is fed from and where it is running towards.

7.1.6 Terminations

All cable terminations must be properly planned in terms of spacing on the respective gland plates. All cable ends must be properly made-off with cable glands to suit the cable type and size, with one gland per cable only. Note the bonding requirements of the armouring, that all cable ends must be sealed with colour-coded heat-shrink and the lugs must be properly rated for the final cable size. In the instances where CB stubs are too close together, or where the bending radius of the cable is exceeded due to space limitations, then offset busbar ‘stubs’ must be provided to suit the application requirements.

All gland openings not used must be properly closed-off.

All external glands must be of the Pratley Enviro (double seal) type and motor terminal boxes must be designed and cater accordingly.

7.1.7 Borehole Pump Connection

As per the tender drawings, sleeves must be provided between the MCC plinth and the borehole baseplate housing. Fixed cables must be provided between the MCC and the baseplate, which must be terminated at an IP67 Pratley cable box. The borehole power and control cables must be connected in this box, to facilitate any borehole removal, if and when required.

Note that the borehole cables must not be installed or operate under any tension and adequate compression glands and supports must be designed within the baseplate housing to accommodate the required cables. The baseplate must further be designed with adequate cable glands, sleeves and the Pratley box so as to leave adequate space for cable bending radii as well as free working space.

Note that the probe fixed cable must be of the twisted pair, individually screened type.

7.2 EXCAVATIONS

Cables must be installed at a depth of 0.75m.

The trench must be made wide enough that it does not fall in on itself while introducing the bedding, cable and backfilling and compaction.

No bedding may be provided until the trench has been approved by the either the Engineer or Municipality.

Note that all OHS Act requirements must be met, specifically relating to an open trench and barricading and signage for the public and other workers' protection and safety.

7.2.1 Cable Installation

A minimum of 150mm bedding must be provided for the cable, with the material having a low clay content and a maximum resistivity of 1.2Km/W. After the cable is installed, in as straight a line as possible, an additional 150mm cover must be provided.

Thereafter a 400mm backfilling section is to be provided, properly compacted.

Two runs of danger tape must be installed on top of this layer, ensuring that the tape is installed directly above the cable. The tape must be polyethylene, nominally 230mm wide and imprinted with a triangle and electrical flash symbol, as well as the words "DANGER, GEVAAR, INGOZI", at no more than 1m intervals.

The final round of backfilling must be provided and the entire trench properly compacted as per 2.5.4 below.

Cable route markers must be provided at every cable turn and every 50m along a straight run.

7.2.2 Bedding, Grading And Backfilling

Both the bedding and backfilling material must be free of all plant materials, stones and clots larger than 15mm and any other foreign objects that could potentially damage the cable. Sea and/or river side is not acceptable due to their high thermal resistivity values.

In light of the material requirements above, as much as possible of the excavated material must however still be used. The excavated material must be sifted to ensure compliance. Only in the instance where there is not enough suitably graded backfilling material on-site, can suitable imported material be sourced. Payment for bedding and backfill material will only be done for sourced material, with the excavated material paid as part of the cable excavation's labour component.

7.2.3 Compaction

Note that backfilling must be done in sections of no more than 150mm at a time (after compaction). Compaction must be done to an AASHTO-density percentage of 98% and record must be kept and supplied to the Engineer for each layer of compaction done.

7.3 CABLE TRAY

Cables must be installed on heavy duty hot dipped galvanized cable tray, with a minimum of 76mm depth. The tray widths will be dependent upon the final routes and positions, as well as the amount of cables running along a certain section. The provisional sizes as per the BOQ must be used for the purpose of pricing, with all final sizes and routes to be confirmed with the Engineer before ordering of equipment. Any modifications during construction stage due to a lack of coordination upfront will be for the Contractor's account.

Regardless of the route and installation type mentioned below, all cable tray will be measured and paid for final installed distance. The rate must include for all radius bends and changing in the Y- or X-axis. All directional changes must be of the pre-fabricated type and no bending or cutting of the tray will be accepted on-site.

The metre rate must further include all required ancillary, securing and fastening as well as spacer material, equipment and labour components for a fully compliant installation. Note at certain sections where the cable tray must connect to the control panels from the centre column, additional floor supports will have to be provided and this must be included as part of the tender price.

7.4 LOCAL CONTROL STATIONS

Local control stations must be equipped with a Start push-button and a Red mushroom-head push lock, pull unlock pushbutton. The control station must be installed within arms-reach of the motor and the emergency stop must be wired fail safe.

The control station stand must be manufactured from HDG channel, with the pushbuttons mounted flush onto a stainless steel, IP65 hinged housing cover, with min. 50mm roof overhang. The channel stand must be provided with slots so as to fasten the cables and be no less than 550mm high.

All ancillary equipment such as nuts, bolts, hinges, etc. must be manufactured from stainless steel.

7.5 REDUNDANT EQUIPMENT

All redundant equipment, in line with the installation program, must carefully be removed and taken to the Municipal stores for safe-keeping. A signed delivery receipt must be obtained for the equipment dropped-off and forwarded to the Engineer for record-keeping purposes.

8. EARTHING AND SURGE PROTECTION

8.1 MAIN EARTH

Each LV installation must be provided with a main earth point in accordance with SANS 10142-1, 2. An installation can be a single MCC/distribution board with related electrical installation, or multiple MCCs/distribution boards with related electrical installations on the same site, from the same LV source or distributed sources from separate transformers.

8.1.1 **LV Supply From A Supply Authority**

In the case of a LV supply from a supply authority, the earth connection from the supply authority will serve as the main earth point extended from the point of connection to the consumer's earth bar, which for the purposes of this specification will usually be the earth bar of the related MCC. The earth conductor from the point of connection will be specified in the Project Specification. The Supply Authority may require additional earthing in terms of the specific earthing system and the Contractor must verify this requirement with the Supply Authority, unless specified in the Project Specification.

It will remain the responsibility of the contractor to ensure that the earthing at this point complies irrespective and additional earthing, by means of earth electrodes or an earth mat as described below, must be provided as required.

Downstream installations fed from this main LV supply, must be linked to this main earth, but supplementary earthing in situ may be required.

8.1.2 **LV Point Of Connection Without An Earth Connection**

This could be a LV supply point from a Supply Authority without an earth connection, or a LV supply point from a transformer or distribution point on the consumer's site downstream of a Supply Authority connection without an earth connection.

It is the responsibility of the Contractor to provide a system earth installation at this point, unless provided by another party and stated as such in the Project Specification. The design and installation must be done by an earthing specialist appointed by the Contractor. The specialist must do a soil resistivity test to determine the most cost effective system of earth rods and/or earth mat.

Normative provision is made for purposes of tender comprising an earth mat measuring 1,0m x 1,0m constructed from 70 mm^2 stranded copper conductor cad-welded in a 100mm x 100mm grid and installed at a depth of 1,0m below ground level in close proximity of the related MCC. The earth mat must be linked to the MCC earth bar with a 70 mm^2 stranded bare copper conductor. All required excavations, connections and coordination must be included as part of the earth mat price.

This configuration can be used for construction, but need be endorsed by the abovementioned earthing specialist in terms of the actual soil resistance and amended as required to meet an earth resistance of ≤2ohm.

The result of the soil resistivity test and proposed design must be submitted to the Engineer. Any cost adjustment between the tender provision and the final accepted design will be accommodated by means of a variation order.

In the case of a site with multiple MCCs fed from a distribution point, each supply cable must be provided with its own earth conductor (from the main earth point), which at the point of connection can be considered as equivalent to (a) above. Notwithstanding, the earth resistance must still be ≤2ohm and additional earthing must be provided as described above if the earth resistance does not comply.

After completion and commissioning of the earthing installation, the Contractor must submit the test results and certify that the earthing installation has been done in accordance with the abovementioned requirements.

8.2 GENERAL EARTHING

Where specified and indicated on the drawings and in the BOQ, dedicated Bare Copper Earth Conductors (BCEC) must be installed alongside and strapped to its associated electrical supply cable. The size of the BCEC is provisional along with the supply cable size. BCEC must be terminated with crimped lugs and solidly bolted at both ends.

All required electrical points and paths along the installation must be solidly bonded, with the return path solidly connected to the MCC's main earth.

If there is a spare core in the supply cable, this may be used as an earth conductor for the final connection of equipment such as motors. Supply cables to MCCs are excluded since the BCEC forms part of the earthing system grid.

Note that for mechanical strength reasons no BCEC may be smaller than $4mm^2$.

8.3 LIGHTNING PROTECTION SYSTEM

Lightning surge protection is for purposes of this specification considered a specialist building installation and excluded from the normal scope, unless stated to the contrary in the Project Specification.

In such a case the Contractor will be required to appoint a specialist subcontractor to do the complete design and installation, against a provisional sum allowed in the Schedule of Prices in accordance with the applicable SANS standards (latest edition), as listed below but not limited to :

- SANS 10313
- SANS (IEC) 61643.1
- SANS (IEC) 62305-Full Suite

STANDARD SPECIFICATION

SSE03 - INSTRUMENTATION AND CONTROL DEVICES

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1. **SCOPE**

This section covers the technical requirements of the instruments and control devices referenced in the Project Specification.

Some terminology relating to instrumentation is often used loosely and interchangeably if specific differentiation is not intended. For purposes of this specification the terminology below will have the following general meaning, within the context of the application:

a) **Instrument:** A comprehensive device which measures a variable physical parameter (level, flow, pressure, turbidity etc.) and converts the physical property into an electrical signal, which is amplified, conditioned and processed to a standard formatted output signal proportional to the measured value. The instrument can have additional features such as programmable control and alpha numerical parameter display.

b) **Analyser:** A specific type of instrument to measure chemical/composition properties such as pH, chlorine content, density etc.

c) **Transmitter (1):** Per definition an instrument that interacts directly with the measured process entity and has a voltage output signal output proportional to the measured entity.

d) **Transmitter (2):** Within context, the operator interface and signal processing unit of an instrument, as referenced in the literature and in P & IDs.

e) **Transducer:** Per definition an instrument that interacts directly with the measured process entity and has a current output signal proportional to the measured entity.

f) **Sensor (1):** The term sensor is interchangeable with either transmitter or transducer and is generally used if there is no need for differentiation.

g) **Sensor (2):** Within context it refers to the sensing device of an instrument with voltage, current or digital communication output signal used in conjunction with transmitter (2).

h) **Probe:** Within context it generally refers to the wet end of an immersion sensor, being a protective tube containing the sensing elements.

i) **Meter:** Generic term for the comprehensive instrument as a single unit, usually used in conjunction with flow measurement.

j) **Analyser:** A specific type of instrument to measure chemical/composition properties such as pH, chlorine content, density etc.

k) **Signal Processor Controller:** The part of the instrument that acts as interface between the sensor and operator/control system. (Some literature references this as the Transmitter in the context of (d) above. It is microprocessor based for signal processing and conversion to a digital code for communicating over an industrial communication system and has some or all of the following features/facilities to provide the functionality specified in the Project Specification:

- Analogue outputs.
- Communication network connectivity.
- Operator keyboard and/or navigation buttons.
- LCD display unit.
- Programmable relays to provide selected switch-points from the measured value.
- Configurable digital outputs.

l) **Control device:** A device that monitors a parameter, with a digital (on/off) output signal reflecting a specific point status of the parameter, usually configured as a type of switch with open/closed state, e.g. a float level switch.

1.1 GENERAL APPLICATION:

When considering an instrument or control device for an application, the tenderer must offer the best option in terms of economy, suitability for the application and performance in terms of reliability and integrity of the measured value signal.

1.1.1 Transmitter

The transmitter has a voltage output and is a three or four wire device. It is more susceptible to electrical noise (EMI/RFI) than a Transducer. It has a low power demand but is limited in length of the signal cable.

This is the non-preferred option, only to be used if it offers distinct advantages over the equivalent transducer.

1.1.2 Transducer

The transducer has a current output and is a two wire loop powered device. It is less susceptible to electrical noise than a transmitter (EMI/TFI) and suitable for use over extended distances for the output signal cable. The power requirement is more demanding as for the transmitter, specifically with regard to a battery supply.

This the preferred option, unless there are specific reasons to use an equivalent transmitter.

2. LEVEL

2.1 FLOAT LEVEL DETECTOR (SWITCH)

Float level switches are control devices of the buoyancy contact type for surface level detection of liquids, with switched on/off potential free output.

There are many types of float level switches for specific applications, such as free suspended with adjustable switch-point, fixed single switch point, bar centred sliding float with adjustable switch-point, etc. and they will be referenced with a type designation.

2.1.1 Type A: Suspended

2.1.1.1 Application

The application will normally be liquid level point detection in large holding structures such as reservoirs, tanks, sumps etc. mainly in the water and sewage purification and transportation (pumping) industry, for level control and alarm purposes. This includes liquid chemicals used within these industries.

Float level switches may not be used for direct switching of motors, but via an intermediate relay or directly connected to a PLC. The only exception is if it is an integral part of the controlled equipment such as a drainage pump. Float level switches which are used for low level alarm or protection function must be wired fail safe.

2.1.1.2 Principle of operation and construction.

This type comprises a position sensitive switching element encased in a float element (referred to as the float). The float must be a moulded from an inert substance such as polypropylene. The switch lead out cable must be of the nitrile rubber type moulded into the body that the process fluid cannot enter the switch housing.

The float element is suspended from its lead out cable and when it comes into contact with the process fluid, the buoyancy of the float element will cause the float element to change its orientation angle from vertical (hanging) to an angle determined by the level of the fluid. The float element is weighted that once the level has risen sufficiently the float element will rotate through a 180° degree arc until it is in the inverse upright (floating) position. The weight must be adjustable to vary the swing of the arc.

The switching element must have a positive switching action with differential, i.e. the float element float must move through a specified angle (default is 90° degrees), before switching and the same when recovering from the floating to the hanging position. Once switched it must maintain the switched position, until rotated again through the differential angle. The switch must be a change-over type with a three wire lead out cable. The cable must be selectable in standard lengths and ordered with the correct length for the application. No joints will be allowed in the cable.

The switching element must be robust in construction and the preferred type is a fixed reed switch activated by a moving magnetic slug or a micro switch mechanically operated by the tilting action. Mercury tube switches will not be acceptable. The applied switching voltage must be 24V DC and the contacts must be rated at 0,5A min.

2.1.1.3 Installation

The installation method will vary, depending on the type of holding structure, but will generally require a sturdy stainless steel bracket of not less than 4mm thickness secured to the structure by means of suitable brass or stainless steel anchor devices. Brass must not be used in sewage sumps. This point must be easily accessible and positioned that the float switches and cable will not be damaged by the removal of equipment such as submersible pumps in a sump.

The float switch cable must be secured to this bracket by means of a PVC type compression gland. The float switch must be identified at this point with a label as to its

function, e.g. *HIGH ALARM*. The label must be an engraved plastic tag attached to the cable with cable ties.

The lead out cable must be terminated in a watertight cable box (IP 68), of the Pratley or CCG manufacture. This box must be installed in an easily accessible position and serve as connection point of the cable extension to the controlling MCC, or intermediate cable junction box. The extension cable must be installed in hot dipped galvanized steel conduit to the exit point from the holding structure. It must be 1,5mm² multicore cable of the PVC SWA PVC type for underground installation, or unarmoured if installed on a rack in a controlled environment or inside a building. All cable terminations must be with a watertight gland to suit the cable type.

The conductors within the electrode connection box and cable junction box must be numbered as per the schematic drawings with corresponding numbers on the terminals.

General points:

- In new concrete holding structures and large above ground steel tanks, purpose made openings must be made in the structure with removable cover plates for securing the bracket.

- Existing concrete structures must be core drilled and steel structures must be cut. Prior approval for core drilling/cutting must be obtained from the Engineer to prevent compromising the structure. If these methods are not viable, the fixing point of the suspension bracket must be inside the structure within easily accessible reach from an access opening.

- The float switch must not be subjected to turbulence and the point of installation must be away from sources of turbulence such as the incoming water/sewage. If turbulence is unavoidable, the float switch must be installed in a still chamber of custom design and adequate size to provide for the float swing.

- In sewage sumps the position must be selected to avoid getting caught up in a position where flotsam may gather.

- The float switch cables must be tied to a hot dipped galvanized steel chain or weighted down nylon rope, the last tie in close proximity of its operating point, to prevent drifting and potential entangling with structures such as access ladders.

2.1.2 Type B: Fixed point

Not applicable to this project.

2.2 ELECTRODE LEVEL DETECTOR

Electrode level detectors are of the submerged contact type for surface level detection of liquids.

2.2.1 Application

The application will normally be liquid level point detection in smaller holding structures such as tanks, channels, sumps, enclosed vessels etc., mainly in the water and sewage

purification and transportation (pumping) industry for control and level alarm purposes. This includes liquid chemicals used within these industries.

Electrode level detectors are used where it is unpractical, undesirable or impossible to use float level switches such as small tanks and boreholes. Electrodes may not be used in liquids with solids content such as raw sewage.

Fixed electrodes should not be used where level switch-point adjustments are anticipated.

2.2.2 Principle of operation and construction

Electrode type level detectors comprise a set of electrodes installed in the related liquid, which must be electrically conductive. There are two or more electrodes of different lengths to provide level differential and/or multi-level switching points. In multi-level application the longest electrode is common (reference) with the level electrodes at the detection point level. A low voltage is applied to the electrodes and as soon as the liquid level reaches a level electrode, a conductive path is established between the level electrode and the common electrode. Continuity is sensed by a remote electronic level control relay, with changeover switches corresponding to the number of point electrodes.

The conductivity of different liquids varies and the level control relay must have a sensitivity adjustment facility as well as an adjustable switching time delay. Specific care must be taken with low conductivity liquids such as borehole water with low impurity or dissolved mineral content.

The electrodes can be of two types, depending on the application:

a) **Rigid rod** :

The electrodes must be 304 stainless steel rods, with thickness primarily determined by the length to maintain rigidity (nominally 6mm ø to 10mm ø), for installation in relative shallow vessels (up to 4m deep).

The electrode rods must be secured to a sturdy electrode holder, with watertight lid to provide for the connections from the electrodes to the lead out cable. The holder must be fitted with a screw thread to be fixed to a bracket, fixed to the holding structure (usually an open tank) or flange mounted on a closed vessel. The electrodes must be adequately spaced to prevent short circuiting and provided with non-conductive spacers to maintain separation.

Rods installed in media which can cause build-up and bridging (to be avoided), must be coated (insulated) with suitable covering, leaving only the tips exposed.

b) **Flexible conductor**:

When the depth of the vessel makes the use of rigid rods unpractical, such as deep wells and boreholes, flexible insulated conductors must be used within the fluid suspended from a suitable sturdy bracket and fitted probe end capsules.

2.2.3 Installation

The installation method will vary, depending on the type of holding structure, and electrode type. For a screwed electrode holder base, a sturdy stainless steel bracket of not less than 4mm thickness must be secured to the holding structure by means of suitable brass or stainless steel anchor devices. In the case of closed or pressure vessels the electrode base must be provided with a flange and mounded on the corresponding vessel flange.

The lead out cable from the electrode base to the controlling MCC, or intermediate cable junction box must be installed in hot dipped galvanized steel conduit to the exit point of the holding structure. It must be 1,5mm² multicore cable, of the PVC SWA PVC type for underground installation or unarmoured if installed on a rack in a controlled environment or inside a building. It must be terminated on the electrode base with a watertight gland to suit the cable type.

The conductors within the electrode connection box or intermediate cable junction box must be numbered as per the schematic drawings with corresponding numbers on the terminals.

2.2.4 Technical Requirements:

Level control relay:

a) Power supply: 230VAC (+10%, -15%).

b) Output: one single pole double throw (change-over) potential free contact per level electrode.

2.3 ULTRASONIC LEVEL DETECTOR

Ultrasonic level detectors are of the non-contact type for continuous surface level detection of liquids, with analogue and digital code communication signal output.

2.3.1 Application

2.3.1.1 Level and volume

The application is for continuous surface level measurement for monitoring level and volume in large liquid holding structures such as reservoirs, tanks, sumps etc. mainly within the water and sewage purification and transportation (pumping) industry for control and level alarm purposes. This includes liquid chemicals used within these industries as well as chemical bulk storage hoppers filled with dry chemicals in powder/granular form. Reference will mainly be made to liquid surfaces, but is also applicable to bulk dry mass level. The effective range is nominally 1-30m.

Care should be taken with application in pressurised vessels due to the effect of density on the propagation speed. Radar level detectors are more suitable.

2.3.1.2 **Flow**

This application is for continuous surface level measurement for monitoring flow rate and totalised flow in open channels, flumes and weirs for flow recording and control purposes.

2.3.2 **Principle of Operation and Configuration**

2.3.2.1 **Level function**

An ultrasonic level detector makes use of the speed of sound in air in the ultrasonic frequency band (approximately 20kHz to 200kHz), based on the time of flight principle.

An ultrasonic pulse transmitter/receiver detection head is installed above the liquid surface level emitting a high frequency pulse burst, which is reflected back from the liquid surface to the detection head. The half time taken from transmission of the pulse burst to when the reflected echo is received is proportional to the distance from the sensor to the surface of the liquid. The signal processing must make corrections to the flight time to compensate for air temperature variance.

The transmission is directed in a cone shape with approximately 6° angle at the apex. The cone is not a sharp cut-off and there can be secondary echoes from nearby structures and disturbances in the liquid and the instrument must be designed to mask these unwanted signals and use only the high amplitude return signal for processing.

Some surfaces may have surface layers of foam, clumps of clogging substances or debris floating on the surface (as typically encountered in sewage sumps), subsurface rising bubbles or agitation turbulence, which may tend to absorb or scatter the signal, leading to false or no return signal at all. The instrument must have tuning facilities, such as (but not limited to) frequency or amplitude, selecting specific operating conditions, to counteract these conditions and deliver an accurate level reading. The instrument must have interchangeable detection heads, varying in shape (narrow/wide cone) to suit the specific application and maximum operating distance (bottom to soffit) and ensure limited and effective cone spread at maximum operating distance.

The instrument must be able to detect a loss of echo with a corresponding digital alarm contact (NO and NC), as well as provision in the setup to select the output signal to go to either minimum (empty) or maximum (full) value.

The level measurement must be selectable as distance up from the bottom of the holding structure or from the sensor down to the surface (taking cognisance of the dead band).

2.3.2.2 **Flow function**

The principles as described above will also be applicable for flow measurement relating water level to flow in standard profiled flow structures. The level must be linearized to calculate flow from level. The controller must have three selectable linearization algorithms to generate an output proportional to flow rate:

a) Pre-programmed flow curves.

b) Flow formula with freely selectable parameters.

c) Freely editable flow chart (table) with up to thirty two points.

The flow rate must be integrated to provide a total flow count (totalizer) for accumulated flow (not resettable) and daily flow count (resettable).

Both flow rate and totalized flow must be displayed in selectable engineering units (l/s, m^3/h) and (l, Ml and m^3) respectively.

2.3.3 **Configuration**

This specification provides for the following instrument configurations with type designation as shown. If the applicable type is not specified in the Project specification, the default option will be type B.

2.3.3.1 **Type A: Compact**

The compact type comprises the detection head, controller and display in an integrated compact configuration. The housing must have a threaded base, or fitted with fixing lugs for bracket mounting or flange adaptor for direct flange mounting. The setup of the software is done in situ via the navigation buttons and menu driven multiline LCD display in plain text (English).

The system interface is via 4-20mA output and fieldbus digital signal communication.

This type is to be used for external mounting to open structures (bracket mounted) or enclosed vessels (flange mounted) where in situ display and software setup is required. It may not be used within enclosed holding structures like tanks, reservoirs or sewage sumps.

Protection degree must be IP 68 and the electrical supply can either be two wire loop powered 4-20 mA or four wire AC/DC supply.

2.3.3.2 **Type B: Discrete**

The instrument comprises a discrete detection head with threaded base for bracket mounting and cable connection to a remote mounted signal processor controller, either within in a field housing or DIN rail mounted within the related MCC. The controller must be provided with navigation buttons and menu driven multiline LCD display in plain text (English) with level display and programmable level relays for control purposes, as per the Project Specification.

The detection head protection degree must be IP 68 and IP 66 for the field housing.

<u>Differential level:</u>

The controller will normally be a single channel device for single level detection. If two levels must be monitored, to calculate a differential level, a single two channel controller with provision for two detection heads must be provided.

2.3.4 Installation

2.3.4.1 Level function

The installation method will vary, depending on the type of holding structure and instrument. Flange mounted instruments must be bolted to the corresponding vessel flange. Sensors with threaded fixture or fixing lugs must be fixed as appropriate to a sturdy stainless steel bracket of not less than 4mm thickness, secured to the structure by means of suitable brass or stainless steel anchor devices.

- Sensors may not be installed within concrete or steel liquid holding structures such as tanks, sumps and reservoirs. Purpose made openings must be provided during construction in the structure soffit covered with a removable and lockable stainless steel access lid, properly sealed when closed to prevent ingress of water or escape of process fluid or sewage gas.

- Existing concrete structures must be core drilled as required and steel structures must be cut. Prior approval for core drilling/cutting must be obtained from the Engineer to prevent compromising the structure. If these methods are not viable, the fixing point of the suspension bracket must be inside the structure within easily accessible reach from an access opening.

- The sensor must not be installed close to other structures or a point of turbulence which can cause echo interference, including float level switches in close proximity.

- Sewage sumps often have dimensional constraints and specific care must be taken with regard to:

  - Float switches and weighting chains that is a clogging point for fatty material and foam.

  - The inflow of sewage causes foam and there usually is a drift pattern with foam and floating debris accumulating in a dead corner. The detection head must not be installed above such a position.

- For enclosed structures with limited head space there must be sufficient space between the bottom face of the detection head and the maximum level to be measured to accommodate the dead band (typically 400-600mm).

- In the case of an open structure, the bracket must preferably be fixed to a structure spanning the structure such as a walkway. If not possible the bracket must be extended from the structure side wall, close enough to be easily accessible but not too close to cause echo interference. If necessary, the bracket must be attached to a swing arm that extends sufficiently away from the side but can be swivelled close for maintenance access.

- The sensing head must be perpendicular to the surface for liquid level detection. In the case of solids, the head must be at a slight angle to the perpendicular.

The lead out cable from the instrument must be terminated in a watertight cable box (IP 67), of the Pratley or CCG manufacture. This box must be installed in an easily accessible position and serve as connection point of the cable extension to the

controlling MCC, or intermediate cable junction box or remote signal processor controller. The extension cable must be instrumentation and/or communication cable as required for the specific installation, installed in hot dipped galvanized steel conduit to the exit point from the holding structure. If the extension is done underground, it must be installed within a suitable sleeve and installed on a cable rack in a controlled environment or inside a building. All outdoor cable terminations must be done with a watertight gland to suit the cable type.

The conductors within the connection box and cable junction box must be numbered as per the schematic drawings with corresponding numbers on the terminals.

2.3.4.2 **Flow function**

The general considerations and requirements for *Level function* above also apply for flow measurement.

The sensor must be of the threaded type fixed to a sturdy U-channel section spanning the channel/flume/weir (structure) with the detector over the centre of the structure. The U-channel must be supported on vertical legs both sides and upstream of the measuring structure. The mounting height of the sensing head must be sufficient that the maximum water level will not enter the dead-band.

If the structure width is too wide for maintenance access to the detector, one leg must be a vertical bar which will allow the cross bar channel section to be swivelled to the side for access.

2.3.5 **Technical Requirements**

The following requirements relate to both compact and discrete types unless otherwise indicated.

a) Power supply:

- Compact instrument: Two wire loop-powered 4-20 mA from an external power source (to be included in the price).
- Discrete instrument (controller): 230 V AC (+10%, -15%) or 24V DC.

b) Measuring range: as per project specification for the application.

c) Output:

- 4-20mA**.**
- Fieldbus digital communication.
- Programmable relays (discrete controller): up to 4 no, as per Project Specification.

d) Controller operator interface:

- Menu driven multiline LCD display:

- Level selectable in (m) or (%).
- Holding volume calculated from standard holding structure configurations.
- Level reference selectable from bottom upwards or top reference downwards.
- Programmable relays switch levels.
- Flow rate.
- Flow count (Total flow and daily flow)

- Navigation keys.
- LED display:
  - Power on.
  - Alarm.
  - Fault.
  - Programmable relays *ON/OFF* status (Controller discrete).
  - Loss of Echo.

2.4 HYDROSTATIC LEVEL DETECTOR

Refer to the section for Pressure sensing instruments.

2.5 RADAR LEVEL DETECTOR

Radar level detectors are of the non-contact type (unguided) for continuous surface level detection of liquids and solids, with analogue and digital code communication signal output.

2.5.1 Application

2.5.1.1 Level and volume

The application is for continuous surface level measurement for monitoring level and volume in large liquid and solids holding structures such as reservoirs, tanks, sumps etc. mainly within the water and sewage purification and transportation (pumping) industry for control and level alarm purposes. This includes liquid chemicals used within these industries as well as chemical bulk storage structures filled with dry chemicals in powder/granular form. Reference will mainly be made to liquid surfaces, but is also applicable to bulk dry mass level. The effective range covered is nominally 1-40m.

Radar level detection is suitable for level measurement of high die-electric process fluids such as water and most chemical solutions. It is not suitable for low die-electric materials and less suitable for solids such as lime, or very turbulent surfaces. Where

turbulence is unavoidable, still wells need be used. They are suitable for use over a wide range of temperatures, pressures and within a gaseous or vapour environment.

Radar level sensors cost more than ultrasonic level sensors, but are very accurate and suitable for difficult applications, including dusty atmospheres and mainly used where ultrasonic level sensors are not viable. Protective measures must be taken against condensation, contamination and deposit build up.

2.5.2 Principle of Operation and Configuration

2.5.2.1 Level function

A radar level detector makes use of the propagation and reflection of electromagnetic radiation and reflection in the very high microwave (GHz) frequency band.

A high frequency transmitter/receiver antenna is installed above the measured surface level emitting a high frequency signal, which is reflected back from the surface to the antenna.

Two measurement principles are applied; pulse radar transmission and frequency modulated continuous wave (FMCW) transmission, referenced by type.

a) Type A

The pulse radar technique is based on the time of flight principle, making use of the known speed of propagation.

The signal is emitted as pulse bursts toward the measured level. The half time taken from transmission of the pulse burst to when the reflected signal is received is proportional to the distance from the antenna to the measured surface.

This type is commonly used for general application, liquids and solids level measuring range 0-30m and transmission frequency typically 6/25GHz

b) Type B

The FMCW continuously varies the frequency of the transmitted signal. The frequency of the reflected signal is slightly less than the transmitted signal and the difference in frequency between the transmitted and received signal is proportional to the distance from the antenna to the measured surface.

This type is mainly used for long distance measuring, mostly for solids with low dielectric level in a very dusty environment measuring range 1-60m with transmission frequency up to 80GHz.

The performance of the radar sensor for a given application is affected by frequency. Lower frequencies have a wider beam width and high frequencies a narrower more focused beam and the antenna size is inversely proportional to beam width. Lower frequencies is less affected by vapours and absorbent surfaces such as foam and antenna contamination than high frequencies, but more susceptible to disturbance from nearby structures. High frequency narrow beams are less susceptible to disturbance from nearby structures and can be optimally placed in this regard.

Radar sensors are little affected by variance in pressure and temperature but compensatory measures must be provided notwithstanding.

Antennas have various shapes to suit specific applications. This includes cones of different length, parabolic and rod type, manufactured from different materials such as stainless steel 316L, Tantalum or other suitable material. The electronics body must be cast aluminium and powder coated. The Antenna system exposed to the process in enclosed tanks subject to condensation, or used within a dusty atmosphere such as bulk silos, must be sealed from the process and enclosed with PTFE or similar material. Condensation, contamination or product build up must not affect the performance of the antenna and software algorithms must be used to filter out resultant interference or attenuation of the signal.

The transmission is directed in a cone shape with approximately 4° angle at the apex for a narrow beam antenna. The cone is not a sharp cut-off and there can be secondary reflections from nearby structures the instrument must have software signal processing algorithms to mask these unwanted signals.

The antenna transmission frequency, cone type and material must be selected to best suit the specific application and maximum operating distance (bottom to soffit) as per Project Specification and ensure limited and effective cone spread at maximum operating distance.

The instrument must be able to detect a loss of reflection with a corresponding digital alarm contact (NO and NC), as well as provision in the setup to select the output signal to go to either minimum (empty) or maximum (full) value.

The level measurement must be selectable as distance up from the bottom of the holding structure or from the sensor down to the surface (taking cognisance of the dead band).

2.5.3 **Configuration**

This specification provides for the following instrument configurations with type designation as shown. If the applicable type is not specified in the Project specification, the default option will be type B.

2.5.3.1 **Type A: Compact**

The compact type comprises the antenna and signal processor in an integrated compact configuration. The housing must have a threaded base, or be flanged for direct flange mounting. The setup of the software is done in situ via the navigation buttons and menu driven multiline LCD display in plain text (English).

The system interface is via 4-20mA output and fieldbus digital signal communication.

This type is to be used where in situ display and software setup is required. It may not be used within enclosed holding structures like reservoirs or sewage sumps or silos.

Protection degree must be IP 68 and the electrical supply can either be two wire loop powered 4-20 mA or four wire AC/DC supply.

2.5.3.2 **Type B: Discrete**

The sensor comprises a discrete antenna and related electronics housing with threaded or flanged base, cable connected to a remote mounted signal processor controller either within in a field housing or DIN rail mounted within the related MCC. The signal processor controller must be provided with navigation buttons and menu driven multiline LCD display in plain text (English) with level display and programmable level relays for control purposes, as per the Project Specification.

The sensor protection degree must be IP 68 and the field housing IP 66.

Signal processor controller:

The signal processor controller must have the following features:

a) Menu driven Multiline backlit LCD display.

b) Navigation buttons.

c) Setup and diagnostic software.

d) Stray reflection and unwanted signal filter.

e) Analogue output: 4-20mA proportional to level, configurable in meters or percentage.

f) Fieldbus system communication.

g) Programmable output relays.

2.5.4 **Installation**

The installation method will vary, depending on the type of holding structure and instrument. Flange mounted instruments must be bolted to the corresponding vessel flange. Sensors with threaded fixture or fixing lugs must be fixed as appropriate to a sturdy stainless steel bracket of not less than 4mm thickness, secured to the structure by means of suitable brass or stainless steel anchor devices.

Sensors may not be installed within concrete or steel holding structures such as tanks, sumps and reservoirs. Purpose made openings must be provided during construction in the structure soffit covered with a removable and lockable access lid, properly sealed when closed to prevent ingress of water or escape of process fluid or sewage gas. Prior approval for core drilling/cutting must be obtained from the Engineer to prevent compromising the structure. If these methods are not viable, the fixing point of the suspension bracket must be inside the structure within easily accessible reach from an access opening.

In enclosed structures with limited head space there must be sufficient space between the bottom face of the detection head and the maximum level to be measured to accommodate the dead band, specific to the sensor.

In the case of an open structure, the bracket must preferably be fixed to a structure spanning the structure such as a walkway. If not possible the bracket must be extended

from the structure side wall, close enough to be easily accessible but not too close to cause reflectance interference. If necessary, to meet this criteria the bracket must be attached to a swing arm that extends sufficiently away from the side but can be swivelled close for maintenance access.

- The antenna must be installed perpendicular to the measured surface.
- The antenna must protrude slightly from a guide tube or structural opening.
- The antenna head must not be installed close to other structures or a point of turbulence which can cause reflectance interference, including float level switches in close proximity.
- Sewage sumps often have dimensional constraints and specific care must be taken with regard to:
    - Float switches and weighting chains that is a clogging point for fatty material and foam.
    - The inflow of sewage causes foam and there usually is a drift pattern with foam and floating debris accumulating in a dead corner. The detection head must not be installed above such a position.
- Choose an antenna with largest possible diameter to concentrate (small beam angle) the beam for maximum strength and reflectance from surfaces with poor reflectance.

The lead out cable from the instrument must be terminated in a watertight cable box (IP 68), of the Pratley or CCG manufacture. This box must be installed in an easily accessible position and serve as connection point of the cable extension to the controlling MCC, or intermediate cable junction box or remote signal processor controller. The extension cable must be instrumentation and/or communication cable as required for the specific installation, installed in hot dipped galvanized steel conduit to the exit point from the holding structure. If the extension is done underground, it must be installed within a suitable sleeve and installed on a cable rack in a controlled environment or inside a building. All outdoor cable terminations must be done with a watertight gland to suit the cable type.

The conductors within the connection box and cable junction box must be numbered as per the schematic drawings with corresponding numbers on the terminals.

2.5.5 Technical Requirements

The following requirements relate to both compact and discrete types unless otherwise indicated.

a) Power supply:

- Compact instrument: Two wire loop-powered 4-20 mA from an external power source (to be included in the price).
- Discrete instrument (controller): 230 V AC (+10%, -15%) or 24V DC.

b) Measuring range: as per project specification for the application.

c) Operational frequency: process and distance dependable:

- Typically 6/26GHz, water and solids level measurement general application.
- Up to 80MHz, typically solids, long distance and harsh conditions.

d) Temperature:

- Ambient : -10 °C to 80°C.
- Process : 1°C to 60°C.

e) Pressure : 0 to 3bar.

f) Accuracy:

- Deviation ±3mm: general application.
- Deviation <3mm: as per Project Specification.

g) Output:

- 4-20mA/HART : x 2
  - Proportional to level**.**
  - Proportional to volume.
- Fieldbus digital communication.
- Programmable relays (discrete controller): up to 4no, as per Project Specification.
  - Contacts: SPDT 0,5A at 24V DC.

h) Controller operator interface:

- Menu driven multiline LCD display:
  - Level in (m) or (%).
  - Holding volume calculated from standard holding structure configurations.
  - Level reference selectable from bottom upwards or top reference downwards.
  - Programmable relays switch levels.
  - Fault diagnostics.
  - Instrument configuration.

- Navigation keys.
- LED display:
  - Power on.
  - Alarm.
  - Fault.
  - Programmable relays *ON/OFF* status (Controller discrete).
  - Loss of reflection.

3. FLOW

3.1 FLOW DETECTOR (SWITCH): PADDLE TYPE

3.1.1 Application

Paddle type flow detectors are control devices used to detect flow or no flow in a pipeline, used for protection of pumps against running dry, and in air lines for blower no flow protection, as mainly used in the water and sewage purification and transportation (pumping) industries.

Paddle type flow switches may only be used in clean water applications.

Air flow switches will normally be of the paddle type.

3.1.2 Principle of Operation and Construction

Water flow

This type is an electromechanical intrusive device comprising a paddle inserted in the water flow path linked to a micro switch or reed switch.

The composite unit comprises a threaded body from brass or stainless steel screwed into a corresponding threaded socket welded into the pipe. The body contains a switch coupled to a pivoted paddle protruding into the flow path. The coupling can be mechanical such as a metal bellows operating a micro switch, or magnetic whereby the paddle arm moves a magnet relative to a reed switch. The magnet can be an integral part of the paddle arm on the wet side or move a magnet within the switch compartment (dry side) via mechanical action. The switch compartment must be sealed that no water can enter from the wet side, which is under pressure.

The switch housing must be rated IP 66 and have a threaded entry for a cable gland cable termination.

The paddle must be from brass or stainless steel and screw fixed to the paddle arm available in different lengths and selected to provide the minimum flow restriction for effective operation. The paddle arm must be spring-loaded with a tension adjustment screw inside the housing to adjust the sensitivity.

The switch must be of the changeover type with snap action and differential switching O-C-O, configured to close under flow. The switching voltage must be 24V DC.

Flow switches used for small pipe diameters must be of the inline type with screwed pipe connection ends.

Air Flow:

Paddle type flow switches for flow detection in air (blower) lines are similar in operation and construction as described above for water flow application, but must be adapted as required to suit air flow characteristics.

Air flow switches installed indoors can be rated at IP 54.

3.1.3 Installation

Flow switches for water application will mostly be installed in indoors in pumps suction or delivery pipework. Sockets to suit the flow switches must be fitted prior to coating of the pipes. Sockets may not be installed on site in situ. Should a socket be required, the pipe section must be removed for drilling and welding in a workshop and the complete pipe section must re-coated, including hot dipped galvanized pipework.

Flow switches must be installed in the vertical position and on horizontal pipe sections only and may not be installed in close proximity (less than five pipe diameters) from sources of turbulence such as bends, T-pieces reducers etc.

Control cables must be 1,5mm² x 3 core PVC PVC for indoor installation and PVC SWA PVC for underground installation. The control signal cables must be terminated directly on the switch housing. Compression glands must be used for PVC PVC cables and double seal glands for armoured cable. The cable from the switch must be supported on a cable rack from the switch to the related cable wireway to ensure there is no tension on the termination.

3.1.4 Technical requirements

- Body : Brass or stainless steel.
- Paddle : Brass or stainless steel.
- Output : SPDT contact, rated 0,5A at 24V DC.
- Protection : IP 66.

3.2 FLOW MONITOR: CALORIMETRIC (THERMAL) TYPE

The scope covers calorimetric flow meters (flow rate, totalised flow and temperature), and flow switches, generically referred to as flow monitors.

3.2.1 Application

This type of flow monitor is an instrument used to monitor flow in a pipeline, and can be applied as comprehensive flow meter, or in its most basic configuration as flow switch for low/no flow protection of pumps against running dry.

It is of the minimal intrusive type whereby the sensor tip protrudes minimally into the flow path and can be used in clean water applications, as well as water containing impurities including sewage and slurries.

3.2.2 Principle Of Operation And Construction

The instrument is of the flow monitor type which operates on a calorimetric (thermal) principle. It comprises a threaded stainless steel body fitted into a socket on the pipeline. The body can either be threaded and screwed into the socket, or unthreaded flanged secured to an externally threaded socket with a union nut and O-ring seal.

The wet side of the body is a cylindrical probe protruding into the liquid flow path. Two temperature sensors and a heating element are integrated in the probe tip. One sensor is continuously heated and the other sensor is at the water temperature (reference), thus causing a temperature differential. The flow past the heated element cools the temperature element, decreasing the differential. The rate of cooling corresponds with the flow rate. I.e. the higher the flow, the smaller the differential is. This varying differential is processed by the detector electronics into a flow rate. An alternative approach used is to keep the temperature differential constant by varying the power to the heating element as flow varies. The applied power thus corresponds with the flow rate.

For sewage application the tip may not protrude more than 6mm into the flow stream.

The comprehensive instrument must have the following (not limited to) main features (*):

a) A digital display for flow rate and other parameters, selected via navigation keys.

b) An analogue output signal proportional to flow rate.

c) An output relay programmable with low and high limits which can be configured as the effective no flow signal for purposes of the application.

d) Frequency output for an external totalizer.

e) Status LEDs must be provided to indicate flow, error or out of range operation.

f) Higher order instruments used for flow monitoring must also be fitted with digital signal communication facilities, to interface with a laptop PC for setting and checking parameters and reading of measured values with software provided as part of the instrument package.

   The cable connection must be by means of a M12 cable connector and a M12/USB interface cable must be used for communication with the laptop.

(*) The project specification will state the minimum required features. If not stated, for purposes of tendering the default option will be the instrument meeting the minimum functional requirements only. I.e. if the functional application is flow/no flow detection only, the digital display, and frequency outputs need not be provided.

3.2.3 Installation

The instrument must be installed in the horizontal plane to ensure it is always immersed.

The control cable must be a four or five core instrumentation cable combined for the supply and output signals in accordance with the specific manufacturer's requirements. The cable must be connected to the instrument with a M12 connector or other as per the manufacturer's requirements. The cable from the instrument must be supported on a cable rack from the instrument to the related cable wireway to ensure there is no tension on the termination.

3.2.4 Technical requirements

a) Supply voltage : 24V DC.

b) Flow speed range : 0-2,0m/s.

c) Outputs :

- Analogue : 4-20mA (adjustable span).
- Digital output : programmable relay with hysteresis (1*).
- Frequency : to interface external totalizer (2*).
- Digital signal : laptop communication (2*).

d) Digital display : flow rate and other parameters as per Project Specification (2*).

e) LED status display :

- Power on.
- Flow.
- Out of range.
- Error.

f) Repeatability deviattion: <2%

g) Ambient temperature : -10°C to 60°C.

h) Material : Stainless steel

i) Protection : IP 65.

Note:

(1*) Not required if analogue output is used with a controlling PLC.

(2*) Optional as per Project Specification.

3.3 FLOW METER: ELECTROMAGNETIC TYPE

3.3.1 Application

Electromagnetic flow meters are instruments to measure flow rate and totalised flow in a pipe line for electrically conductive process fluids only. The conductivity of the process fluid must be more than six micro siemens per centimetre.

The application for purposes of this specification will be mainly as required in the water and waste water purification and transportation (pumping) industries, including associated liquid chemicals, at nominal ambient temperatures.

3.3.2 Principle Of Operation And Construction

The instrument must be of the inline flanged type. It operates on the electromagnetic induction principle, whereby two coils placed on opposite sides of a pipeline generates a magnetic field perpendicular to the process fluid flow path. The fluid is electrically conductive and a voltage proportional to flow rate is induced in two electrodes placed on both sides of the pipeline, perpendicular to the magnetic field. The electronics of the flow meter amplifies and converts this signal in an analogue signal proportional to flow rate and calculates totalized flow over a period of time.

The magnetic field covers the entire cross section of the meter. The magnetic field can also be generated with an insertion type probe whereby the magnetic field radiates outward from the probe position. This technology is not preferred for the intended application and may not be offered for tender unless specifically requested in the Project Specification. The magnetic field coils must use periodically pulsed DC to excite the field coils with a low frequency square wave to eliminate electrical noise associated with line frequency excitation systems.

The electrodes must be manufactured from 316L stainless steel for clean water application and nickel alloy 276 for higher corrosion resistance for acideous and abrasive pumping medium.

The internal lining of the metering tube must be suitable for the pumped media. If not specified in the Project Specification, selection must be done based on the following criteria:

a) Polyurethane: Reduced chemical resistance, excellent abrasion resistance Suitable for water and slurries with small to medium particles, fluid temperature -18°C to 60°C; typically clean water.

b) Neoprene: very good abrasion resistance, suitable for water and slurries with small to medium particles; better chemical resistance than polyurethane; typically applied for water with chemicals and seawater, fluid temperature -18°C to 60°C; the preferred lining for high pressure application.

c) PTFE: Highly chemically resistant and high temperature application.

Liners must be protected against separation from the metering tube under vacuum operation, collapsing and being sucked into the measuring tube. Process conditions that could even cause temporary vacuum conditions must be avoided. If such condition is

unavoidable the material must be carefully selected in conjunction with the manufacturer.

The signal processor operator interface can either be field mounted on the meter body, or remote mounted. Remote mounted interfaces must be installed within a polycarbonate box with hinged clear lid, or as specified in the Project specification. The interface must have a backlit LCD multiline display and navigation buttons for instrument setup and parameter access.

The coil and electrode sensing cable between the meter body and remote signal processer must preferably to be combined in one cable, but provided in accordance with the manufacturer's recommendation as well as the maximum allowable cable length.

Features:

The instrument must have the following salient features (but not limited to):

- Reverse flow measurement over the full flow range.
- Empty pipe detection.
- Zero flow detection.
- Programmable high and low alarms.
- Analogue output.
- Pulse output for totalizing volume flow in selectable engineering units. The pulse frequency and pulse width must be adjustable.
- Fieldbus communication connectivity.
- Fault self-diagnostic function.

3.3.3 Installation

The meter must be installed that it is not affected by disturbances and the pumping medium may not contain bubbles. It must be installed at least five pipe diameters downstream and three pipe diameters upstream of any sources of disturbance, such as bends, reducers, valves etc. This is a nominal (minimum) requirement and the manufacturer's installation instructions need be verified and followed if more strict. The meter inner diameter will normally be the same as the adjacent pipework. Should it be less, the reducers must be installed the required number of pipe diameters upstream and downstream and the pipework between the reducers and the meter must be of the same diameter as the meter.

The metering tube must always be fully filled and installed in the bottom leg of a U-shaped pipe configuration if there is any chance of partial filling. Vertical installation (upward flow direction) is preferred, especially with slurries and sewage or fluids containing solids prone to settling with no flow.

The meter sensing elements are sensitive to electrical noise and grounding rings with external tabs for grounding conductors must be installed both sides of the meter that the meter face on either side is separated from the pipe flanges. The grounding rings must be manufactured from 316L stainless steel or nickel alloy 276 depending on the pumping medium. Earthing straps will not be acceptable in lieu of grounding rings.

The control cable must be a four or five core instrumentation cable combined for the supply and output signals in accordance with the specific manufacturer's requirements. The cable must be connected to the instrument with a compression gland or other industry standard connection as per the manufacturer's requirements. The cable from the instrument must be supported on a cable rack from the instrument to the related cable wireway to ensure there is no tension on the termination.

3.3.4 **Technical requirements**

a) Power supply:

- 24 DC to a meter with field installed signal processor and interface.
- 230V AC or 24V DC to a remote installed signal processor
- Quick act fuses must be provided for the supply (in addition to a supply circuit breaker in the related MCC).

b) Degree of protection: IP 68 for the meter with remote mounted signal processor interface.

c) Electrode material:

- 316 L stainless steel for clean water and non-acideous chemical content.
- Nickel alloy 276 for sewage and slurries or oxidizing fluids.

d) Liner material :

- Clean water : Polyurethane, neoprene.
- Waste water and slurries : Neoprene.
- Other : Refer to manufacturer.

Liner material offered for potable water must be certified for drinking water.

e) Flow rate range: As per project Specification.

f) Meter diameter: To suit adjoining pipe work as per Project Specification.

g) Flanges: To SANS 1123 table as per Project Specification.

h) Flow speed range: 0,01 to 10m/s both forward and reverse flow; fully adjustable.

- Low flow cut-off adjustable 0,01-0,003m/s (zero flow display).

i) Accuracy (maximum error): :

- Flow rate : ± 0,5% of flow rate from 0,3-10m/s.
- Pulse : ±0,4% (max) of reading at 0,8m/s; 0,2% (max) of reading 2-10m/s).

j) Repeatability : ± 0,1% of reading max deviation.

k) Outputs:

- Analogue: 4-20mA proportional to flow rate; selectable full scale value.
- Frequency: 2-10kHz full scale.
  - Pulse on/off ratio 1:1, adjustable pulse width.
  - Pulse amplitude and polarity adjustable.
- Modbus, RS 485 connection.
- Discrete (switched):
  - Analogue output fail.
  - Empty pipe.
  - Zero flow.
  - Reverse flow.
  - Instrument error.
  - Flow limits (3 x programmable).
  - Totalizer limits (3 x programmable).

l) Discrete inputs: Totalizer zero (individual).

m) Diagnostics :

- Comprehensive self-test.
- Analogue output.
- Pulse output
- Coil circuit.

n) Ambient: -20°C to 60°C.

3.4 FLOWMETER: ULTRASONIC TYPE: OPEN CHANNEL

Refer to ultrasonic level sensor, flow application.

3.5 **FLOW METER: ULTRASONIC TYPE: TIME OF FLIGHT**

Not part of this specification.

3.6 **FLOW METER: ULTRASONIC TYPE: DOPPLER EFFECT**

Not part of this specification.

3.7 **FLOWMETER: AXIAL TURBINE TYPE**

Not part of this specification.

3.8 **FLOWMETER: VARIABLE AREA TYPE: ROTAMETER**

Not part of this specification.

4. PRESSURE

4.1 PRESSURE SWITCH

4.1.1 Application

Pressure switches are electro mechanical control devices used to detect a high or low pressure in a fluid within a pipe or enclosed vessel mainly for protection of pumps and other pressure sensitive devices by means of electrically switched contacts opening/closing at a pre-set pressure. Solid state pressure switches are not covered in this section.

The application for purposes of this specification will be mainly as required in the water and waste water purification and transportation (pumping) industries, including associated liquid chemicals, at nominal ambient temperatures.

4.1.2 Operating Principle And Construction.

Pressure switches comprise a threaded enclosure manufactured from stainless steel screwed into a socket in the pipework or container. It has two chambers, one open to the process side and the other sealed from the process side containing the switching element. The fluid pressure on the process side displaces or deforms a coupling/sensing device proportional to the pressure and this motion is transferred to the switch. The coupler must be spring-loaded to provide switch point adjustment.

The seal between the two chambers must ensure no cross leakage between the chambers. It can also act as coupler such as a metal bellows or diaphragm. For pressures higher >3bar, a piston type actuator must be used. The device must be configured that the switching contacts open/close on rise or drop of the pressure, in accordance with the application.

If the instrument is used in a viscous medium or fluid containing impurities or solids such as sewage, the pressure sensing aperture can become blocked. In such cases a flush diaphragm seal must be fitted to separate the medium from the sensing device. The pressure from the medium acts on the diaphragm in turn acting on a fill fluid between the diaphragm and sensing device. This diaphragm must preferably be an integral part of the pressure switch body or fitted as an adaptor to the pressure switch.

The switch must be of the snap action micro switch changeover type with switching differential (hysteresis), non-adjustable for general application.

The switch point must be adjustable on a calibration scale.

Pressure switch with adjustable hysteresis

For this pressure switch variant the switch point and hysteresis reset is separately adjustable for precise hysteresis control, such as a high switch point with low reset (changeover).

Differential pressure switch

This is a pressure switch that has two pressure inputs on either side of a diaphragm normally from upstream and downstream of a process element. The motion actuator linked to the micro switch moves in the direction of the greater pressure and transfers the motion to the output micro switch which is configured to change state when the pressure differential exceeds a pre-set value.

4.1.3 Installation

The switch must be threaded and screwed into a socket, or fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and switch body. Sockets to suit the switches must be fitted prior to coating of the pipes. Sockets may not be installed on site in situ. Should a socket be required, the pipe section must be removed for drilling and welding in a workshop and the complete pipe section must re-coated, including hot dipped galvanized pipework

The switch must be installed vertically on pipework in an easily accessible and visible position. All process connections must be fitted with an isolation valve.

Control cables must be 1,5mm² x 3 core PVC PVC for indoor installation and PVC SWA PVC for underground installation. The control signal cables must be terminated directly on the switch housing with an industry standard termination as per the manufacturer's provision. The termination may not compromise the instrument IP rating. If the lead out cable is moulded to the body, a disconnection point within a IP 67 cable junction box must be provided in close proximity of the switch that the cable is not twisted or damaged when removing screw-in switches and also allow removal of the switch only. The cable from the switch must be supported on a cable rack from the switch to the related cable wireway to ensure there is no tension on the termination.

4.1.4 Technical requirements

a) Operational range : As per project specification.

b) Rated overpressure : 2,0 x max. operational pressure.

c) Repeatability (set-point) : ±2% of full scale max. deviation.

d) Output switch contacts : SPDT.

e) Switching voltage : 24 V DC.

f) Contact rating : 0,5A at 24V DC.

g) Degree of protection : IP 65

4.2 PRESSURE SENSOR: FIXED INSTALLATION

This section covers fixed position threaded or flanged electronic pressure sensors. Electro mechanical instruments such as Bourdon tube pressure monitors are not covered in this section.

4.2.1 Application

Pressure sensors are used to monitor analogue pressure within a pipe or enclosed vessel mainly for pumps and process control and protection of pressure sensitive pipework and equipment.

The application for purposes of this specification will be mainly as required in the water and waste water purification and transportation (pumping) industries, including associated liquid chemicals, at nominal ambient temperatures and operating pressure 0- 40 bar (application for higher pressures will be detailed in the Project Specification). Application will mostly be for direct pressure measurement, but can also be used for level measurement in vessels and holding structures with associated calibration.

4.2.2 Operating Principle And Construction

Pressure sensors can be based on various technologies, depending on the application. For the application stated above the operating principle and construction will be similar to pressure switches described above, in that the process fluid pressure is transferred via a diaphragm to a pressure sensing element, instead of a micro switch, with output proportional to pressure. Various sensing elements can be used such as thin film, capacitance, piezo-resistive strain gauges, etc. Commonly used diaphragms include metal, ceramic and silicone.

For purposes of this specification, pressure sensors for general application must be of the ceramic capacitive (oil free) type with a ceramic process separation diaphragm for application 0 - 40bar. Other types and/or higher pressures will be detailed in the Project Specification.

The diaphragm displacement is applied to the sensing device capacitive elements imbedded in the separation diaphragm and a parallel ceramic disk. The applied force changes the capacitance, resulting in a variable capacitance proportional to pressure. This signal is processed by the instrument electronics to an analogue output signal proportional to pressure.

Three types of instrument configurations are type referenced below:

a) Type A: this comprises a loop powered sensor only with analogue current output to a remote control/display unit or PLC.

b) Type B: as for type A, but with LED flow display, navigation buttons for setup and programmable solid state digital output switches.

c) Type C: comprehensive in situ instrument with signal processing, analogue output, programmable digital outputs and fieldbus communication facilities. The operator interface /controller can be field mounted or remote mounted.

Tender prices must include the power supply for loop powered instruments.

The operator interface and control unit for type C must be of the menu driven type with:

- Multiline backlit LCD visual display.
- Navigation buttons for navigation through the menu and setting up of the instrument.
- Analogue output.
- Programmable relays for digital outputs.
- Fieldbus connectivity.

Differential pressure sensing:

Differential pressure measurement upstream and downstream of a process element must comprise two types A or B sensors, connected to a remote controller as described above, but with two channels for the two pressure inputs and a differential pressure analogue output.

4.2.3 **Installation**

The process connection will either be threaded (default) or flange mounted (special application). For threaded connection, the sensor must be threaded and screwed into a socket, or the sensor must be unthreaded and fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and sensor. Sockets to suit the flow switches must be fitted prior to coating of the pipes. Sockets may not be installed on site in situ. Should a socket be required, the pipe section must be removed for drilling and welding in a workshop and the complete pipe section must re-coated, including hot dipped galvanized pipework

The instrument must be installed vertically on pipework in an easily accessible and visible position. All process connections must be fitted with an isolation valve.

Power supply and signal cables must be provided in accordance with the type designation above and in accordance with the manufacturer's requirements.

The cables must be terminated directly on the instrument housing with a M12 socket or other approved industry standard connection in accordance with the manufacturer's provision. The termination may not compromise the instrument IP rating. If the lead out cable is moulded to the body, a disconnection point within a IP 67 cable junction box must be provided in close proximity of the switch that the cable is not twisted or damaged when removing screw-in switches and also allow removal of the switch only. The cable from the instrument must be supported on a cable rack from the sensor position to the related cable wireway to ensure there is no tension on the termination.

4.2.4 **Technical Requirements**

a) Case and threaded connection : Stainless steel.

b) Protection : IP 66.

c) Power supply : 24V DC.

d) Measurement range : As per project specification.

e) Overload : 2 x operating range.

f) Accuracy : Deviation <0,5 (% of span)*.

g) Linearity : Deviation < 0,1%*.

h) Outputs

- Analogue : 4-20mA, 0-10V (fully scalable) : Type A,B,C.
- Digital (2 x programmable contacts) : Type B, C.
- I/O link communication standard : Type B.
- Fieldbus (Modbus) : Type C.

i) Operator interface

- Display:
  - Type A: None.
  - Type B: LED.
  - Type C: Multiline backlit LCD.
- Navigation buttons: Type A and B.

j) Ambient temperature: -20°C to + 60°C

(*) : or as per Project specification.

4.3 **PRESSURE SENSOR: SUSPENDED INSTALLATION (HIDROSTATIC)**

This section covers suspended pressure sensors of the hydrostatic type for level measurement.

4.3.1 **Application**

Pressure sensors of the hydrostatic type are electronic instruments used to monitor analogue level within a deep well or borehole, where other type of level measurement is not suitable or non-preferred. The pressure sensor will be suspended from its signal cable, with additional strengthening material for very deep installation as required.

The application for purposes of this specification will be mainly as required in the water purification and transportation (pumping) industries, including associated liquid chemicals, at nominal ambient temperatures and operating pressure 0- 20 bar.

4.3.2 **Operating Principle And Construction**

The pressure sensor is of the ceramic capacitive type as described for fixed pressure sensors and conforms to the general operational principles as stated, with analogue 4-20mA current output.

The measuring element must be housed in a tubular stainless steel casing. For borehole application the casing must be of the slim-line type with outer diameter not more than 22mmø, to fit the inner diameter of the sensor sleeve down the borehole and referred to as the pressure probe. Probes for other applications such as deep well with no diameter constraints can be of larger diameter.

The suspension lead out cable must be moulded to the probe casing to ensure a watertight seal with continuous length to the surface connection box for extension to the controlling MCC, or junction box. It must be ordered to length for the applicable installation depth. The cable must be provided with an integral atmospheric pressure compensating tube from the sensing element to the cable end. The cable outer sheath must be of the nitrile rubber, neoprene or other suitable type purpose designed for the immersion fluid. The sensor must be fitted with temperature compensation only if so required in the Project Specification.

The probe 4-20mA signal must be connected to a PLC to determine switching levels, or a display/control unit with programmable relays for switching levels, as per Project Specification. It should be noted that the pressure at the probe is the water column pressure plus atmospheric pressure and the display must be calibrated that the water level is referenced to ground level; i.e. to either water column height above the probe or water level below ground level for boreholes (as per Project Specification).

4.3.3 **Installation**

Borehole installation:

The borehole has limited diameter with tight tolerances and must accommodate the submersible pump delivery pipe, electrical supply cable and level sensing equipment. Only the first section of the borehole will be lined and the probe must be installed within a continuous thick wall polycop sleeve of ø28mm ID that will not kink, to protect the probe from damage and snagging. The sleeve must be tied to the pump line every two meters and kept as straight as possible to prevent the probe from snagging and lowered into the borehole with the pump and pipework. Since the protection sleeve cannot be 100% straight, apart from the probe diameter, the probe length relative to the sleeve ID must be carefully considered to ensure smooth installation.

The probe default installation depth must be just above the pump, or at a depth stipulated in the project specification. Note that the borehole depth may be more than the pump initial installation depth and the pump cable must be supplied in accordance with the borehole total depth.

The cable must be suspended from a retaining plate across the access hole in the borehole baseplate by means of a compression gland or purpose made wedge clamp.

The installation depth must be marked with a cable tie at the fixing position. From the borehole baseplate the cable must be extended to an elevated above ground level vented (for atmospheric compensation) cable junction box at the borehole base and extended from this junction box to the controlling MCC. If this cable box is sealed, the extension cable must be of the same type as the lead out cable with compensation tube to the pump control panel. This installation must be done to enable removal of the probe without pulling extension cable back from the MCC. Any spare probe cable must be coiled within the borehole base mounting box which must be custom designed as per Project Specification.

Deep well installation:

The probe must be suspended from a sturdy stainless steel bracket of 3mm thickness (minimum) fixed to the holding structure with stainless steel or brass fasteners, in an easily accessible position. The probes may not be installed closed to sources of turbulence. If this is unavoidable, the probe must be installed within a still well manufactured from PVC sleeve perforated at the bottom end, or other suitable stilling structure. The probe must be installed just above the holding structure floor level. The lead out cable connections must be done as described above for boreholes.

4.3.4 **Technical Requirements**

a) Case material : Stainless steel.

b) Protection : IP 68.

c) Power supply : 24V DC, loop powered.

d) Measurement range : As per project specification.

e) Overload : 2 x the operational range (minimum 10bar).

f) Accuracy : Deviation <0,2 (% of span)*.

g) Linearity : Deviation < 0,1%*.

h) Output : Analogue, 4-20mA (fully scalable).

i) Temperature compensation : PT 100 temperature sensor (*).

j) Process temperature: -10°C to + 70°C

(*) Or as required as per Project specification.

5. **MASS MEASUREMENT**

Not part of this project.

6. TEMPERATURE

6.1 TEMPERATURE GAUGE: BIMETALLIC TYPE

Temperature gauges for the purposes of this specification are mechanically actuated instruments of the dial and needle type.

6.1.1 Application

Temperature gauges will normally be for temperature measurement of a process or equipment, where local indication only is required.

The application for purposes of this specification will be mainly as required in the water purification and transportation (pumping) industries, including associated liquid chemicals, at nominal ambient temperatures.

6.1.2 Principle of Operation and Construction.

The instrument comprises a round dial with indicating needle and tubular stem (probe) of different diameters and lengths, for immersion into the process media, being fluid or air. The stem must is threaded at the base for either direct connection to the process pipe/vessel or fitted within a thermowell.

The principle of operation is that the measuring element comprises a bimetallic strip, with different expansion coefficients. One end is fixed and the other linked to a rotational indication needle. When the temperature changes, the bimetallic strip bends proportional to the temperature change and this rotational movement is transferred to the indicating needle moving across the circumference of a calibrated dial. The bimetallic strip can be constructed helically or spirally wound.

If the application is subject to vibration, liquid damping must be provided.

If the process media is corrosive, under high pressure or inserted in a high flow application, the stem must be fitted into a thermowell, threaded or flanged to suit the application.

The stem and/or thermowell material must be stainless steel 316 or brass, to suit the application, threaded or flanged.

6.1.3 Installation

The stem must be screwed into a threaded receptacle and the probe must be fully immersed into the vessel or flow in a pipeline/duct. The length of the probe must be selected to be fully inserted in the process (i.e. not retracted in a raised boss) and of sufficient length that it will capture the process temperature.

When installed in a thermowell, care must be taken that the circumferential clearance between the stem and thermowell wall is minimum and the stem bottom must not contact the thermowell bottom due to different expansion rates of the stem and thermowell materials and the manufacturer specific clearance must be maintained.

6.1.4 Technical Requirements

Temperature range: As per project specification.

Dial size : 63mm nominal.

Window material : Glass or Plexiglas.

Bezel material : Stainless steel.

Case material : Stainless steel.

Accuracy : 2% of scale max. deviation.

Protection : IP 65

Thermowell :

- Material : Brass/stainless steel, best suited to the process medium.
- Pressure : As per Project Specification, default 6 bar.

6.2 THERMOCOUPLE

6.2.1 Application

Thermocouples are suitable for measuring over a large temperature range, from −200°C up to 2000 °C.

The application for purposes of this specification will be mainly as required in the water and waste water purification and transportation (pumping) industries, including associated liquid chemicals, at nominal ambient temperatures, for measuring temperature in vessels and pipes.

If the process temperature range is relative small and a high accuracy is required, RTDs will be more suitable.

6.2.2 Method Of Operation And Construction

A thermocouple is a junction of two dissimilar conductors (such as iron and copper) exposed to the temperature to be measured relative to a reference temperature. The thermo-electrical effect between the two dissimilar conductors generates a small potential difference approximately proportional to temperature difference, which is amplified at the two wire lead out and the resulting voltage reading is calibrated as temperature. The output voltage depends on the thermal characteristics of the conductors. For general application with temperatures ranging from -40°C to 800°C, type K (Chromel-Alumel) thermocouples must be used.

The thermocouple voltage output is not linear with temperature and must be linearized by the signal processing electronics. Digital instruments must be programmed with linearization tables for the specific thermocouple type.

The conductors must be insulated from each other with suitable material to withstand the temperature range and measured media for the application. Open junction thermocouples will generally not be acceptable and the junction must be fitted within a protective stainless steel enclosed tube (probe) constructed that the process temperature is transferred to the junction without affecting the reading and with length to suit the application. The probe must be fitted with a threaded process connection for direct installation in the process vessel or pipeline, or within a thermowell.

6.2.3 Installation

The thermocouple installation method will depend on the process to be measured, being directly inserted, or fitted inside a thermowell or pre-manufactured temperature pocket. The lead out connections must either be crimped or pressure connected by means of pressure pads and screws. Extension cables to the signal processing display and control unit must be of the same type as the thermocouple and installed in close proximity to limit the length of lead out cable.

The lead out conductors must be installed within a flexible sleeve to ensure that the conductor insulation is not damaged in any way.

6.2.4 Technical Requirements

Thermocouples must comply with the following,

Temperature range : -40°C to 800°C.

Thermocouple : Type K (ISA).

Accuracy : 1% deviation of the full scale range.

Housing : Cast aluminium, IP 65.

Probe : Stainless steel

6.3 RESISTANCE TEMPERATURE DETECTOR

Not part of this project.

7. ANALYTICAL

7.1 PH MEASUREMENT

pH measurement is based on the response of a sensor to the logarithmic concentration of hydrogen ions in solution and are a measure of the acidity or alkalinity of the solution**.** A neutral solution At 25°C has a pH of 7. Solutions with pH <7 are acidic and >7 is alkaline and the normal overall pH range for water solutions containing water solvents is 0-14pH.

7.1.1 Application

The pH of water is an important parameter of water quality and the application for purposes of this specification will be mainly for process monitoring as required in the water purification industry, whereby the pH is measured with the objective to correct

pH deviation for the specific application to relevant/statutory standard by the addition of appropriate chemicals.

The instrument will be used for online monitoring, or for periodic measurement of samples pumped with a sampling pump to a remote mounted combination analysing/testing station. Monitoring will be within open structures, enclosed vessels and inline piped flow application.

The application for the instrumentation described below will be for intermediate pH measurements as typically encountered within the above stated industries. pH measurement at the extreme ends of the scale (high acidity/alkalinity levels) must be done with conductivity based instrumentation.

7.1.2 **Operating Principle And Construction**

The measuring principle is based on the hydrogen ion (H+) activity of a solution of unknown (measured) pH relative to a solution of known pH (reference), measured as a electrochemical potential difference between the two solutions in pH units.

The sensor comprises a probe made up from two electrodes forming an electrical circuit, one being pH sensitive in contact with the measuring fluid and the other non pH sensitive acting as a reference, with circuit voltage output (proportional to pH) to a remote signal processor serving as operator and system interface. The pH of a solution is temperature dependent and a temperature sensing element such as a PT 100 must be included in the probe, providing a temperature signal to the pH analyser for temperature compensation.

The electrodes comprise two concentric glass tubes. The inner (measuring) tube is filled with a solution of known pH (such as potassium chloride buffered at pH 7) and the outer (reference) tube with a concentrated solution (such a potassium chloride). Both the tubes are fitted with suitable metal wire inserts (such as silver wire with silver chloride coating) serving as lead out for the electrical connection. The inner tube is the measuring tube fitted with a thin walled pH sensitive glass bulb manufactured from a manufacturer specific composition (containing metal salts) fused to the tube tip, in contact with the measuring fluid, allowing migration of hydrogen ions. The outer tube has a porous plug junction with the measured fluid to provide electrical continuity to the reference electrode, whilst keeping the measured and reference solutions separated.

The plug junction material must be selected on the performance objective such as long life (typically wood or equivalent) or chemical resistance (typically ceramic or equivalent).

The hydrogen (H+) ion activity (ion exchange) at the glass membrane is quantified as a logarithmic concentration. The concentration at the outside (variable) relative to the inside (fixed), creates an electrical potential difference across the glass membrane. The outer potential varies with change in pH of the measured solution whilst the potential on the inside remains constant due to the fixed pH of the fill solution.

The reference electrode completes the electrical circuit at a constant potential which provides a known reference to the measuring electrode. The resultant potential between the electrodes is a voltage signal proportional to pH, which is amplified,

temperature compensated and displayed on the transmitter as a pH value. The voltage signal is 0V for a pH of 7 at 25°C.

The probe pH proportional output can also be configured in a digital signal, *Memosense* protocol whereby the output is via contactless inductive coupling. This is an optional feature, to be provided in conjunction of other *Memosense* sensors within the system.

The probe comprises the combination electrode tube and housing for the on-board electronics and cable connection. The electrode tube is inserted within an outer protective plastic tube, easily removable for cleaning and maintenance of the probe. The specific configuration will depend on the process structure entry for mounting, being an open vessel, inline pipe with socket T-entry or enclosed vessel, with screw or flanged entry.

The probe must be threaded and screwed into a socket, or unthreaded and fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and sensor. Probes fitted to vessels must have a retraction enclosure that the probe can be removed without affecting the process or having to drain the vessel.

The lead out cable connection type must allow for easy removal of the probe, especially the threaded type, that the cable is not twisted in the process, either by removing the housing cover and disconnecting the cable, or having a short lead out to an intermediate junction box.

Maintenance and durability:

pH sensors require regular maintenance and cleaning and the choice of probe and features must take cognizance of the characteristics of the medium to be measured such as exposure to contaminants, deposits, air bubbles etc., to minimise maintenance and cleaning cost.

The measuring electrode is susceptible to long term deterioration and the analyser must have re-calibration facilities to compensate. Depending on the process fluid characteristics, the measuring electrode bulb can be contaminated or covered with deposits, requiring regular cleaning. By default online probes must be fitted with a self-cleaning facility whereby the electrode bulb is automatically washed periodically by means of a jet spray of clean water or cleansing fluid. Testing station probes can be hand cleaned and constructed for easy access.

The reference electrode fill will contaminate over time with migration across the junction plug and the chloride will also get depleted, thus requiring replenishment or total probe replacement. The electrode fill can be either liquid solution or aqueous gelled solution type. The liquid fill can be replenished/refilled as part of maintenance and have a relative long operational life, whereas the gel filled type is non-replaceable and disposable at end of life, typically six to twelve months. The specific type must be best suitable for the application and maintenance considerations as per the Project Specification. The default type for tender will be liquid filled. Gel type must be used for pressurized tanks and pipes.

The electrode impedance is an important parameter to monitor the condition of the probe. The measuring electrode bulb separation barrier is high impedance and low

impedance is indicative of a crack in the bulb or overall failure. The reference electrode junction is porous to allow the migration of ions for conductivity and is of relative high impedance. Very high impedance is indicative of junction plugging. The analyser must have a real time impedance diagnostic function with alarm when a fault is detected.

Transmitter

The pH sensor must be used in conjunction with a remote installed transmitter serving as operator and system interface and control unit, which must be of the menu driven type with:

- Backlit LCD multiline visual display (simultaneous).
  - pH measurement main display/data setup display.
  - Secondary display parameters such as temperature.
  - Error code.
  - Mnemonics for other functionality such as relay status.
  - Indicators for measuring, calibration and setup (configuration) mode and relays active status.
- LED status display (manufacturer dependent).
- Inputs from probe:
  - pH proportional voltage signal.
  - Temperature signal.
  - *Memosense (and or similar)* protocol digital signal.
- Outputs:
  - Analogue output: 4-20mA proportional to pH.
  - Alarm output relay configurable for specific or grouped alarms.
  - Programmable relays for digital outputs assigned to specific pH and temperature limits, error status, etc.

    Auto/manual selection: for auto operation the relay is controlled by the controlling parameter and in manual the relay can be manually switched.
  - Fieldbus connectivity for system communication.
- Functionality
  - pH measuring range selection (high/low limits).
  - Impedance fault diagnostic capability.

- Sensor calibration capability.
- Navigation buttons serving for navigation through the menu and setting up of the instrument.
- Temperature compensation with 25°C reference temperature.

7.1.3 **Installation**

The probe must be installed in an easily accessible position in view of frequent removal for maintenance.

The process connection will either be threaded (default) or flange mounted (special application). The sensor must be threaded and screwed into a socket, or fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and sensor. Sockets to suit the sensors must be fitted prior to coating of the pipes. Sockets may not be installed on site in situ. Should a socket be required, the pipe section must be removed for drilling and welding in a workshop and the complete pipe section must re-coated, including hot dipped galvanized pipework

The power supply and signal cables must be terminated directly on the instrument housing with an approved industry standard connection in accordance with the manufacturer's provision. The termination may not compromise the instrument IP rating. If the lead out cable is moulded to the body, a disconnection point within a IP 67 cable junction box must be provided in close proximity of the sensor that the cable is not twisted or damaged when removing screw-in probes and also allow removal of the probe only. The cable from the sensor must be supported on a cable rack from the sensor position to the related cable wireway to ensure there is no tension on the termination.

The electrode bulb must always be wetted and the probe may not be installed at an angle larger than 80° from vertical and not upside down, even with the bulb wetted, to prevent air bubbles forming in the bulb.

If installed in a flow application, the sensor must always be inserted in an inverted U-section pipe to ensure the bulb is always immersed in fluid. The sensor must always be provided with a bypass pipe and appropriate isolation valves, that the sensor can be removed for maintenance without interruption of the process. The flow should not exceed 3m/s (or to the manufacturer's instructions) to prevent leaching of the metal salts from the electrode bulb surface layer.

Sensors installed in a vessel must be fitted with a retraction facility that the probe can be removed without affecting the process or having to drain the vessel.

7.1.4 **Technical Requirements**

7.1.4.1 **Probe**

a) Power supply : 24V DC .

b) Electrodes : Refer Principle of Operation section.

c) Temperature element : PT 100 (or equivalent).

d) Process connection : Screwed or flanged as per Project Specification.

e) Output

- Voltage signal proportional to pH.
- Temperature signal.
- *Memosense (and or similar)* digital signal (optional as per Project Specification).

7.1.4.2 **Transmitter**

a) Power supply : 24V DC

b) Operator interface

- Menu driven.
- Backlit LCD multiline display for simultaneous parameter display.
- LCD status display (1*).
  - Normal/calibration mode.
  - Manual/Auto (relay) selection.
  - Relay active.
  - Error/alarm.

  (1*) manufacturer specific LED status/LCD text display.

c) System interface

- Fieldbus connectivity for system communication.

d) Inputs

- pH proportional voltage signal.
- Temperature signal.
- *Memosense* (and or similar) protocol digital signal.

e) Outputs:

- Analogue output: 4-20mA proportional to pH, HART.
- Relays: SPDT contacts 0,5A at 24V DC
  - Alarm output relay configurable for specific or grouped alarms.
  - Up to 4 no configurable, as per Project Specification.

- Functionality: Refer *Functionality* section narrative/Project Specification.

7.2 DISSOLVED OXYGEN (DO) MEASUREMENT

DO measurement, by means of optical based sensing, refers to the amount of free, non-compound oxygen present in water or other liquids, as a percentage of oxygen versus liquid (% saturation, or Parts Per Million (ppm)).

7.2.1 Application

The DO levels in water is an important parameter of water quality and the application for purposes of this specification will be mainly for process monitoring as required in the water purification industry, whereby the DO is measured to assist with the treatment process and adjustments.

The instrument will be used for online monitoring, or for periodic measurement of samples. Monitoring will be within open structures, enclosed vessels and inline piped flow application.

7.2.2 Operating Principle And Construction

The measuring principle can be done in two ways, namely through optical-sensing or the membrane-covered method. This specification will focus only the optical-sensing (luminescent) type.

The DO sensor is coated with a luminescent material. A LED light transmits blue light to the surface, which excites the material and in turn emits a red light. An internal referenced red light is also flashed, to act as the check. The time to emit the red light is measured and used as a function of DO saturation. The higher the DO concentration, the less time to relax and emit the red light, and vice versa.

DO saturation levels are subject to the salinity and temperature of the liquid measured. The salinity and temperature tables must be utilised in the setup and calibration of the equipment.

The probe DO proportional output can also be configured in a digital signal, *Modbus* protocol whereby the output is via contactless inductive coupling.

The probe comprises the combination electrode tube and housing for the on-board electronics and cable connection. The electrode tube is inserted within an outer protective SS316 housing, easily removable for cleaning and maintenance of the probe. The specific configuration will depend on the process structure entry for mounting, being an open vessel, inline pipe with socket T-entry or enclosed vessel, with screw or flanged entry.

The probe must be threaded and screwed into a socket, or unthreaded and fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and sensor. Probes fitted to vessels must have a retraction enclosure that the probe can be removed without affecting the process or having to drain the vessel.

The lead out cable connection type must allow for easy removal of the probe, especially the threaded type, that the cable is not twisted in the process, either by removing the

housing cover and disconnecting the cable, or having a short lead out to an intermediate junction box.

Maintenance and durability:

The DO sensor must be of the maintenance free type, with no calibration required (ie no drift accepted on the unit from factory calibration) nor membranes nor solution needing replacement.

Transmitter

The DO sensor must be connected to the field controller (either of the 2 or 6 way type), depending on Contractor design configuration and field equipment positions. Refer pH transmitter above for further detail. All devices connected to the transmitter/controller must be displayed and programmable. The manufacturer of the sensors and transmitter must be the same.

The transmitter must be Modbus-485 compatible, capable of networking to a wider industrial network, whether it be local or remote.

7.2.3 **Installation**

The probe must be installed in an easily accessible position in view of frequent removal for maintenance.

The process connection will either be threaded (default) or flange mounted (special application). The sensor must be threaded and screwed into a socket, or fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and sensor. Sockets to suit the sensors must be fitted prior to coating of the pipes. Sockets may not be installed on site in situ. Should a socket be required, the pipe section must be removed for drilling and welding in a workshop and the complete pipe section must re-coated, including hot dipped galvanized pipework

The power supply and signal cables must be terminated directly on the instrument housing with an approved industry standard connection in accordance with the manufacturer's provision. The termination may not compromise the instrument IP rating. If the lead out cable is moulded to the body, a disconnection point within a IP 67 cable junction box must be provided in close proximity of the sensor that the cable is not twisted or damaged when removing screw-in probes and also allow removal of the probe only. The cable from the sensor must be supported on a cable rack from the sensor position to the related cable wireway to ensure there is no tension on the termination.

The sensor must always be wetted and the probe may not be installed at an angle larger than 80° from vertical and not upside down. Refer project specification for further special mounting requirements, whether by a floating mount kit, pole-mount kit or in-line pipe mounted.

7.2.4 **Technical Requirements**

7.2.4.1 **Probe**

a) Power supply : 24V DC .

b) Wetted end : Acrylic sensor cap

c) Housing : SS316

d) Process connection : Screwed or flanged as per Project Specification.

e) Output : Saturation % proportional to DO.

f) Accuracy : 0.1ppm (mg/L), below 5ppm

g) Range : 0 – 20ppm (0 – 20mg/L)

7.2.4.2 **Transmitter**

- Refer pH for generic detail

7.3 SUSPENDED SOLIDS (SS) MEASUREMENT

SS measurement, by means of optical based sensing, refers to the amount of foreign particles (solids) present in water or other liquids, as a percentage of solids versus liquid (NTU for turbidity applications, or ppm for suspended solids).

The measurement and sensor principles apply to both Total Suspended Solids (TSS) as well as Mixed Liquor Suspended Solids (MLSS). The unit must be selected and calibrated for its specific application, depending on sludge thickness and process location.

7.3.1 Application

The SS levels in water is an important parameter of water quality and the application for purposes of this specification will be mainly for process monitoring as required in the water purification industry, whereby the SS is measured to assist with the treatment process and adjustments.

The instrument will be used for online monitoring, or for periodic measurement of samples. Monitoring will be within open structures, enclosed vessels and inline piped flow application.

7.3.2 Operating Principle And Construction

The measuring principle is by means of dual-beam optics and integrated photoreceptors. A dual-beam LED light source transmits light to the sensor face at an angle of 45°. Photoreceptors are then positioned at 90° as well as at 140° for backscatter light, to detect the transmitted light. The more backscattered light is detected, the higher the SS concentration, and vice versa.

The probe comprises the combination sensor and housing for the on-board electronics and cable connection. The electrode tube is inserted within an outer protective SS316 housing, easily removable for cleaning and maintenance of the probe. The specific configuration will depend on the process structure entry for mounting, being an open vessel, inline pipe with socket T-entry or enclosed vessel, with screw or flanged entry.

The probe must be threaded and screwed into a socket, or unthreaded and fitted into a socket with external thread, secured by means of a union nut and appropriate seal

between the nut and sensor. Probes fitted to vessels must have a retraction enclosure that the probe can be removed without affecting the process or having to drain the vessel.

The lead out cable connection type must allow for easy removal of the probe, especially the threaded type, that the cable is not twisted in the process, either by removing the housing cover and disconnecting the cable, or having a short lead out to an intermediate junction box.

Maintenance and durability:

The unit must be provided complete with integrated wiper mechanism, to assist with accurate readings. The wiper components must be made from stainless steel, with the blade made of silicon.

Transmitter

The SS sensor must be connected to the field controller (either of the 2 or 6 way type), depending on Contractor design configuration and field equipment positions. Refer pH transmitter above for further detail. All devices connected to the transmitter/controller must be displayed and programmable. The manufacturer of the sensors and transmitter must be the same.

The transmitter must be Modbus-485 compatible, capable of networking to a wider industrial network, whether it be local or remote.

7.3.3 Installation

The probe must be installed in an easily accessible position in view of frequent removal for maintenance.

The process connection will either be threaded (default) or flange mounted (special application). The sensor must be threaded and screwed into a socket, or fitted into a socket with external thread, secured by means of a union nut and appropriate seal between the nut and sensor. Sockets to suit the sensors must be fitted prior to coating of the pipes. Sockets may not be installed on site in situ. Should a socket be required, the pipe section must be removed for drilling and welding in a workshop and the complete pipe section must re-coated, including hot dipped galvanized pipework

The power supply and signal cables must be terminated directly on the instrument housing with an approved industry standard connection in accordance with the manufacturer's provision. The termination may not compromise the instrument IP rating. If the lead out cable is moulded to the body, a disconnection point within a IP 67 cable junction box must be provided in close proximity of the sensor that the cable is not twisted or damaged when removing screw-in probes and also allow removal of the probe only. The cable from the sensor must be supported on a cable rack from the sensor position to the related cable wireway to ensure there is no tension on the termination.

The sensor must always be wetted and installed as per supplier recommendations. All required brackets, shafts, adaptors and couplings must be provided to install the sensor at the correct process location. Sensors installed in pipeline applications must be

provided with either flanged connections or else safety armatures for securing of the sensor.

Care must be taken to access the sensor, for maintenance and cleaning purposes. All installation material in sewage applications to be SS316.

Note that the unit cannot be installed in a high flow area (greater than 3m/s) and not in a pipeline of pressure greater than 6bar.

7.3.4 **Technical Requirements**

7.3.4.1 **Probe**

a) Power supply : 24V DC .

b) Housing : Stainless steel

c) Process connection : Screwed or flanged as per Project Specification.

d) Output : NTU or mg/L

e) Accuracy : <1% with calibration

f) Range : 0.001mg/L to 500g/L

7.3.4.2 **Transmitter**

- Refer pH for generic detail

STANDARD SPECIFICATION

SSE04 – TELEMETRY AND SCADA

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1. GENERAL SCOPE

This section of the Project Works requires a dedicated and specialist sub-contractor to execute the required Works. Close cooperation is critical between the Main Contractor, specialist sub-contractor as well as MCC manufacturer and no claims in this regard will be entertained.

The project specification covers the related design, construction, supply, delivery, installation, testing, commissioning and site optimisation of a radio telemetry and central SCADA system in line with the Client's current supplier, contract and standard of operations. The current supplier must be utilized as the specialist sub-contractor so as to ensure continuity of service and modifications of the central and critical SCADA control system.

This project's scope of works is summarised as follows:

- Telemetry outstations and central SCADA implementation in line with the project specifications

2. TELEMETRY OUTSTATIONS

2.1 ENCLOSURE

The enclosure must be wall-mounted in close proximity of the applicable MCC.

The outstation must be manufactured from 1.6mm^2 mild steel with an epoxy power coated finish. It must be fitted with a hinged door and be of the lockable type by either square-key type locks or quarter turn coin slot screws. The door must be equipped with a limit switch, connected to the I/O module, so the Client can see and trend when the door is opened on the SCADA system.

A dedicated gland plate and opening must be provided at the bottom of the enclosure, with pre-drilled holes and glands to suit the small cable and wiring sizes, leaving a tight seal.

A dedicated terminal strip for all incoming and outgoing cables must be provided above the gland plat, with all signals wired through to the RTU and I/O configuration cards.

The battery must be installed in such a position that it does not have to be moved in order to gain access to any equipment, terminals or cables. Any required supporting brackets or holders must be included into the original enclosure design.

The enclosure must be securely mounted, at all four corners, against the dedicated MCC backplane. Note that final MCC spatial, door and backplane sizing remains the responsibility of the specialist sub-contractor and must be coordinated with the MCC supplier during the drawing stage. All door openings and other considerations in terms of operations and maintenance must be taken into account.

2.2 RADIO

Offered radios must be of the digital SD4 GE type. Any additional licensing applications must be provided for as part of the tender offer.

Note that a preliminary path analysis between the various sites and the central station must be done as part of the tender offer and any additional provisions in terms of repeaters, digipeating configuration or 'boosting' of signals must be provided for as part of tender pricing and offering. No additional claims during construction stage will be entertained.

2.3 CONFIGURATION

The telemetry RTU configuration must be housed on a dedicated backplane within the enclosure. The CPU, both digital and analogue I/O cards as well as counters must be provided in line with the project specifications and requirements. Special attention must be placed upon the system control and how the SCADA, outstation and MCC must work together for a fully functioning system. The RTU must be equipped with serial and network communication and be of the programmable type, to comply to the control and monitoring requirements as set out below in Section 3.

All field I/O must be galvanically isolated and provided with surge protection.

A two-line digital display keypad must be flush-mounted on the enclosure hinged door. All required analogue values, as well telemetry controlled parameter values, must be displayed. Note that the unit must be able to be locked and any changes must require a password prompt, which must be included into the manuals.

Provision must be made to house the final single line diagram in a door-mounted pouch. Note that a generic drawing will not be accepted and all applicable I/O, with corresponding descriptions, must be indicated on the drawing (applicable to the manuals as well).

2.4 ANTENNA

The detailed path analysis will determine the size and type of outstation antenna to be installed and the final design remains that of the specialist sub-contractor.

In the case where a 'whip-antenna' is suited for the application, the final installation must be done either internally within the enclosure, or a more secure antenna installed on the outside of the canopy. All cabling, glanding and securing of the antenna must be coordinated with the MCC manufacturer so as to not drill unnecessarily into the canopy and introduce a potential weak point for rust.

Should a higher antenna be required then a suitably sized mast made from minimum 3mm HDG steel tubing must be provided (less than 9m of the flagpole type, else of the lattice type). The mast must be provided with robust footing, complete with four securing points capable of being chemically bolted and anchored to the concrete plinth.

It is very important to note that the plinth is sized according to the MCC dimensions only. If a floor-standing mast is required, as per above, then a larger plinth must be provided as part of the tender price. an additional plinth section cast alongside the MCC plinth will not be accepted, as the original plinth design must make provision for all installation requirements (including sleeves to antenna, of the slow bend type, as well as earthing).

The antenna cable must be of the co-axial type, suited to the specific strength and application required. No visible cables will be accepted.

2.5 EARTHING

It is important to note that the antenna mast must be separately earthed from the telemetry outstation, so as to not create a potential lighting path back to the outstation and MCC. The earthing must be done by means of a minimum 35mm^2 BCEC cable (PVC insulated) to a 1.2m earth rod, installed in close proximity to the plinth. The ground resistance must be measured with a value of no more than 1ohm to be obtained. If higher then additional rods must be installed until the value is reached. This value must be included into the commissioning data submitted as part of the operating and maintenance manuals.

Note that the co-axial cable between the antenna and outstation must also be adequately earthed so as to create an equi-potential, but the path of least resistance must be down to earth via the rods.

Note that dedicated surge protection must be provided for all field cables and signals, including the earth and power cables.

2.6 POWER SUPPLY

The outstation will be provided with a 10A SP(230V) circuit breaker point of supply in the MCC's distribution section. The power supply and earth cable from the CB to the outstation must be provided as part of the telemetry contract.

The outstation power supply must be of the dual-supply type, incorporating the normal MCC supply as well as a backup battery supply. The unit must be rated to be able to supply twice the total peak demand of the system.

The battery supplied must be of the maintenance-free, sealed type, capable of providing 12 hours-worth of backup supply to the telemetry outstation, operating at peak capacity. The battery must be provided with a battery charger that operates on a trickle-charge principle, prolonging the life of the battery and not over-charging the battery at any point. The battery charger must be capable of fully recharging the battery within 6 hours and be equipped with an automatic boost function.

3. SYSTEM CONTROL

3.1 OVERVIEW

The overall scheme description as well as monitoring and control requirements are set-out in Section 3, part 4. This section must be studied in detail by the specialist sub-contractor and a final I/O list, as well system control responsibility, must be deduced from here. The I/O list below is a general indication only and tenders cannot determine their final bid on this list alone.

The overall scheme will be described in the project specifications.

3.2 I/O SCHEDULE

The indicative system I/O schedule is as follows:

	PARAMETER	I/O TYPE
A	Telemetry door	Digital In
B	Power failure	
C	Communication failure	
D	Pump/Blower/Mixer Status	
	• CB On/Off/Trip • Manual/Off/Auto • Run • Common Fault • E-Stop • Low and Enable levels	Digital In and Out Analogue In and Out
E	Reservoir Levels	
	• Reservoir level display • Start/stop levels • High level alarm • Low level alarm	Digital In and Out Analogue In and Out
F	Flow	
	• Flow rate • Totalised flow count	Digital In and Counter Analogue In and Out
G	Pressure	
	• Analogue display • High Pressure	Digital In and Out Analogue In and Out
H	Temperature	
	• Analogue display (winding, pump bearing, motor bearing) • High Limit	Digital In and Out Analogue In and Out

3.3 MONITORING AND CONTROL SPECIFICS

3.3.1 Primary Monitoring

Refer project specification for full monitoring description.

3.3.2 Local Display

Refer 2.3 above.

The local telemetry keypad and display must be utilised to indicate all required telemetry signals that have a bearing on the control of the pump.

3.3.3 Remote Reset

Refer electrical project specification for full control description and requirements, where applicable.

4. CENTRAL SCADA

4.1 OVERVIEW

This section of the standard specifications relates to the design and implementation of a central SCADA system, to act as a monitoring, trending and historian-based system for a Client's water, sewer or industrial system.

The design of the various SCADA-system components must be done such that the system is easily scalable at a later stage, that the system is not restricted to a single-supplier or programming entity and that remote access is readily available for off-site assistance.

It remains the responsibility of the Contractor to determine that the current software version can handle the additional outstations and that adequate scan points are available. If the available capacity is to be exceeded by this contract then it must be qualified with all financial implications stated and included as part of the tender offer.

4.2 SOFTWARE, LICENSING AND SCAN POINTS

The SCADA package proposed must be the latest version of either the Siemens SIMATIC or Emerson Electric type, capable of operating on the latest Windows package, with scan point capacity for:

- The complete WTW and WWTW plant installation as specified in the various sections of the electrical project specifications
- The bulk water scheme pump stations (both water and sewer)
- Providing for an additional 20% spare capacity.

Tenderers must state the offered and spare utilisation of the package under this contract.

The various electrical sections within the electrical portion of the tender document relate to the monitoring and control signals and functions of the new plants and pump stations as a whole. As such, it is the responsibility of the contractor to design and incorporate all the necessary digital, analogue, monitoring and control process parameters, for a fully working system, into the newly proposed SCADA system. It will be assumed that the other sections have been fully read and studied and that no additional claims will be entertained for process parameters not included into the tender offer.

The system must be configured for the monitoring and control functions as specified for the networked plant, new outstation and existing bulk water scheme, all in accordance with the various electrical specification sections.

The SCADA system must run on the central server, with the view node desktop the interface between the operator and the server. Note the SQL database requirements, as listed under the specific section. The SCADA system must write all data into this

independent database, which will be used as the main data storage point, but which will also provide a solid platform from which to compile reports.

The tender offer must include all required software and licencing up-front costs, as well as covering the licence costs for a period of two years after taking over has been established. The contractor must further sate in the Bill of Quantities what the applicable licencing costs are per year, as a rate, to enable the client to properly budget for this cost in their upcoming financial years.

4.3 SERVER AND DATABASE

4.3.1 SERVER

In order to provide a degree of reliability and data security, a rack-mounted data server must be provided to act as the backbone for the SCADA system. The server must of the Dell or HP type.

The server will be responsible for running the new SCADA package, with view node capability to be provided on the local control room computer.

In addition, the server must maintain a SQL server database, into which the SCADA system must write all specified plant and bulk water scheme data. A separate reporting tool, as specified under Reporting, must be provided to assist the client in managing the plant.

4.3.2 DATABASE

A SQL server database must be provided as part of the complete central station offer. The database software offer must be of the generic and independent type (in other words, the proposed SCADA software database is not acceptable for this purpose), similar and equal to Microsoft SQL Server.

The tender offer must include all required software and licensing up-front costs, as well covering the license costs for a period of two-years after taking-over has been established. The contractor must further state in the BOQ what the applicable licensing costs are, per year, as a rate, to enable the client to properly budget for this cost in their up-coming financial years.

The programming and composition (structure) of the database is very important and must be designed in detail and discussed during the initial stages of the project, to allow for data integrity and future expansion capability, if so required. A sub-set must be created for each type of tag within the plant database. In other words, all levels must be written to one specific sub-set. Consistency in data recording is of paramount concern here, allowing the client to be able to accurately compile reports and assess plant trends with ease, to prevent either data loss or data inconsistencies.

The SCADA system will remain responsible for writing all the required data into the independent SQL database. Data must be logged per event change, and data updates must be established for each type of digital and analogue tag, both on the plants and remotely from the bulk water schemes. At present, allow for an update every 5 minutes, in order to accurately size the equipment required.

Any OPC allowance must be provided for between the central telemetry outstation (RTU) and SCADA system. The database must be able to accurately communicate with the proposed front-end reporting structure. Note the reporting requirements below, as well as the provision or additional reports during construction stage.

4.4 SECURITY

As there will only be one access/interface point to the SCADA and server system, different levels of access/security need only be provided at this one point. Three levels of access must be provided for on the server:

- Level 1 (lowest level of access) will be for the daily operator who will access the SCADA system for monitoring, fault finding and basic trending.
- Level 2 (process level) will be for the plant manager to be able to adjust process parameters, as set out below in the SCADA section.
- Level 3 (highest level of access) is for the server administrator, to perform diagnostic tests, perform any updates required, compile additional reports, database programming, etc.

Any operator that wishes to log-on to the server (ie, level 1), via the view node, must do so by means of a biometric fingerprint scanner. This recognition process must create an event stamp as to who it is that logged-on, and for how long the applicable party was online.

In order for a level 2 or level 3 individual to perform their required functions, additional password prompts must be requested, before that access can be granted.

It will be contractor's responsibility to supply and install the biometric scanner, including all required software, including the loading of the client's identified operators onto the system, all during the training and commissioning stage of the project. The level 2 operator must further be granted the responsibility and capability to manage (ie, delete and add users) this security feature.

4.5 HARDWARE

4.5.1 SERVER BACKBONE

The offered server must of the industrial, rack-mounted, floor-standing type. The server must be fully equipped, as a minimum, with the following specifications:

- Dual power supply capability (ports for normal and UPS-backup power)
- Newest available processor (quad core)
- DDR3 Memory (min 8GB)
- Two solid state drives (minimum 1TB), with hot plug-in, to cater for zero data-loss and backup redundancy
- All necessary network and controller cards required, including management software, to fully operate the required SCADA and independent database

- All other USB and connection ports required

It will be the responsibility of the contractor's System Integrator (SI) to determine the final server rack size. The rack must be provided with lockable, see-through door, with an industry standard server IP rating. Note that the fibre-optic patch panel, network switch, server and UPS must all be installed within this rack. Ventilation and heating requirements from the individual devices must be considered to determine the eventual size. The rack must be provided with an integral power distribution unit, synchronized with the in-line UPS, to provide seamless power to the various sections of equipment. Note the requirements of the local electrical installation regulations and compliance must be guaranteed at all times.

4.5.2 VIEW-NODE

The minimum requirement for the new central station interface (desktop) is an Intel dual core I7 processor with 2TB hard disk, 8Gb extendible RAM, minimum of three USB ports, DVD writer, wireless keyboard and mouse, 1 x 23" LCD flat screen and two 49" wall-mounted LED displays. Secure locking mechanisms, with pin-code functionality, must be supplied and installed for each screen and desktop body.

The computer must be pre-loaded with the latest Windows and Microsoft Office packages, complete with all certification and licensing costs included as part of the tender offer. An anti-virus program, fully licensed, must further be loaded.

Any additional software required to fully operate with the SQL server must be provided as part of the tender offer, with all licensing costs included.

Access to the desktop must be via a biometric fingerprint scanner, to be provided as part of the tender offer. The scanner must be provided with all required software pre- loaded (including licensing costs) and fully commissioned. The scanner must have visual indication for acceptance/rejection after a scan, minimum IP54 rated, with built-in network capability and up to date high-performance algorithm. The scanner must be installed in a fixed position, within arms-reach of the desktop. Event logging, per scanning event, must be included into the server database.

4.5.3 NETWORK SWITCH

A network switch of the managed type must be included as part of the server design, to integrate with the telemetry outstation RTU as well as view node computer.

The switch must be of the managed type, complete with two fibre ports and a minimum of 4 RJ45 copper ports. The switch must also be dual-supply connected.

4.5.4 UPS

A new single phase in-line UPS must be provided for the central station, with a backup time of at least of one hour. The UPS must be sized to handle the complete load of the central SCADA and server system, including ancillaries, as well as an additional 20%. The UPS must be installed within the server rack and all heating and ventilation requirements must be incorporated into the rack design.

4.6 MENUS AND STRUCTURE

The graphical design and representation is key to the overall functionality and operator understanding. As such, the menu and display structure is very important, and movement between pages and sections must be intuitive and simple.

On each page provision must be made to view the overall main menus, to easily transfer between various main sections and sub-menus.

The following menus and graphic screen layouts are proposed as a holistic system, with only the specific sections required applicable to a specific project:

a) Screen 1: Main Menu

To provide an overview of the scheme, including the Water and Sewer sections, MV supply, emergency generators, housekeeping, alarm page, trending and reporting.

b) Screen 2: Bulk Water Scheme

To provide an overview of the applicable water scheme, complete with Water Treatment Plants, Pump Stations, boreholes, reservoirs and reticulation.

c) Screen 3:

To provide an overview of the applicable waste water scheme, complete with Waste Water Treatment Plants and Sewage Pump Stations.

d) Screen 4: General WTP

This screen displays:

- A schematic line diagram of the plant and associated equipment
- General fault page
- Overall Basic Pump/Motors status
- System analogues status

Screen 4.1: Inlet Works

This screen displays:

- A schematic line diagram of this section of the plant and associated equipment
- Pump/Motors status
- Valves status
- System analogues status
- Plant pH
- Emergency stop active.

Screen 4.2: De-Sludging

This screen displays:

- A schematic line diagram of this section of the plant and associated equipment
- Valves status (per de-sludge tank)

- System analogues and timing status
- Emergency stop active.

Screen 4.3: Filter Plant

This screen displays:

- A schematic line diagram of this section of the plant and associated
- equipment
- Backwash pump/ motors status
- Blowers status
- Each filter's valves status
- System analogues and timer status
- Filters' turbidity
- Emergency stop active
- Clearwater tank.

Screen 4.4: Chlorination Plant

This screen displays:

- A schematic line diagram of this section of the plant and associated equipment
- Pump/motors status
- Chlorination rates
- System analogues status
- Scrubber plant status
- Emergency stop active.

e) Screen 5: General Bulk Water Scheme

This screen displays:

- A schematic line diagram of the scheme as a whole
- General fault page
- Overall Pump/Motors status
- System analogues status

Screen 5.1: Lift Pump Station

This screen displays:

- A schematic line diagram of this section of the scheme and associated equipment
- Pump / motors status
- Protection status
- System analogues (flow, pressure, temperatures) and timer status
- Emergency stop active
- Reservoir levels

Screen 5.2: Bulk Reservoirs

This screen displays:

- A schematic line diagram of this section of the plant and associated equipment
- Level status
- Flows

f) Screen 6: Medium Voltage Sub-station

This screen displays:

- A schematic line diagram of this section of the plant and associated equipment
- MV switchgear status
- Transformer status
- System analogues status
- Power failure

g) Screen 7: Generating set

This screen displays:

- A schematic line diagram of this section of the plant and associated equipment
- Generator status
- Bulk fuel tank and day tank status, including fuse link valve status
- System analogues status
- Power failure
- Main Incomer and MCC CB positions

h) Screen 8: Alarming

This screen must provide a detailed list of all warning and alarms that have been triggered on the system, of all connected remote sites. An alarm must be depicted as Red on the screen and only become yellow once the alarm has been acknowledged. The alarm indication can only become green once the fault causing the alarm has been rectified.

Alarms must be displayed on a scrollable page, with the last week's alarm to be able to be accessed. Alarms older than that must be written into the specific database section, for retrieval and reporting where required.

4.7 GRAPHICAL DISPLAY

Graphic display of status and analogue parameters monitored, as well as trend screens, must be provided as detailed below. Minimum guidelines are given below and allowance must be made within the tender price for liaison with the client and Engineer in this regard. The System Integrator (if separate entity) must make themselves familiar is familiar with the Employer's standards, requirements and software configuration and no claims for additional payment in this regard will be entertained.

Plant Status/Signal	Graphic Depiction / Position	Colour
Telemetry door	Outstation Housekeeping Block	Red when open, else grey
Power failure	Outstation Housekeeping Block	Red on failure, else green
Communication failure	Outstation Housekeeping Block	Red on failure, else green
Pump/Blower/Mixer Equipment	**In process sequence**	
• CB On/Off/Trip	• Below equipment	• Off: White, Trip: Red
• Manual/Off/Auto	• Below equipment	• Healthy: Yellow
• Run	• Visual colour	• Green
• Common Fault	• Visual colour	• Red
• E-Stop	• Pop-up	• Red
Reservoir Levels	**In process sequence**	
• Reservoir level display	• % on reservoir	• Black on white
• Reservoir dimensions	• Height (m)	• Black on white
• Start/stop levels	• On reservoir	• Black on white
• Low and High levels	• On reservoir	• Red
• Enable levels	• On reservoir	• Red
Flow	**Flow meter in piping**	
• Flow rate	• l/s or m^3/hr, at sensor	• Black on white
• Totalised flow count	• m^3, at sensor	• Black on white
• High flow (limit)	• Block around values	• Red
Pressure	**Pressure sensor in piping**	
• Analogue display	• Bar, at sensor	• Black on white
• High Pressure (limit)	• Block around values	• Red
Temperature	**Motor winding / bearings**	
• Winding analogue	• °C, at motor	• Black on white
• High Temp (limit)	• Block around values	• Red
• Motor bearing analogue	• °C, at motor (DE/NDE)	• Black on white
• High Temp (limit)	• Block around values	• Red
• Pump bearing analogue	• °C, at pump (DE/NDE)	• Black on white
• High Temp (limit)	• Block around values	• Red

Provision must be made in the graphical presentation to the Client for an iterative back and forth approval process. Provision must be made in the design stage for a three-stage approval process, including presentations and face to face meetings with the Client.

4.8 TRENDING

Each analogue value, by clicking on the value, must produce a pop-up screen that shows a trend of that specific tag. The general trend page (applicable to all sections), must be provided with scalable functionality, to enable the operator to select the viewing period. Note that level 1 access is adequate for this section.

Each sub-section page, whether it be a pump station or section of plant, must be provided with a trending push-button, which creates a separate pop-up, to a trending page that depicts all the main components from that specific sub-section page. At a pump station for example, the following must be shows, each with a dedicated colour and description at the bottom:

- Pump Run
- Pump Trip
- Reservoir Level
- Pump Flow
- Pump Pressure

Additional trend screens must be created where (including but not limited to):

- The operator will be able to see the raw water inflow, the main lift pump station outflow and calculated plant wastage flow, all on the same screen. Each analogue parameter must be clearly distinguishable and the screen must display monthly data, with the previous history averages summarised in tabular format, for system and process efficiency analysis;
- All the filters' backwash sequences are plotted next to one another, to indicate when a sequence has started and stopped. This will assist the operators in analysing and modifying their spacing and programming of when to backwash the filters;
- As the chemical and chlorination dosing will be manually adjusted according to the set flow of the plant, the operator must be able to monitor the inflow of the plant versus the dosage rates of the dosing and chlorination systems. Therefore, at, for example, a certain time within a certain day, the inflow will be x and the operator will be able to analyse what the various dosage rates were for each of these chemical dosing sections. Seasonal process adjustments can then be made more accurately, if and when required;
- All the reservoirs within the bulk water scheme (Clearwater reservoir included) must have their analogue values displayed on one screen, in order to assess the balancing of the scheme as a whole, including being able to call up the trending data of previous months, for a more detailed comparison.
- All high lift pumps, per site, are trended against one another, per analogue process variable (ie, bearing temperatures, vibrations, pressure per duty pump, flow per duty pump, etc).

The Engineer and Client reserve the right to request or amend pages during the working drawing stage and the contractor must make provision for these changes as part of the tender offer (3 iterations as a minimum).

4.9 REPORTING

A front-end reporting software package must further be provided as part of the tender offer. The software must also run on the main central server, with all required reports to be designed, modified through an iterative approval process and automatically provided to the client on a monthly basis.

The tender offer must include all required software and licencing up-front costs, as well as covering the licence costs for a period of two years after taking over has been established. The contractor must further sate in the Bill of Quantities what the applicable licencing costs are per year, as a rate, to enable the client to properly budget for this cost in their up-coming financial years.

The reports are generally taken a few steps further in terms of detailed information and complexity than the additionally requested trend screens, as stated above. The reports must indicate daily, monthly and yearly data, they must consist of graphs, bar-charts and must be structured in such a way so as to include dates, introductions, purpose of the report and provide technical summaries.

As part of this scope of works, the contractor must make provision for the following types and amounts of reports, with provision for further reports to be requested by the client during construction stage:

- Plant total flow reports, taking into account the raw water inlet, pumped water out and backwash/waste water. These values must be processed to provide total wastage of the plant, incorporating filter backwash and desludging frequency.

- Bulk water scheme balance report, indicating how many times the pumps at each pump station starts, how the pumping cycles and the levels of the reservoirs coincide with one another and a general view on the balance of the system.

- Bulk sewage scheme balance report, indicating how many times the pumps at each pump station starts, how the pumping cycles and the levels of the sumps change and a general view on the balance of the system.

- Generator usage report, highlighting the amount of times the generator has run, what the fuel usage is and how the plant is adapted to when the generator runs (limited inflow to the plant, main pump flow delivery, other interlock statuses as per Section 3)

Note that provision must be made for an additional three reports which the client will detail during the construction stage of the project. The reports will consist of nominally the same amount of information and calculations as per the three reporting requests above.

4.10 ANCILLARIES

Any ducting, power-skirting and power supply points required for the creation of the new central SCADA station must be provided for as part of the offer. Assume that single phase power is available at a Local DB.

A L-shape operator table must be provided, complete with executive swivel chair.

The wall-mounted displays must be mounted by means of adjustable brackets, to adjust tilt and rake.

5. GENERAL

All preliminary and general matters must be referred to Section 1 for detailed descriptions and requirements, in-line with the Main Contractor's tender offer.

Additional and specific items are detailed below.

5.1 TESTING AND COMMISSIONING

Provision must be made for a fully automated factory test at the premised of the MCC manufacturer, before site implementation can commence. Only after the system has been functionally tested and found to be in-line with the specification can the site work commence.

Site commissioning not only relates to installation and testing of the system on-site, but also to running and optimising of the system in-line with the general requirements as set-out in the general project specifications.

Note that all drawings, approvals, construction, testing and site commissioning must be in accordance with the program of the Main Contractor. It remains the responsibility of the specialist sub-contractor to confirm said program and fall in-line accordingly.

5.2 MANUALS

Note the general project specifications relating to all manuals requirements. Further note the detailed layout that must be included at each telemetry outstation, as detailed in 2.3 above.

The following items must specifically be included:

- Overall system layout (graphical)
- I/O schedules
- Wiring diagrams (with applicable I/O descriptions)
- Cable and connection schedules
- Software I/O configuration
- Technical hardware description

- SCADA screenshots
- Trending examples, including specific requests

5.3 TRAINING

Note the general project specifications relating to the training and induction of operators. Part of this offer must include the training of the various levels of applicable operators and managers on the system. The Contractor must liaise with the Client to determine who the applicable parties are that will be a part of the system.

Training must encompass a continual process of demonstration and supervision, against signed training registers for all applicable members.

STANDARD SPECIFICATION

SSE05 – GENERATORS

INDEX

1 GENERAL REQUIREMENTS

2 BROAD SCOPE

3 SET OUTPUT

4 ENGINE

5 ALTERNATOR

6 SWITCHBOARD AND CHANGEOVER SYSTEM

7 CANOPY

8 COMPLIANCE

9 TESTING

10 TRAINING, DRAWINGS AND MANUALS

11 MAINTENANCE

1. GENERAL REQUIREMENTS

This section of the contract covers the supply, delivery, rigging, installation, detailed commissioning, taking-over and maintenance inspections for standby generating sets, by a dedicated specialist supplier.

This project's scope of works is summarised as follows:

- Refer project specifications.

2. BROAD SCOPE

The standby generating set will act as a back-up in the event of a power failure and must automatically transfer the load between mains and emergency power. The set must be able to run the full electrical load as stated and the design and sizing of the set, by the specialist supplier, must accommodate all load and site factors.

The complete set, which relates to the engine, alternator, coupling, cooling, fuel, canopy and control system, must be capable of producing the specified output, continuously, without overheating. In addition, the set must be able to run at 110% capacity for one hour every 12 hours in compliance with BS5514.

The engine and alternator must be flange-mounted, via a high-quality coupling, to operate as a unit on a common frame, complete with anti-vibration mountings. The frame must be of the duplex type. A drip tray must be provided (removable), slope to one side, to catch any spills. The fuel tank must be designed within this common frame.

All paintwork and material selection must be specifically designed for the intended application, including storage of fuel and coming to contact with fuel and oils. Due to the close proximity to the see, the generator base, fuel tank, canopy and any and all exposed material must be suitable for both corrosive environments, as well as treated and provided with a protective coating as an additional protective layer.

3. SET OUTPUT

The generating sets must have an output of 400/231V at 50Hz. The output must be constant and be capable of handling the loads as indicated below, as well as taking the starter types into consideration.

The estimated site load is as follows:

- Refer project specification motor load and starter-type requirements

The estimated site conditions are as follows:

- Altitude: 2m above sea level
- Temperatures: 0°C - 40°C

The final sizing and design of the set configurations must be done by the specialist supplier with the responsibility of the set performance and compliance being that of the Contractor.

Note that the values given are nominal at tender stage and the generating set must be sized according to the **actual** equipment offered and verified site conditions. The load is mostly motors (inductive) and starting characteristics must be taken into account to prevent a voltage output dip of no lower than 370V.

Any de-rating for the site conditions must be included in the set sizing and clarified at tender stage. This includes possible compensation for harmonics generated by the VSDs.

4. ENGINE

4.1 General

The engine must run at a speed not greater than 1500rpm, operating on the internal combustion principle by means of atomic injection and compression ignition type.

The set must be started by means of an electric starter and must be able to be started from cold, taking the full load, in one step, within 15 seconds. Water-cooled machines must compensate for freezing conditions by means of suitably sized heaters, thermostatically protected, and supplied directly from the switchboard via a CB.

The battery system must be of the lead-acid, heavy-duty, low-maintenance type, specifically designed for this cold-start, high torque application. It must further be sized to attempt three cold starts before providing a generator start fault indication. The battery (single or more) may be no smaller than 120Ah and must be housed in a lockable battery enclosure, out of the way of any potential engine spill onto the unit.

The battery charger must be housed within the switchboard, fed from the mains or alternator and generally be purpose-built to provide an optimal trickle charge to battery to both prolong the life of the battery and maintain the output and voltage of the battery set. Battery charger status and fault must be monitored.

4.2 Engine Management and Protection

The engine and associated components must be protected against all possible means of failure, with output monitoring to suit. There are two distinct and acceptable management means, either by means of an integral Engine Control Unit (ECU), or discrete via dedicated and dispersed sensors, switches and other gauges required for full protection and operational feedback.

Although the ECU is preferred, a simpler and more robust digital offer will also be accepted, provided that no functionality not protection features are compromised.

The speed of the engine must be by means of a governor and the speed variation may be no more than 4% between no- and full load.

Individual component protection, with engine cut-out and distinct controller display, must be provided for:

- Oil level and pressure, as well as cut-out
- Radiator level, with warning and cut-out
- Over-temperature

- Over-speed

4.3 **Cooling**

Both air and water-cooled sets can be offered. In either case, adequate protection against over-heating must be provided for with corresponding fault indication at the controller.

Water-cooled sets must further be protected against low water level by means of a separate warning and cut-out switches. This can either be via an analogue signal programmed at two separate setpoints, or digital signals from specific cut-out switches.

All required cooling ducting must be provided for and care must be taken in the design that no exhaust air can be re-circulated back into the cooling air supply. Removable air filters must be included in the design of the set.

4.4 **Fuel and Lubrication**

The fuel system must be suited for normal available fuel in Zambia. The fuel tank must be housed within the set's common mounting frame, sized for at least 12-hours standby time at full load.

The fuel tank must be sloped to one single point and provided with a drainage point at least 150mm above ground level, by means of a lockable ball valve and threaded plug. The fuel tank must be provided with dedicated access for re-fuelling, the fuel pump supply as well fuel level monitoring. Both fuel level analogue level as well as low level cut-out, by means of a switch must be provided. A low fuel warning must be programmed in the controller and made available for remote monitoring.

Both a hand re-fuelling pump, as well as electrical fuel pump must be provided. All required brackets as well as fuel pump control must be provided for in the controller. A 3m hose, with non-return valve and stand-pipe, must be provided for re-fuelling purposes. The fuel system must be equipped with the necessary removable filters, and interconnecting pipework must be by means of armoured, flexible tubing.

Lubrication of bearings and other moving parts must be by means of a dedicated force-feed system, complete with removable filters and pumping action for priming purposes. The lubrication status (level and pressure) must be made available, with separate low level cut-out protection visible on the controller.

4.5 **Exhaust System**

The exhaust system must be directed up and outward, preventing any rain ingress. It must be provided with a silencer, with the exhaust system suitably cladded to prevent heat and noise transfer. The exhaust system must further be flexibly connected to the engine to prevent the transfer of vibrations. All material to be SS316 or similar and equal.

5. **ALTERNATOR**

The alternator must be of the self-excited, brushless type, in a ventilated, drip-proof housing. It must be capable of running continuously at full load without exceeding permissible temperature rise of either the stator or rotor.

The windings must be fully impregnated for a 'tropical climate' and must have oil resisting finishing varnish. Overheat protection, by means of thermistors in the windings, must be provided for, with winding insulation being of the 'Class H' type. The alternator neutral must solidly be connected to the switchboard earth bar.

The alternator must be self-regulating within a range of no more than 5% of the nominal output, at a power factor of 0.8. The excitation system must be designed for rapid voltage recovery after the application of a sudden full load.

Individual component protection, with cut-out and distinct controller display, must be provided for:

- Winding over-temperature
- Overload (controller setpoint)

6. SWITCHBOARD AND CHANGEOVER SYSTEM

The switchboard offered must be SANS compliant, with provision made to house the controller and all other control gear. A dedicated separate section must be provided for the change-over mechanism and CBs.

The general switchboard requirements as set out in the electrical section 3 above are applicable to this section as well. This includes alarm notice, E-Stop various labels as well as earth bar labelled EARTH, pre drilled for at least 6 possible connections.

Dedicated voltage free contacts must be provided for relaying the following status information to the telemetry system:

- Fuel level (4-20mA)
- Low fuel warning
- Low fuel cut-out
- Generator common fault
- Generator run
- Mains failure
- Set selector switch (Man/Off/Auto/Test)
- Battery voltage
- Battery or charger fail

The controller must be mounted on the generating set switchboard and must be of the Lovato or Deep Sea type. Only values or feedback from the set not seen on the main display of the controller must be provided for as analogue instruments on the switchboard door.

The switchgear layout must be such that sufficient space is made available for cable connections, glanding and the mounting of CTs. The following switchgear, all suitably

rated in line with the full load requirements, must be provided in a dedicated section of the switchboard:

- Alternator CB
- Mains CB
- Load CB
- Mechanically and electrically interlocked change-over mechanism similar or equal to the Socomec type, with door-protruding handle.

All CTs, wiring and mains sensing must be provided for, connected to the controller. CBs must be of the moulded case type, adjustable and complete with over-current and short-circuit protection.

The change-over mechanism must be able to detect a mains failure, break the normal supply before making connection to the generating set, and vice-versa. At no point may it possible to connect the mains and generator supply onto the same point.

The following system control must be available from the controller, integrated with the switchgear listed above:

- Off: the set is completely isolated, cannot start-up and safe for cleaning purposes
- Test: the set can be started and stopped, but cannot be switched onto the load, even with a power failure occurring
- Manual: the set must be started and stopped on the controller by means of dedicated buttons. A two-action process is however required transferring the generator to the load. The first step would be to start the set with the second step being the transfer of the load onto the generator. The stopping process must be the same, but in reverse.
- Auto: the set must start automatically when a power or phase failure is detected, and stop after normal power has been restored. Mains sensing must be done on the incoming normal CB side. Delay timers must be provided for both the starting and stopping scenarios, to prevent unnecessary starting and/or stopping of the set. Only after this time delay must the generator start or stop and the changeover switch operate as required. An additional cooling period must be provided for, after the changeover switch is back on normal power, for the set to cool down. Should another power failure occur in this period, then the set must stop the cooling period and proceed as if from cold.

7. CANOPY

The complete generating set as described above must be housed within a lockable, weatherproof canopy. The canopy must be made from SS316, with a minimum thickness of 1.8mm.

The canopy must comply with the following main criteria:

- Sloped roof, with lifting lugs
- Removable and lockable panels/doors, with at least handles and adequately numbered and sized to easily access any section of the generator

- Prevent any rainwater ingress onto the doors by means of channel or other diversion mechanism
- Provision for all louvres, exhaust, cable access and sound attenuation material.

This outdoor generating set must be sound attenuated to measure no more than 60dBA at 5m from the set, running at full load. Fire-proof attenuating material must be utilised only.

8. COMPLIANCE

Compliance to all local, national as well as health and safety requirements must be adhered to. This relates to signage and warning labels, fire extinguishers, material and design selection as well as equipment spacing.

Any deviations required from the specification must be fully itemised and costed for in the tender offer.

9. TESTING

The complete set must be tested at the manufacturer's premised by the Contractor, and confirmed in writing to the Engineer that the set is complete and compliant with the specification. The Engineer will then visit the factory to test the set, before it goes to site.

All protections must be simulated for operational correctness, change-over mains failure demonstrated and load testing data provided for full load and overload conditions.

10. TRAINING, DRAWINGS AND MANUALS

Refer section 1 of the project specifications for submission and compliance requirements.

11. MAINTENANCE

Provision must be made for two maintenance trips to site during the retention period of the contract, per generating set. The trips must be carefully coordinated with the responsible Client personnel, so they can be in attendance and witness.

The maintenance actions performed must include replacement of all required filters, checking and topping up oil levels, running a full diagnostic of the various components, run the set for an hour and provide a formal report to the Client as to the current state and run-time of the set.



The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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Meters 1:1000

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-09-27	ES	CD

REVISIONS

DESIGNED	AL	
DRAWN	ES	
CHECKED	CD	

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APPROVED

ENGINEERS: _____

DATE: 2021-10-27

APPROVED

CLIENT: _____

DATE: _____

CLIENT

LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT

CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE

LOCALITY PLAN

SCALE	SHEET
on A1 NOT TO SCALE	1 OF 1
CONTRACT No.	PROJECT No. 21108C

DRAWING No. 21108-C-000 REV A

COORDINATE SYSTEM: WGS84 / Lo19°



The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 60 120
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REVISIONS

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ENGINEERS: _____
DATE: 2021-10-27

APPROVED
CLIENT: _____
DATE: _____

CLIENT
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MUNISIPALITEIT MUNICIPALITY MASEPALA

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
EXISTING SERVICES LAYOUT

SCALE	SHEET
on A1 1:2000	1 OF 1
CONTRACT No.	PROJECT No. 21108C

DRAWING No. 21108-C-001 REV A

COORDINATE SYSTEM: WGS84 / Lo19°

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FITTINGS SETTING OUT DATA

ID	DIA	PART	Y	X
AV1	315mmØ	AIR VALVE	-82909.592	3740871.120
AV2	315mmØ	AIR VALVE	-82892.525	3740649.707
B1	315mmØ	22.5° BEND	-82925.735	3741053.950
B2	315mmØ	45° BEND	-82922.372	3741011.711
B3	315mmØ	45° BEND	-82913.938	3741004.880
B4	315mmØ	22.5° BEND	-82908.264	3740950.852
B5	315mmØ	22.5° BEND	-82914.216	3740930.764
B6	315mmØ	11.25° BEND	-82892.443	3740651.304
FH1	315mmØ	FIRE HYDRANT	-82923.559	3741026.621
WM1	315mmØ	METER	-82903.438	3741122.786

LEGEND
EXISTING SERVICES

- SEWER PIPE
- COVER LEVEL / INVERT LEVEL / DEPTH (22.45 / 20.50 / 1.95)
- SEWER MANHOLE
- WATER PIPELINE
- WATER METER
- WATER VALVE
- WATER FIRE HYDRANT
- COVER LEVEL / INVERT LEVEL / DEPTH (SW4 CL 233.93 IL 1 233.11 D1 0.82)
- STORMWATER DETAILS
- STORMWATER PIPE
- TREES
- EP ELECTRICAL POLES
- ELECTRICAL POWER LINES
- ELECTRICAL BOXES
- TELEPHONE LINE
- TP TELEPHONE POLE
- CONTOURS
- SERVITUDE

PROPOSED SERVICES

- WATER PIPE uPVC CLASS 12 315mmØ
- WM WATER METER
- FH FIRE HYDRANT
- AV WATER AIR VALVE
- WATER BEND
- TIE INTO EXISTING NETWORK

CONSTRUCT NEW PUMP STATION AS PER DETAIL DWG No. 21108-M-001

CONSTRUCT NEW 315mmØ CLASS 12 RISING MAIN FROM NEW PUMP STATION AT RESERVOIR 1 TO RESERVOIR 2

CROSS EXISTING ROADS BY MEANS OF HALF WIDTHS CONSTRUCTION

CONSTRUCT NEW PUMP STATION AS PER DETAIL DWG No. 21108-M-002

CROSS EXISTING ROADS BY MEANS OF HALF WIDTHS CONSTRUCTION

TIE INTO EXISTING RESERVOIR AS SHOWN ON DWG No. 21108-C-210

RESERVOIR 1

RESERVOIR 2

JANSENSINGEL STR

PIETERSEN STREET

AFRICA STREET

PADDY STREET

PADDY

NERINA STREET

MALVA STREET

SAAYMAN STR

RICHTER STR

JASMYN STREET

AFFODIL STREET

WATSONIA STREET

ORLEY STREET

NERINA

JONES STREET

PETUNIA STREET

BEGONIA

ROSTASTR

SONNEBLOM STREET

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Meters 1:1000

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ENGINEERS: _____
DATE: 2021-10-28

APPROVED
CLIENT: _____
DATE: _____

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MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
NEW 315mmØ RISING MAIN
FROM RESERVOIR 1 TO 2

SCALE	SHEET
AS SHOWN on A1	1 OF 1
CONTRACT No.	PROJECT No. C21108

DRAWING No. 21108-C-004-02 REV A

COORDINATE SYSTEM: WGS84 / Lo19°

FITTINGS SETTING OUT DATA

ID	DIA	PART	Y	X
B1	315mmØ	11.25° BEND	-83077.826	3740089.599
B2	315mmØ	45° BEND	-83046.834	3740080.579
B3	315mmØ	90° BEND	-83029.855	3740049.658
B4	250mmØ	90° BEND	-83109.862	3740113.558
B5	250mmØ	90° BEND	-83091.498	3740120.394
B6	250mmØ	22.5° BEND	-83077.177	3740091.008
B7	250mmØ	45° BEND	-83075.494	3740078.226
V1	250mmØ	ISOLATING VALVE	-83107.581	3740109.359
V2	250mmØ	ISOLATING VALVE	-83080.506	3740072.105
WM1	315mmØ	Water Meter Chamber	-83079.657	3740089.928

STORMWATER SETTING OUT DATA

MH ID	Y	X
HW1	-83081.913	3740138.688
MH1	-83085.836	3740126.837
SC1	-83095.039	3740110.384

LEGEND
EXISTING SERVICES

- SEWER PIPE
- SEWER MANHOLE
- WATER PIPELINE
- WATER VALVE
- FIRE HYDRANT
- WATER METER
- STORM WATER

LEGEND
PROPOSED SERVICES

- TIE INTO EXISTING NETWORK
- WATER PIPE uPVC CLASS 12
- WATER PIPE HDPE PE100 PN12.5
- WATER METER CHAMBER
- WATER VALVE
- B1 WATER BEND
- SW SCOUR PIPE CLASS 50D RC
- SW MANHOLE (MH)
- SW SCOUR CHAMBER (SC)
- SW HEADWALL
- CONTOURS

CONNECT TO EXISTING 200mmØ WATER MAIN AS SHOWN ON DWG 21108-C-207

REMOVE HUT AND REINSTATE

CROSS ROAD BY MEANS OF HALF WIDTHS CONSTRUCTION

PROVIDE INTERCONNECTION BETWEEN EXISTING AND NEW GRAVITY MAIN AS SHOWN ON DWG No 21108-C-212

CONSTRUCT NEW 315mmØ PVC-U CLASS 12 GRAVITY MAIN TO TOWN

EXISTING FENCE

RESERVOIR 3 TWL=298.3

TIE INTO EXISTING STEEL INLET PIPE TO EXISTING RESERVOIR

PROPOSED WATER CHAMBER AS PER DWG No. 21108-C-201

CUT TO FILL TO CONSTRUCT NEW RESERVOIR PLATFORM. REFER TO DWG No 21108-C-004-04 FOR DETAILS

PROPOSED DETOUR FOR FEED PIPE TO EXISTING RESERVOIR

PROPOSED SCOUR PIPE

PROPOSED TYPE 2 HEADWALL FOR SCOUR PIPE AS PER DWG No. 21108-C-208

PROPOSED 3Ml RESERVOIR AS PER DETAIL DRAWINGS No. 21108-S-002 & 21108-S-003

TWL=298.3

PROPOSED FENCE AS PER DWG No. 21108-C-209

VEHICLE GATE

PROPOSED FEED PIPE TO TIE INTO EXISTING FEED PIPE TO EXISTING RESERVOIR

MALVA STREET

MULLER STREET

MULLER STREET

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ENGINEERS:
DATE: 2021-10-28

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CLIENT:
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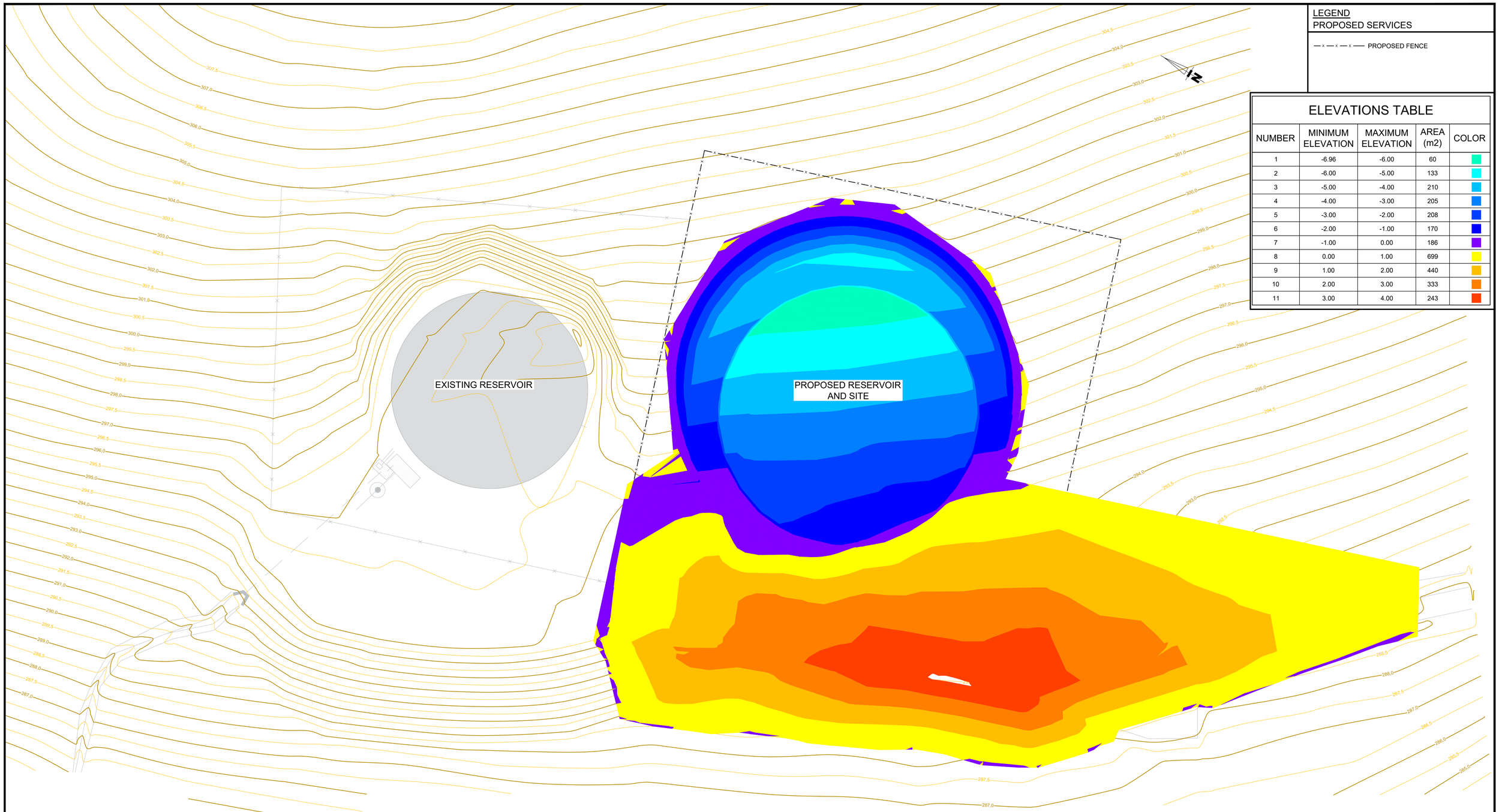
PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
PROPOSED RESERVOIR LAYOUT AND PIPING

SCALE	on A1	SHEET
1:500		1 OF 1
CONTRACT No.		PROJECT No. C21108

DRAWING No. 21108-C-004-03 REV A

COORDINATE SYSTEM: WGS84 / Lo19°



LEGEND
PROPOSED SERVICES

— x — x — x — PROPOSED FENCE

ELEVATIONS TABLE

NUMBER	MINIMUM ELEVATION	MAXIMUM ELEVATION	AREA (m2)	COLOR
1	-6.96	-6.00	60	
2	-6.00	-5.00	133	
3	-5.00	-4.00	210	
4	-4.00	-3.00	205	
5	-3.00	-2.00	208	
6	-2.00	-1.00	170	
7	-1.00	0.00	186	
8	0.00	1.00	699	
9	1.00	2.00	440	
10	2.00	3.00	333	
11	3.00	4.00	243	

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 30 60
Meters 1:1000

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	AL	CD

REVISIONS

DESIGNED	AL	
DRAWN	AL	
CHECKED	CD	

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APPROVED
ENGINEERS: _____
DATE: 2021-10-28

APPROVED
CLIENT: _____
DATE: _____

CLIENT
LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
PROPOSED BULK EARTHWORKS: CUT TO FILL BASED ON FGL

SCALE	on A1	SHEET
AS SHOWN		1 OF 1
CONTRACT No.		PROJECT No. C21108

DRAWING No. 21108-C-004-04 REV A

COORDINATE SYSTEM: WGS84 / Lo19°

LEGEND
PROPOSED SERVICES

— x — x — x — PROPOSED FENCE

ELEVATIONS TABLE

NUMBER	MINIMUM ELEVATION	MAXIMUM ELEVATION	AREA (m2)	COLOR
1	-7.74	-7.00	52	
2	-7.00	-6.00	127	
3	-6.00	-5.00	159	
4	-5.00	-4.00	181	
5	-4.00	-3.00	215	
6	-3.00	-2.00	204	
7	-2.00	-1.00	151	
8	-1.00	0.00	134	

EXISTING RESERVOIR

PROPOSED RESERVOIR AND SITE

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 30 60
Meters 1:1000

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A	ISSUED FOR TENDER	'21-10-25	AL	CD

REVISIONS

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DRAWN	AL	
CHECKED	CD	

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APPROVED
ENGINEERS:
DATE: 2021-10-28

APPROVED
CLIENT:
DATE:

CLIENT
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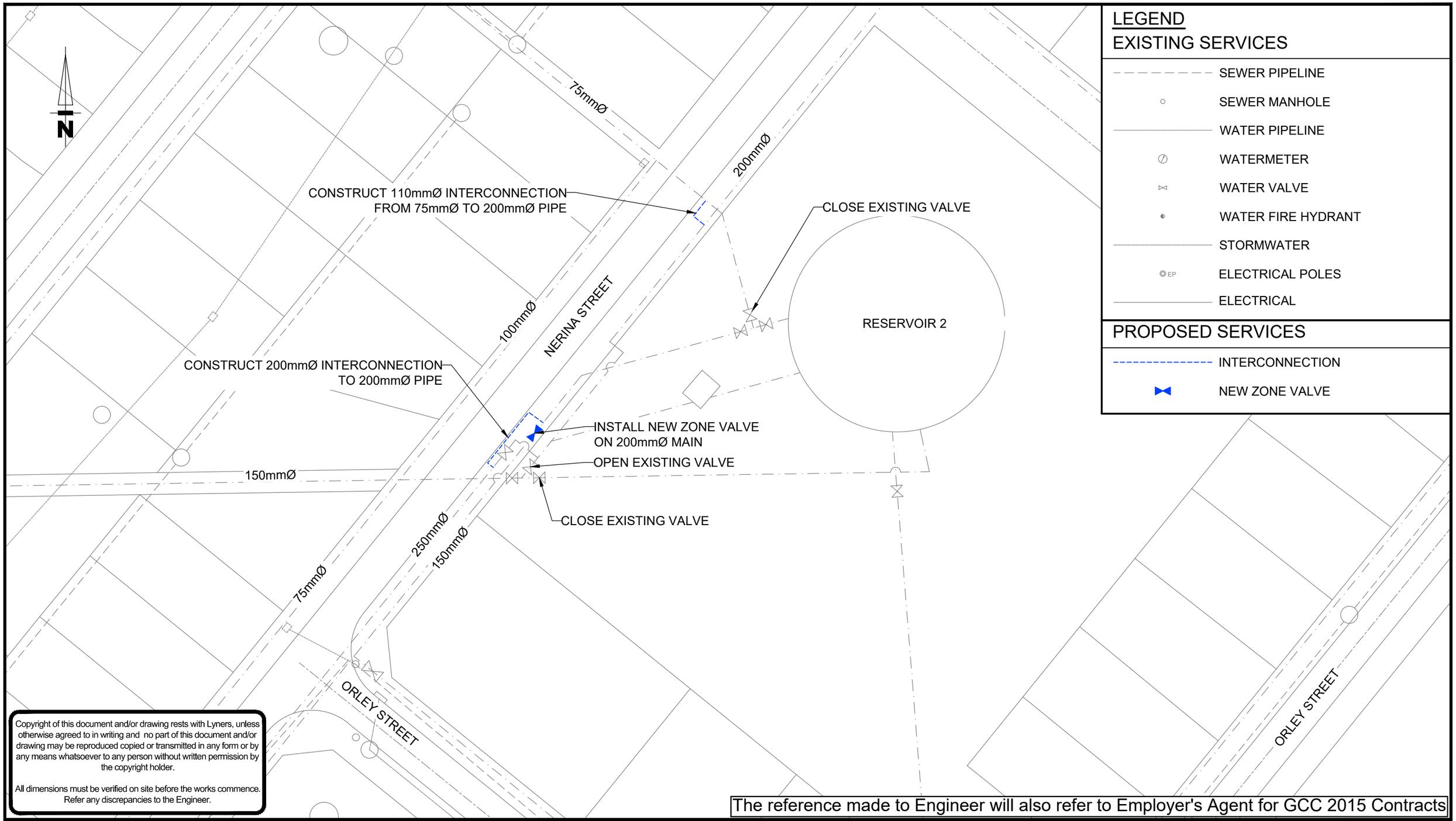
PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
PROPOSED BULK EARTHWORKS: CUT DEPTH TO RESERVOIR FOUNDATION

SCALE	on A1	SHEET
AS SHOWN		1 OF 1
CONTRACT No.		PROJECT No. C21108

DRAWING No. 21108-C-004-05 REV A

COORDINATE SYSTEM: WGS84 / Lo19°



LEGEND

EXISTING SERVICES

- SEWER PIPELINE
- SEWER MANHOLE
- WATER PIPELINE
- WATERMETER
- WATER VALVE
- WATER FIRE HYDRANT
- STORMWATER
- EP ELECTRICAL POLES
- ELECTRICAL

PROPOSED SERVICES

- INTERCONNECTION
- NEW ZONE VALVE

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

DESIGNED	CD	
DRAWN	ES	
CHECKED	CD	

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PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
PROPOSED ZONE AMENDMENTS
AT RESERVOIR 2

SCALE on A3: 1:500	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-004-06	REV: A
COORDINATE SYSTEM: WGS84 / Lo 19°	

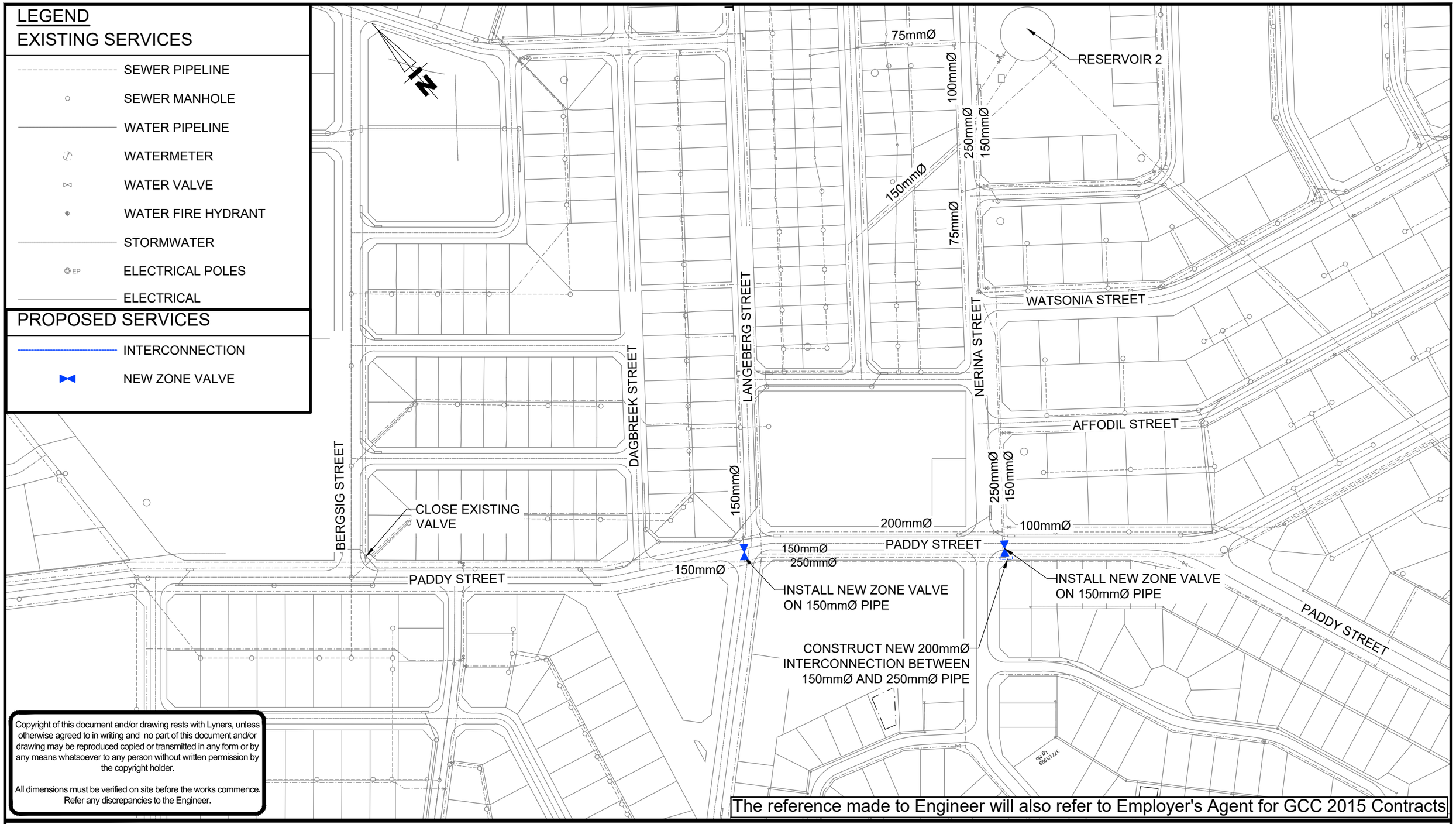
LEGEND

EXISTING SERVICES

- SEWER PIPELINE
- SEWER MANHOLE
- WATER PIPELINE
- WATERMETER
- WATER VALVE
- WATER FIRE HYDRANT
- STORMWATER
- EP ELECTRICAL POLES
- ELECTRICAL

PROPOSED SERVICES

- INTERCONNECTION
- NEW ZONE VALVE



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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

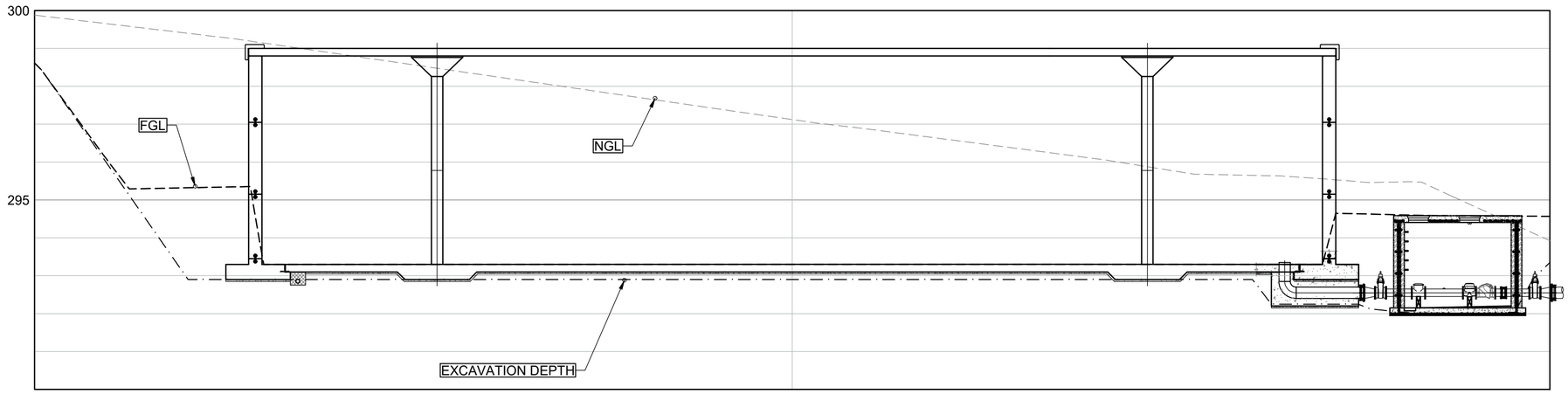
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DRAWN	ES	
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PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
PROPOSED ZONE AMENDMENTS
AT PADDY STREET

SCALE on A3 1:2000	SHEET 1 OF 1
CONTRACT No.	PROJECT No. C21108
DRAWING No. 21108-C-004-07	REV A
COORDINATE SYSTEM: WGS84 / Lo 19°	



SCALES:
Horizontal 1:500
Vertical 1:500

DATUM 290.000

SCALEBAR

0 3 6

Meters 1:100

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	2021-10-28	AL	CD

REVISIONS

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DRAWN	AL	
CHECKED	CD	

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APPROVED
ENGINEERS:
DATE: 2021-10-28

CLIENT

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MUNISIPALITEIT MUNICIPALITY MASIPALA

APPROVED
CLIENT:
DATE:

PROJECT

CONSTRUCTION OF 3M RESERVOIR
ROBERTSON

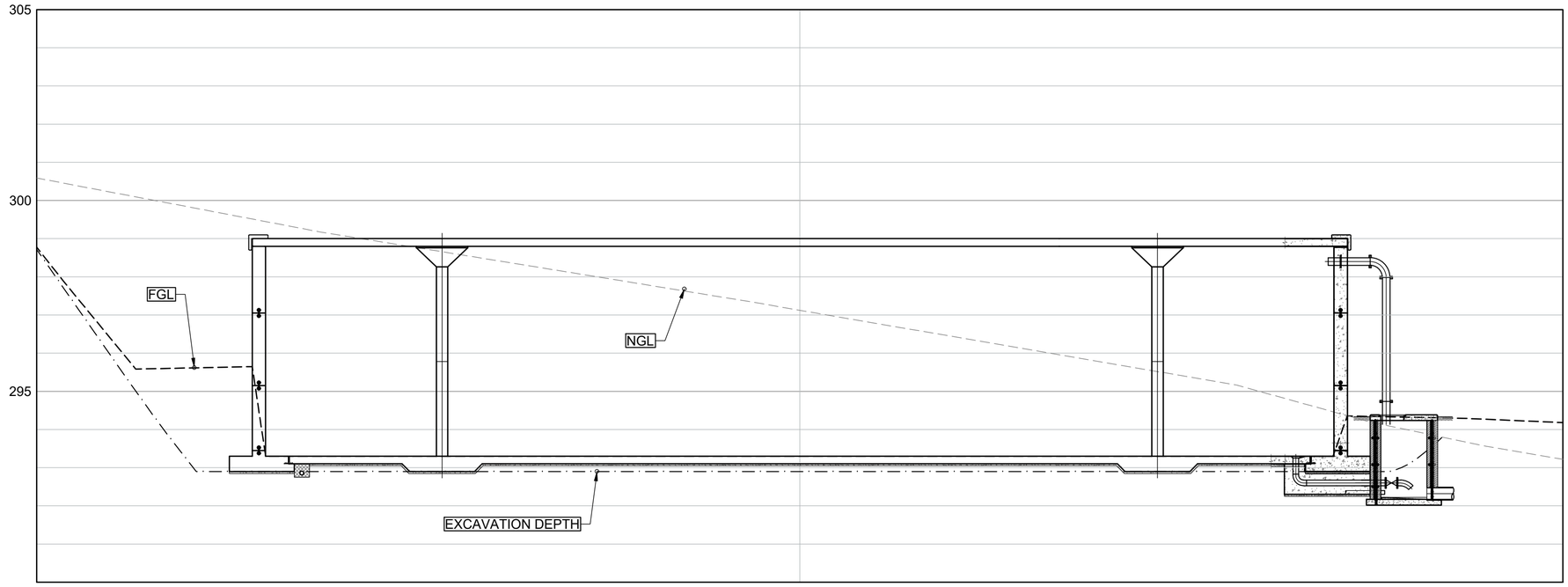
TITLE

OUTLET SECTION AT RESERVOIR

SCALE on A2	SHEET
1:100	1 OF 1
CONTRACT No.	PROJECT No.
	C21108

DRAWING No. 21108-C-004-10 REV A

COORDINATE SYSTEM: WGS84 / Lo19°



SCALES:
Horizontal 1:500
Vertical 1:500

DATUM 290.000

SCALEBAR

0 3 6

Meters 1:100

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	2021-10-28	AL	CD

REVISIONS

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DRAWN	AL	
CHECKED	CD	

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ENGINEERS:

DATE: 2021-10-28

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APPROVED

CLIENT:

DATE:

PROJECT

CONSTRUCTION OF 3M RESERVOIR
ROBERTSON

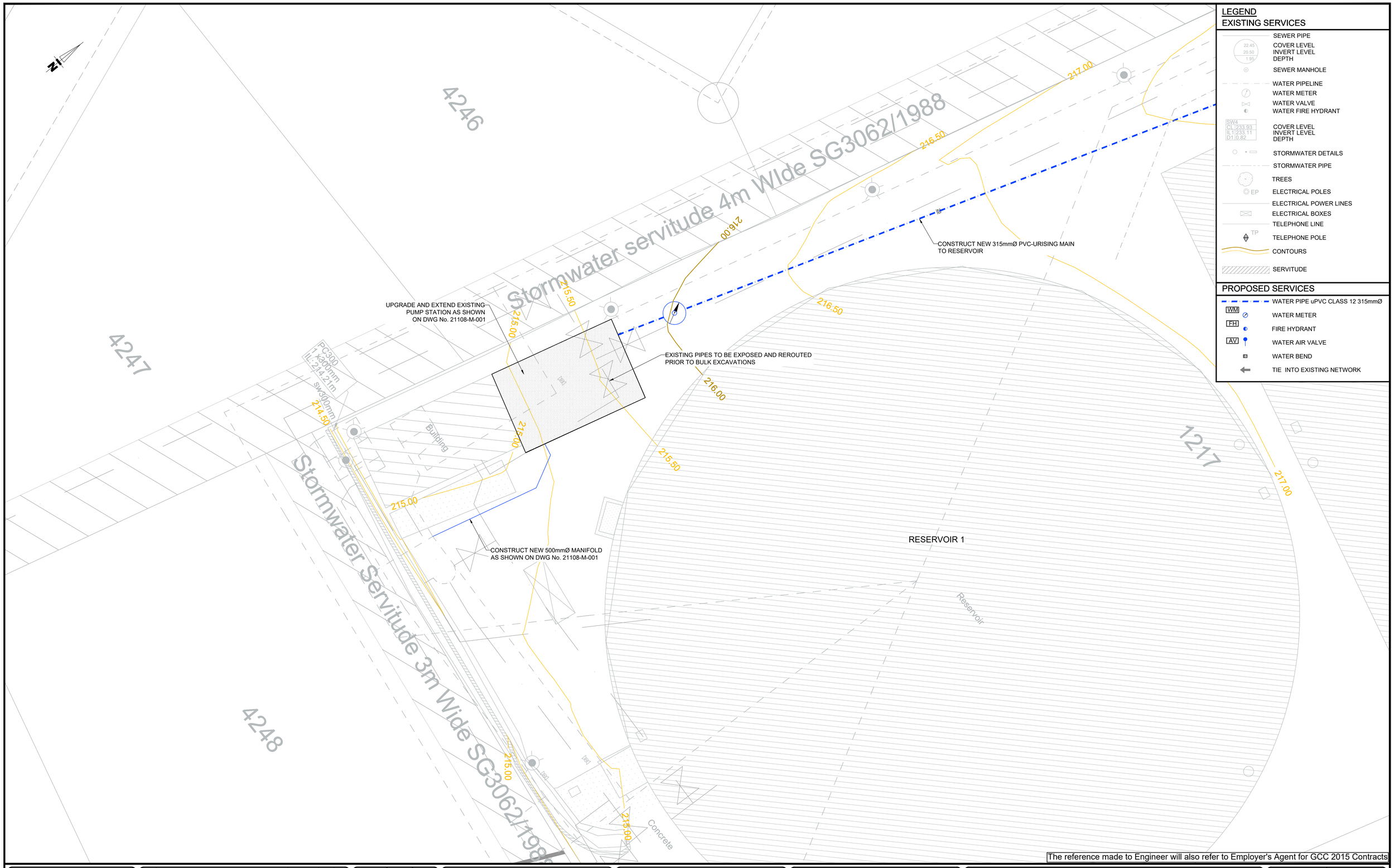
TITLE

SCOUR SECTION AT RESERVOIR

SCALE on A2	SHEET
1:100	1 OF 1
CONTRACT No.	PROJECT No.
	C21108

DRAWING No. 21108-C-004-11 REV A

COORDINATE SYSTEM: WGS84 / Lo19°



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SCALEBAR
0 3 6
Meters 1:100

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

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ENGINEERS: _____
DATE: 2021-10-28

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DATE: _____

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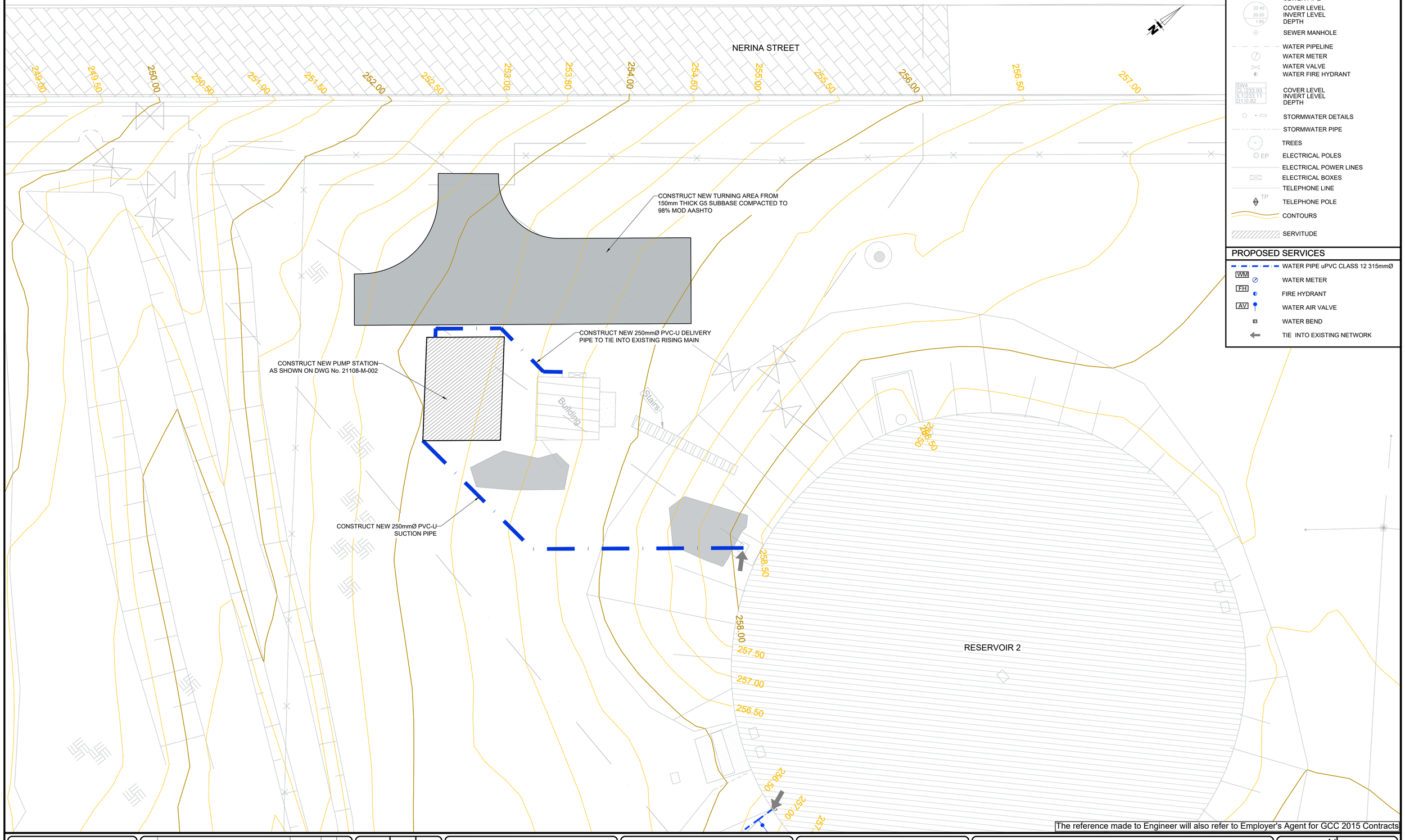
PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
LAYOUT AT RESERVOIR 1

SCALE	on A1	SHEET
1:100		1 OF 1
CONTRACT No.		PROJECT No. C21108

DRAWING No. 21108-C-007-01 REV A

COORDINATE SYSTEM: WGS84 / Lo19°



LEGEND

EXISTING SERVICES

- SEWER PIPE
- COVER LEVEL / INVERT LEVEL / DEPTH (22.45 / 20.50 / 1.95)
- SEWER MANHOLE
- WATER PIPELINE
- WATER METER
- WATER VALVE
- WATER FIRE HYDRANT
- COVER LEVEL / INVERT LEVEL / DEPTH (SW4 CL 233.93 IL 233.11 D1 0.82)
- STORMWATER DETAILS
- STORMWATER PIPE
- TREES
- EP ELECTRICAL POLES
- ELECTRICAL POWER LINES
- ELECTRICAL BOXES
- TELEPHONE LINE
- TP TELEPHONE POLE
- CONTOURS
- SERVITUDE

PROPOSED SERVICES

- WATER PIPE uPVC CLASS 12 315mmØ
- WM WATER METER
- FH FIRE HYDRANT
- AV WATER AIR VALVE
- WATER BEND
- TIE INTO EXISTING NETWORK

SCALEBAR

0 3 6

Meters 1:100

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A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

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DRAWN	ES	
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APPROVED

ENGINEERS: _____

DATE: 2021-10-28

APPROVED

CLIENT: _____

DATE: _____

CLIENT

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PROJECT

CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE

LAYOUT AT RESERVOIR 2

SCALE	on A1	SHEET
1:100		1 OF 1
CONTRACT No.		PROJECT No. C21108

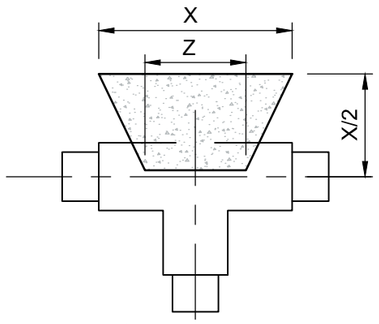
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COORDINATE SYSTEM: WGS84 / Lo19°

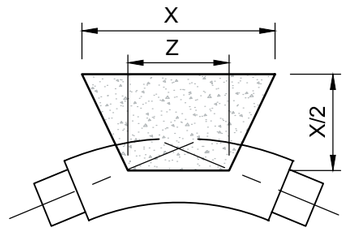
The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

NOTES:

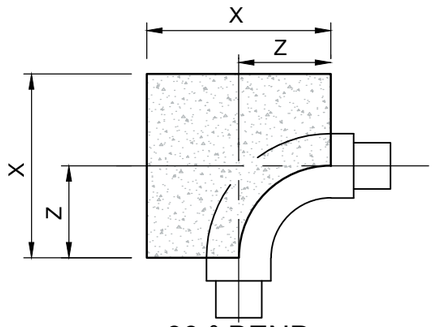
1. THRUST BLOCKS TO BE SYMMETRICAL TO THE CENTRELINES OF THE PIPES AND FITTINGS.
2. ALL ADDITIONAL EXCAVATION REQUIRED FOR THE CASTING OF THRUST BLOCKS IS REGARDED AS TRENCH EXCAVATION. THE RATES MUST INCLUDE THESE COSTS.
3. THRUST BLOCKS TO BE CAST AGAINST UNDISTURBED EARTH.
4. ALL CONCRETE TO BE CLASS 20/19.
5. ALL GALVANIZED BENDS TO BE PLAS-COATED WITH PPA 571 HES



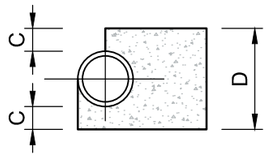
T - PIECE AND END CAP



22,5 ° AND 45 ° BENDS



90 ° BEND



TYPICAL CROSS-SECTION

DIMENSIONS OF THRUST BLOCKS IN SOIL WITH MAX.HOR. BEARING CAPACITY OF 55 kPa (SOFT CLAYS)				
PIPE DIA	X	D	Z	C
		T - PIECE		
300	1950	1200	550	450
250	1475	900	425	325
200	1300	800	350	300
150	1000	600	275	225
100	650	400	200	150
		22,5 ° BEND		
300	1200	1000	375	350
250	900	700	350	225
200	700	600	325	200
150	600	500	275	175
100	400	300	175	100
		45 ° BEND		
300	1150	1200	375	450
250	1125	900	350	325
200	1000	800	325	300
150	750	600	275	225
100	500	400	175	150
		90 ° BEND		
300	2550	1300	575	500
250	1890	1000	500	375
200	1640	900	475	350
150	1210	700	400	275
100	740	500	250	200

DIMENSIONS OF THRUST BLOCKS IN SOIL WITH MAX.HOR. BEARING CAPACITY OF 150 kPa				
PIPE DIA	X	D	Z	C
		T - PIECE		
300	1000	1000	550	350
250	900	800	450	275
200	700	600	350	200
150	600	500	275	175
100	400	300	200	100
		22,5 ° BEND		
300	650	600	375	150
250	600	450	350	100
200	500	350	325	75
150	400	250	275	50
100	300	150	175	25
		45 ° BEND		
300	950	800	375	250
250	800	650	350	200
200	600	550	325	175
150	550	350	275	100
100	350	250	175	75
		90 ° BEND		
300	1300	1100	575	400
250	1100	950	500	350
200	900	750	475	275
150	700	550	400	200
100	500	400	250	150

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'21-09-30	ES	CD

REVISIONS

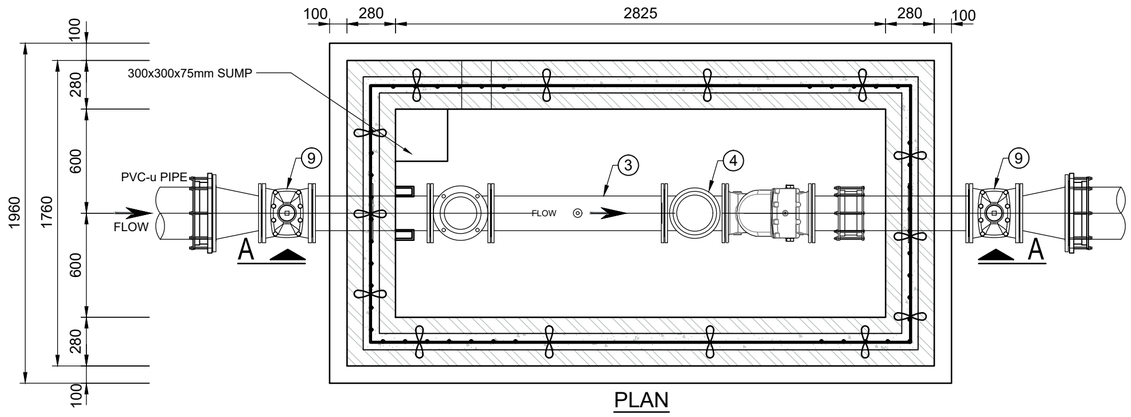
DESIGNED	AL	
DRAWN	ES	
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PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

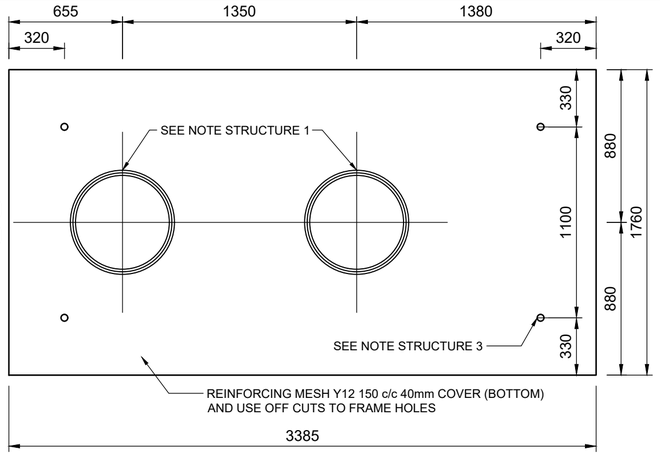
TITLE
TYPICAL DETAIL OF WATER THRUST BLOCK

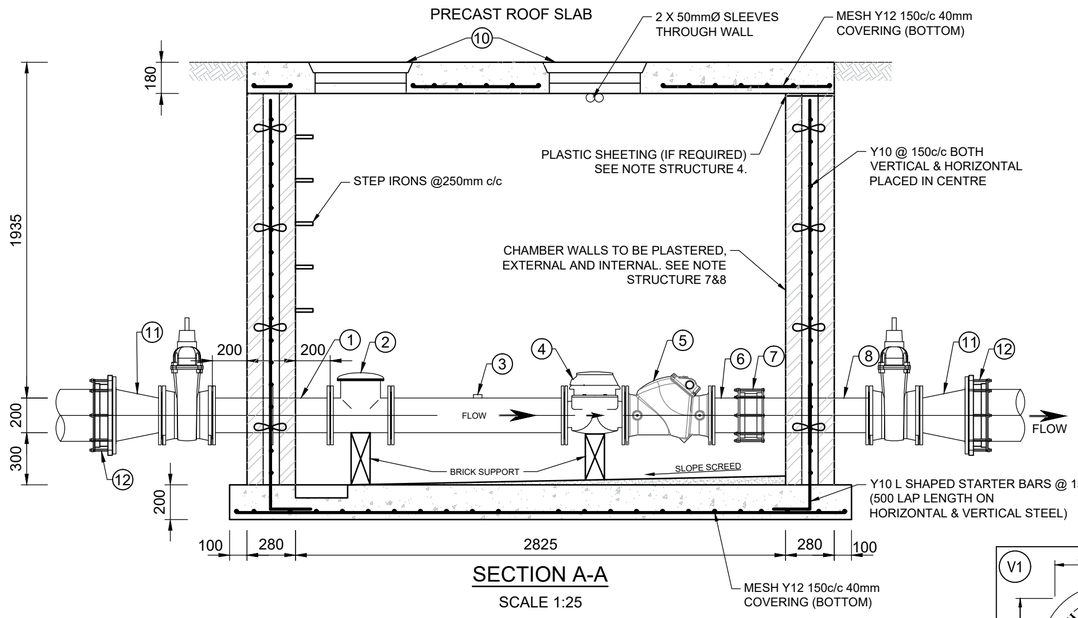
SCALE on A3: AS SHOWN	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-200	REV: A
COORDINATE SYSTEM: WGS84 / Lo 19°	



PLAN

SCALE 1:25

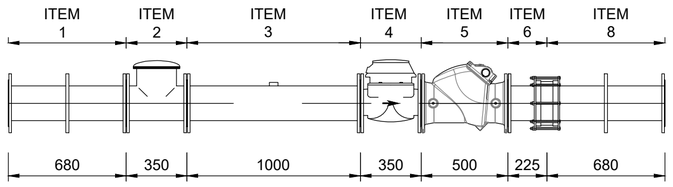




SECTION A-A

SCALE 1:25

INSET "A"



SCALEBAR

0 15 30

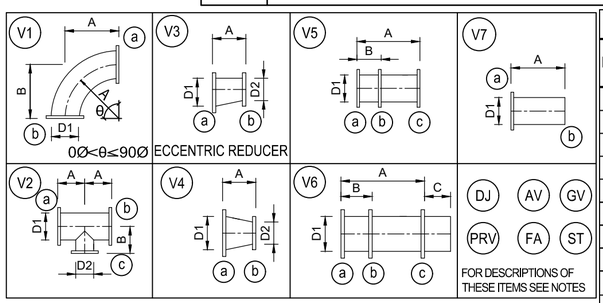
Meters 1:500

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DESCRIPTION OF COUPLINGS AND VALVES	
SHAPE	DESCRIPTION
FA1	KLAMFLEX BLACK COUPLING TO SUIT STEEL PIPES,
SV	AVK SWING CHECK VALVE, FLANGED\PN16\T16
WM	WATER METER, FLANGED\16 ELSTER KENT H4000 COMBINATION METER
ST	ELSTER KENT IN LINE STRAINER OR SIMILAR APPROVED.
SPL	SPOOL PIECE WITH PRESSURE NIPPLE & 25mmØ BALL VALVE
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, ANTI-CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 16 BAR AVK 02/20 OR SIMILAR APPROVED
FA2	KAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC-U PIPES

LEGEND	
□	EXACT LENGTH TO BE DETERMINED ON SITE
x	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED



NOTES: PIPEWORK

1. Steel and stainless steel pipes shall comply with the following.
a) Stainless steel pipes shall be Grade 304 and shall comply with ANSI B36.19m Schedule 10S.
b) Mild steel pipes up to 150mmØ shall be seamless, medium class steel pipes manufactured in accordance with SANS 62.
c) Mild steel pipes of 200mmØ and greater shall be manufactured in accordance with SANS 719 shall be Grade C pipe material and the wall thickness shall be in accordance with Table 2, Column 3 of SANS 719.
d) Flange drilling shall be in accordance with SANS 1123:Table 1600/3.
2. Dimensions of all pipes, fittings, valves, etc must be submitted for approval on a shopdrawing before any material is ordered
3. Step irons to be Calcamite-type or approved equivalent
4. All structural concrete shall be 30MPa/19mm concrete, unless stated otherwise on drawing with minimum 40mm cover for reinforcing
5. All steel pipe work or fittings buried in the ground shall be externally protected by a wrapping system the specification for the wrapping system is as follows:
a) Clean surface to required standard (minimum preparation ST2 according to SI6 055900-1967)
b) Brush or spray denso priming solution or denso S105 paste denso mastic to create profile for denso tape, so as to ensure that there are no air voids forming beneath the denso tape
c) Denso tape (petrolatum tape) wrapped spirally around prepared area
d) Double wrap polyethelene tape (minimum 300 Micron thick)
6. SABS approval certificates of all coatings to be delivered to the engineer for approval
7. Mild steel pipes shall be coated with three layers of Carboguard 891, 125 Micron dry film thickness (dft) per layer
8. Backfilled material compacted to 93% MOD AASHTO (100% for sand) unless otherwise specified
9. Only ss 316L nuts and bolts with anti seize compound may be used

NOTES GENERAL :

1. All dimensions shown on this drawing shall be verified by the contractor in order to ensure that on-site requirements are met. Dimensions may vary depending on the type and make of items such as valves. Any discrepancies must be reported to the engineer prior to the ordering of any materials
2. A calibration certificate must be submitted to the Engineer for each water meter

NOTES STRUCTURE :

1. Ductile iron cover frames to be placed over water meter and strainer.
2. Cut & Bend mesh to suite cover opening & sump
3. Provide 4no. 40 mmØ lifting hole in roof slab[Plugged with bitumen after roof slab is in place to prevent water seepage]
4. Plastic sheeting 375 micron embossed D.PC. SABS 952\1962 Type B to be placed on walls before placing roof slab in place and seal internal and external joints with Sikaflex-Pro 2HP
5. Concrete Grade 25/19MPa for floor and roof slabs
6. Avoid placing the meter chamber in the road and entrance wherever possible
7. Chamber walls to be plastered external and internal (Plaster 13mm thick, steel toweled to smooth surface)
8. External plastered walls to be coated with 2 coats Duraslurry [ABE]

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges a	Flanges b	Flanges c	Quantity
1	▲V5	200	-	620	310	-	-	x	x	x	1
2	ST	200	-	-	-	-	-	x	x	-	1
3	SPL	200	-	1000	-	-	-	x	x	-	1
4	WM	200	-	-	-	-	-	x	x	-	1
5	SV	200	-	-	-	-	-	x	x	-	1
6	▲V7	200	-	225	-	-	-	x	-	-	1
7	FA1	200	-	-	-	-	-	-	-	-	1
8	▲V5	200	-	620	310	-	-	x	x	-	1
9	GV	200	-	-	-	-	-	x	x	-	2
10	600mm Ø,Y 600D, DUCTILE IRON COVER AND FRAME (HINGED WITH LOCKING MECHANISM)										2
11	▲V3	200	315	300	-	-	-	x	x	-	2
12	FA2	315	-	-	-	-	-	x	-	-	2

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

REV	DESCRIPTION	DATE	REV BY	CHKD
0	ISSUED FOR TENDER	'2021-10-26	AL	CD

REVISIONS

DESIGNED	AL	
DRAWN	AL	
CHECKED	CD	

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APPROVED

ENGINEERS:

DATE: 2021-10-28

CLIENT

LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

APPROVED

CLIENT:

DATE:

PROJECT

CONSTRUCTION OF 3 M/ RESERVOIR ROBERTSON

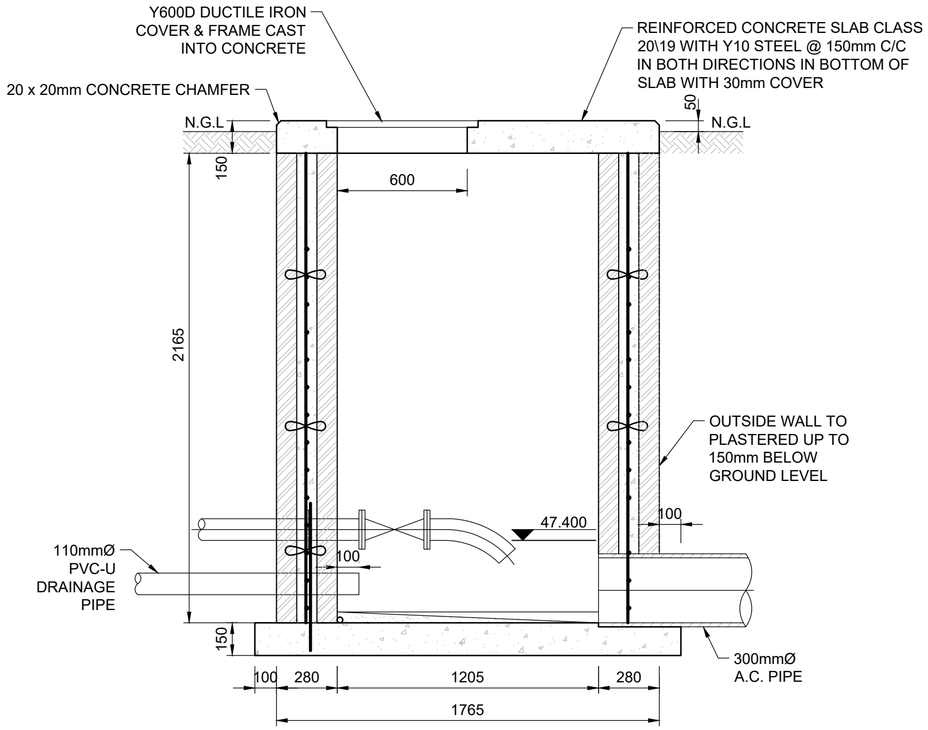
TITLE

200mm DIAMETER WATER METER DETAIL

SCALE	on A2	SHEET
AS SHOWN		1 OF 1
CONTRACT No.		PROJECT No. C21108

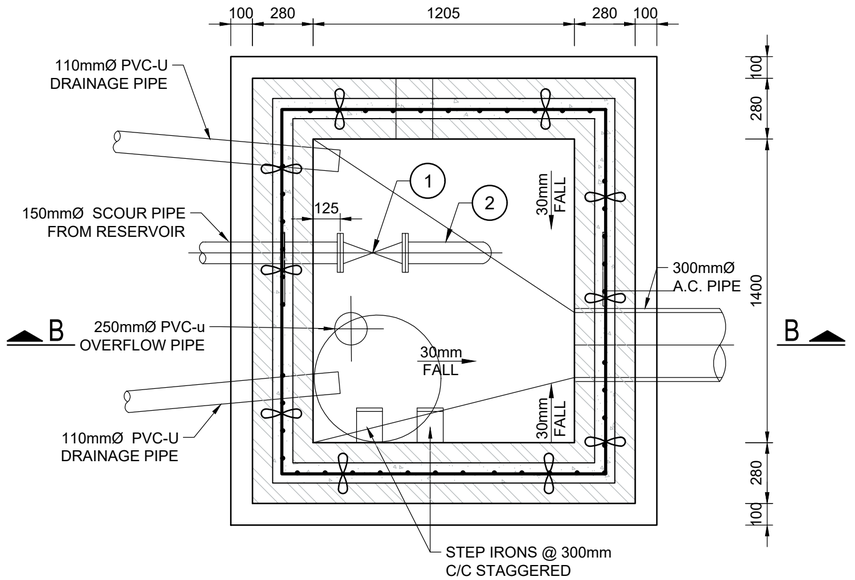
DRAWING No. 21108-C-201 REV A

COORDINATE SYSTEM: WGS84 / Lo 19



SECTION B-B

SCALE 1:20



PLAN: FLUSH PIPE, OVER FLOW PIPE & FLUSH CHAMBER

SCALE 1:20

NOTES: PIPEWORK

1. Steel and stainless steel pipes shall comply with the following.
a) Stainless steel pipes shall be Grade 304 and shall comply with ANSI B36.19m Schedule 10S.
b) Mild steel pipes up to 150mmØ shall be seamless, medium class steel pipes manufactured in accordance with SANS 62.
c) Mild steel pipes of 200mmØ and greater shall be manufactured in accordance with SANS 719 shall be Grade C pipe material and the wall thickness shall be in accordance with Table 2, Column 3 of SANS 719.
d) Flange drilling shall be in accordance with SANS 1123:Table 1600/3.
2. Dimensions of all pipes, fittings, valves, etc must be submitted for approval on a shopdrawing before any material is ordered
3. Step irons to be Calcamite-type or approved equivalent
4. All structural concrete shall be 30MPa/19mm concrete, unless stated otherwise on drawing with minimum 40mm cover for reinforcing
5. All steel pipe work or fittings buried in the ground shall be externally protected by a wrapping system the specification for the wrapping system is as follows:
a) Clean surface to required standard (minimum preparation ST2 according to SI6 055900-1967)
b) Brush or spray denso priming solution or denso S105 paste denso mastic to create profile for denso tape, so as to ensure that there are no air voids forming beneath the denso tape
c) Denso tape (petrolatum tape) wrapped spirally around prepared area
d) Double wrap polyethelene tape (minimum 300 Micron thick)
6. SABS approval certificates of all coatings to be delivered to the engineer for approval
7. Mild steel pipes shall be coated with three layers of Carboguard 891, 125 Micron dry film thickness (dft) per layer
8. Backfilled material compacted to 93% MOD AASHTO (100% for sand) unless otherwise specified
9. Only ss 316L nuts and bolts with anti seize compound may be used

NOTES GENERAL :

1. All dimensions shown on this drawing shall be verified by the contractor in order to ensure that on-site requirements are met. Dimensions may vary depending on the type and make of items such as valves. Any discrepancies must be reported to the engineer prior to the ordering of any materials
2. A calibration certificate must be submitted to the Engineer for each water meter

NOTES STRUCTURE :

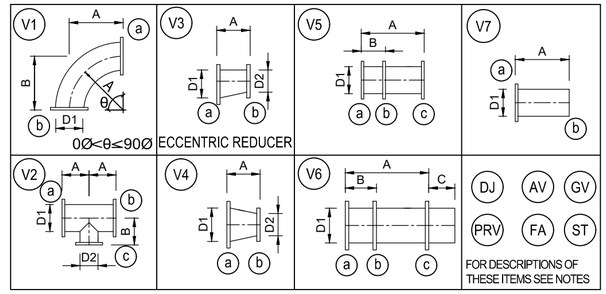
1. Ductile iron cover frames to be placed over water meter and strainer.
2. Cut & Bend mesh to suite cover opening & sump
3. Provide 4no. 40 mmØ lifting hole in roof slab[Plugged with bitumen after roof slab is in place to prevent water seepage]
4. Plastic sheeting 375 micron embossed D.PC. SABS 952\1962 Type B to be placed on walls before placing roof slab in place and seal internal and external joints with Sikaflex-Pro 2HP
5. Concrete Grade 25/19MPa for floor and roof slabs
6. Avoid placing the meter chamber in the road and entrance wherever possible
7. Chamber walls to be plastered external and internal (Plaster 13mm thick, steel toweled to smooth surface)
8. External plastered walls to be coated with 2 coats Duraslurry [ABE]

LEGEND	
□	EXACT LENGTH TO BE DETERMINED ON SITE
x	FLANGED END
#	SCOUR TEE
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
bW	CONTINUOUSLY BUTT WELDED ON SITE
∞	THREAD FEMALE CONNECTION
8	THREAD MALE CONNECTION

DESCRIPTION OF COUPLINGS AND VALVES	
SHAPE	DESCRIPTION
VJFA	VIKING JONHSON OR SIMILAR APPROVED FLANGE ADAPTOR PN 10 TO SUIT PVC-u PIPE.
GV	AVK 02/20 OR SIMILAR APPROVED PN10 FLANGED GRATE VALVE.
BFV	AVK BALL FLOAT VALVE PN10.

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges a	Flanges b	Flanges c	Quantity
1	GV	150	-	-	-	-	-	-	x	-	1
2	▲V1	150	-	-	230	-	22.5	-	-	-	1



SCALEBAR

0 0.6 1.2

Meters 1:20

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The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'2021-10-26	ES	CD

REVISIONS

DESIGNED	CD	
DRAWN	ES	
CHECKED	CD	

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APPROVED
ENGINEERS:
DATE: 2021-10-28

CLIENT
LANGEBERG MUNISIPALITEIT MUNICIPALITY MASIPALA

APPROVED
CLIENT:
DATE:

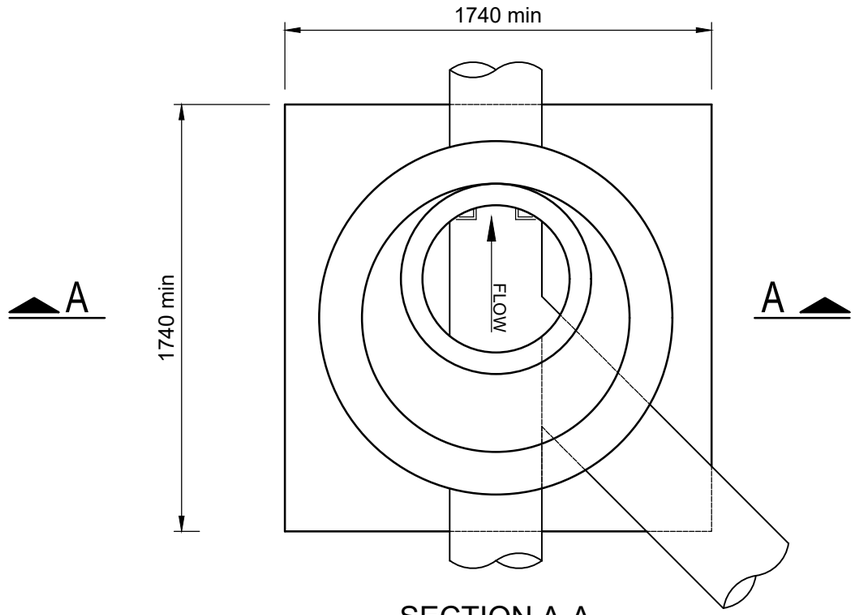
PROJECT
CONSTRUCTION OF 3 Mℓ RESERVOIR ROBERTSON

TITLE
SCOUR CHAMBER DETAIL

SCALE	on A2	SHEET
1:20		1 OF 1
CONTRACT No.		PROJECT No. C21108

DRAWING No. 21108-C-202 REV A

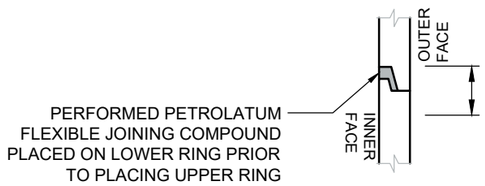
COORDINATE SYSTEM: WGS84 / Lo 19°



SECTION A-A

SCALE 1:25

PIPE DIAMETER	CHAMBER DIAMETER
375	1000
450	1000
525	1250
600	1250



PERFORMED PETROLATUM FLEXIBLE JOINING COMPOUND PLACED ON LOWER RING PRIOR TO PLACING UPPER RING

200mm WIDE LAMINATED NON HARDENING PETROLATUM AND ADHESIVE LAYER ON PVC BACKING FILM

DETAIL "A" JOINT SEALER

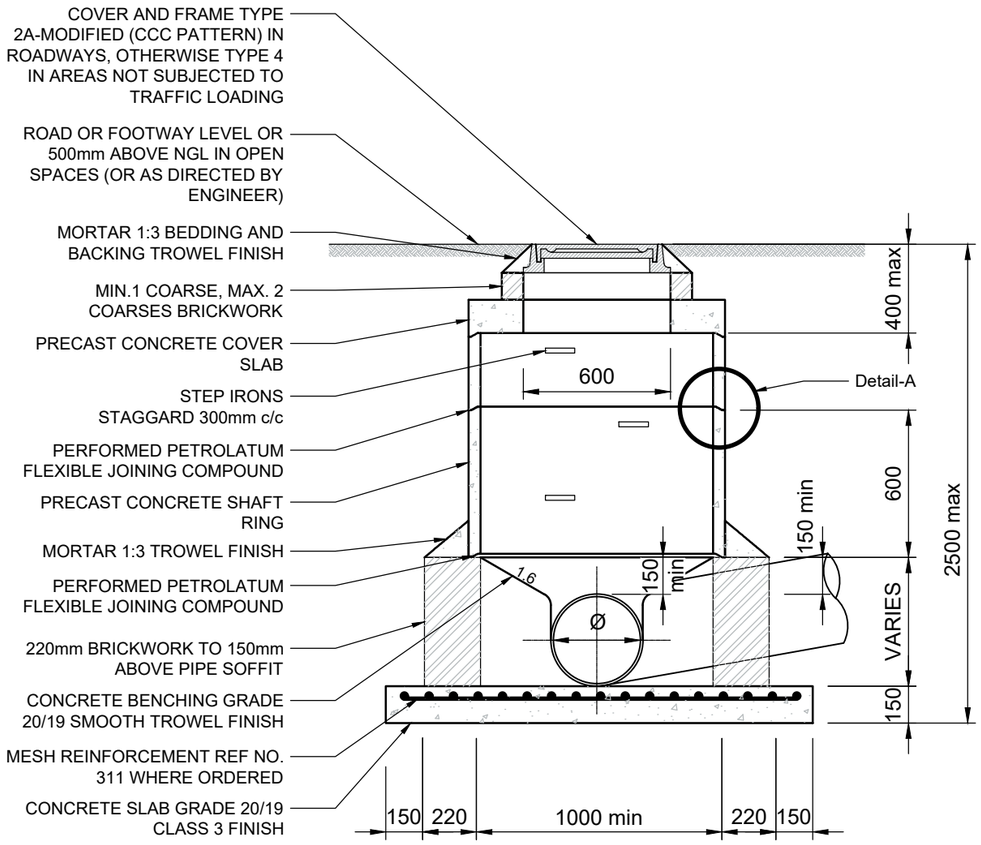
NTS

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NOTE:

1. Refer to sans 1200 le for specifications and items not indicated.
2. Min. C/L radius of benching 2.5 x pipe diameter.
3. Chimney opening to be placed as closed to the center line of the main incoming and outgoing pipe as possible.
4. Mortar for brickwork to be 1:3.



SEE TABLE FOR CHAMBER Ø

PLAN

SCALE 1:25

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	LV	CD

REVISIONS

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DRAWN	ES	
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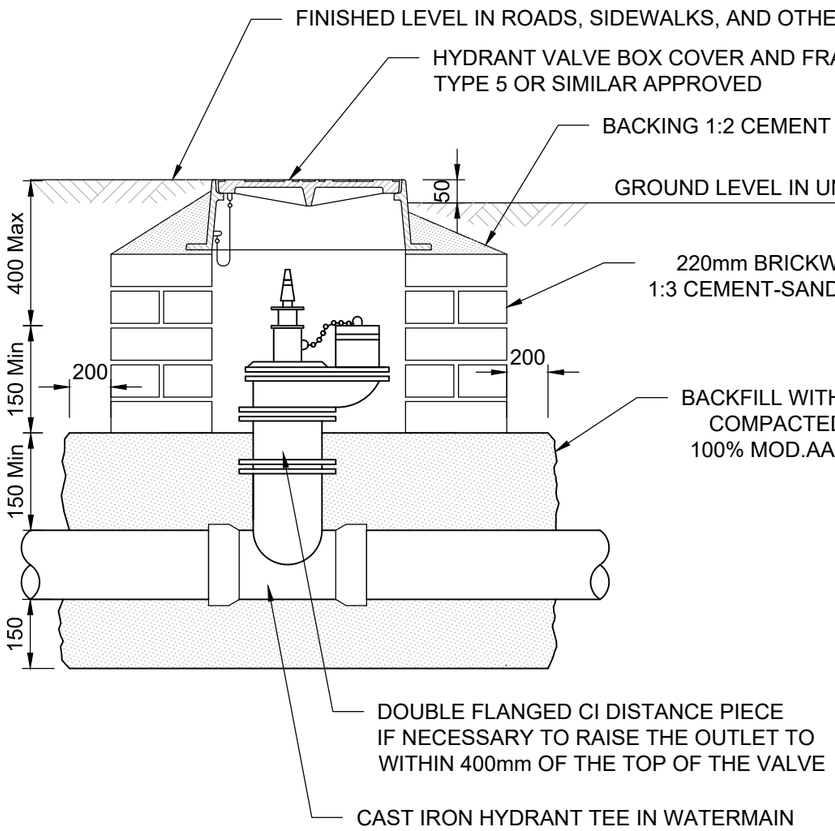
PROJECT
LANGEBERG MUN - CONSTRUCTION OF 3.0ML RESERVOIR, ROBERTSON

TITLE
TYPICAL DETAIL OF STORMWATER MANHOLE FOR PIPES UP TO 600mm Ø

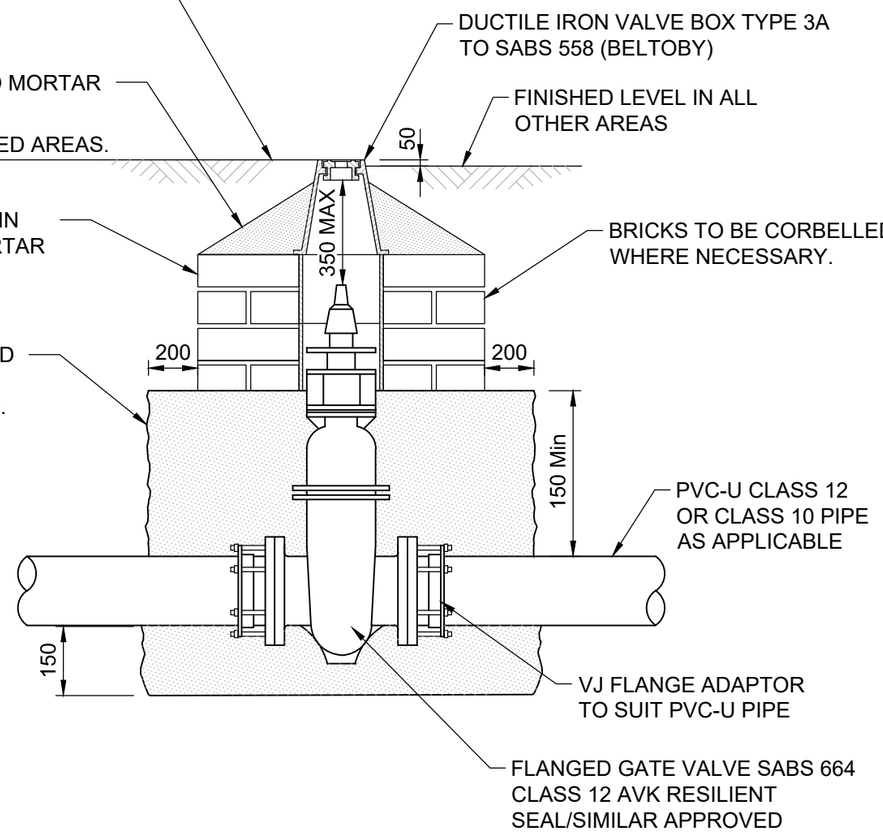
SCALE	SHEET
1:25	1 OF 1
CONTRACT No.	PROJECT No. 21108C

DRAWING No. 21108-C-203 REV A

DATE OF FIRST ISSUE:



DETAIL OF FIRE HYDRANT



DETAIL OF VALVE CHAMBER

NOTES:

1. ALL VALVES SHALL BE ANTI CLOCKWISE CLOSING WITH A NON-RISING SPINDLE AND SPINDLE CAP FITTED WITH A CAPTOP WITH A STAINLESS STEEL BOLT TO ATTACH THE CAPTOP TO THE SPINDLE. NO CLIPS, SPLIT PINS OR SCREWS ALLOWED.
2. ALL VALVES SHALL BE CLASS 12
3. INSTALL EXTENSION ROD ON VALVE SPINDLE IF THE TOP OF THE VALVE IS MORE THAN 350mm BELOW FINISHED SURFACE LEVEL.
4. ALL COVERS & FRAMES MUST BE PAINTED WITH 2 LAYERS OF OIL PAINT CHAMBER CHAMBER VALVE: BLUE
5. VALVES SHALL BE COATED INTERNALLY AND EXTERNALLY BEFORE DELIVERY.
6. ALL VALVES TO BE FLANGED VALVES DRILLED TO SANS 1123 TABLE 1600/3.
7. ALL NUTS AND BOLTS TO BE STAINLESS STEEL 316 WITH NICKEL ANTI-SEIZE COMPOUND.
8. FLANGE ADAPTORS TO BE WRAPPED IN 3 LAYERS OF DENSO TAPE.

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

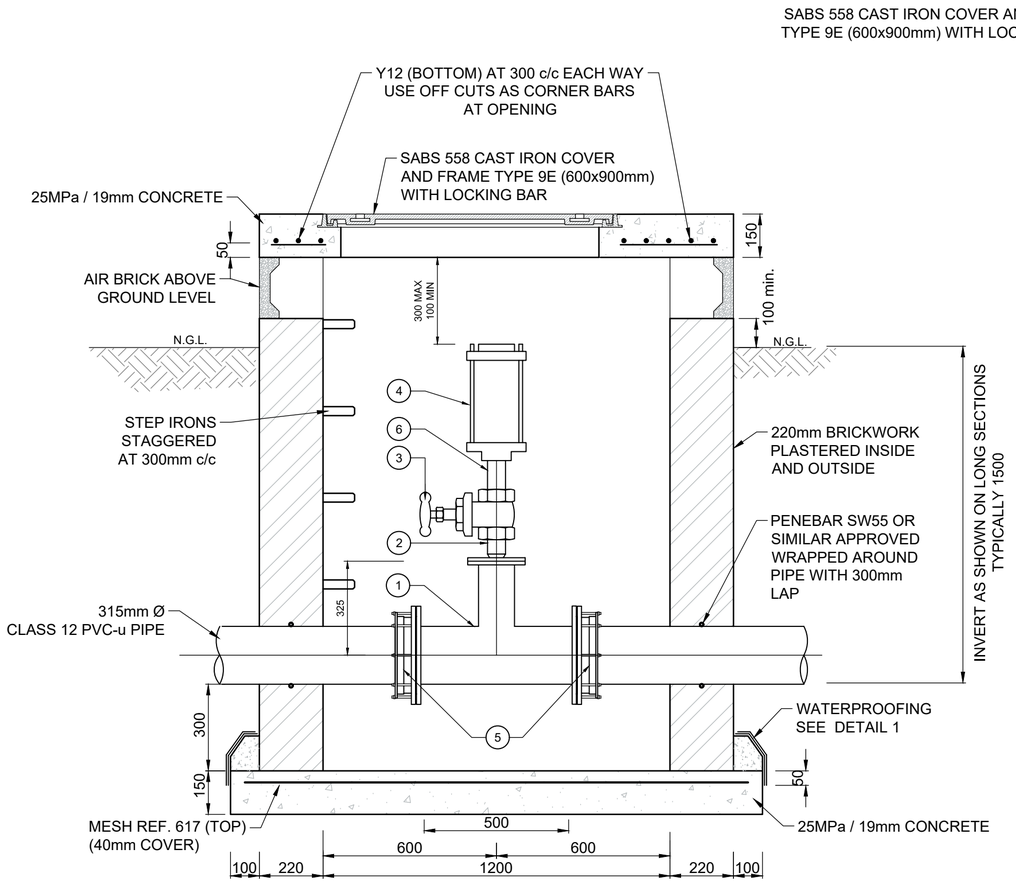
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DRAWN	ES	
CHECKED	CD	

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PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

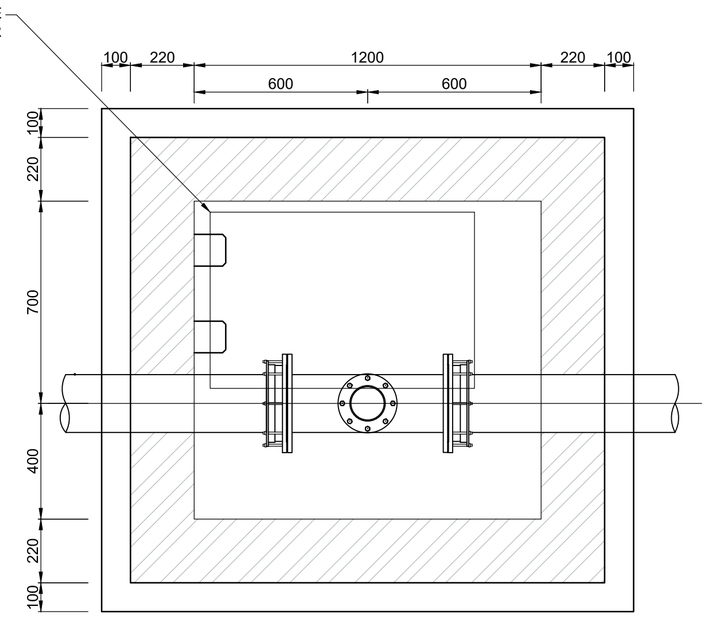
TITLE
TYPICAL DETAIL OF GATE VALVE
AND FIRE HYDRANT

SCALE on A3: N.T.S.	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-204	REV: A
COORDINATE SYSTEM: N/A	



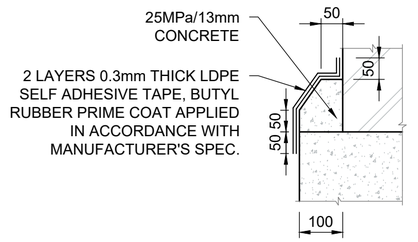
TYPICAL DETAIL OF SEWAGE AIR VALVE AND AIR VALVE CHAMBER

N.T.S.



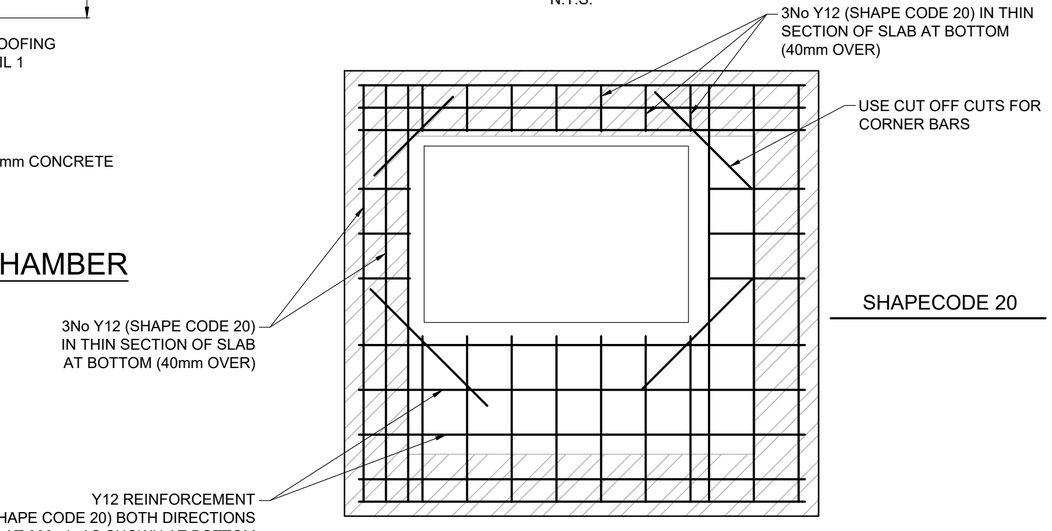
TOP VIEW

N.T.S.



DETAIL 1

N.T.S.



SHAPECODE 20

REINFORCING OF TOP SLAB

N.T.S.

NOTES

1. INTERNAL SIZE OF VALVE CHAMBER TO BE 1100 x 1200mm
2. ALL FITTINGS IN CHAMBER TO BE ENTIRELY DENSO WRAPPED

FITTINGS

1. MILD STEEL GALVANIZED AND CARBOGUARD 891 COATED REDUCING TEE 315 x 150 FLANGED ALL ENDS TO SANS 1123 TABLE 1600/3
2. 50mm GALV. SCREWED STEEL PIPE WITH REDUCING FLANGE TO RAISE AIR VALVE TO 300mm FROM SOFFIT OF ROOF SLAB
3. 50mm STAINLESS STEEL BALL VALVE WITH REMOVABLE LEVER
4. VENT-O-MAT 50mm RBX STAINLESS STEEL AIR VALVE
5. KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC PIPE
6. 50mm STAINLESS STEEL BARREL NIPPLE

SCALEBAR

0 0.45 0.9

Meters 1:15

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

DESIGNED	ML	
DRAWN	ES	
CHECKED	CD	

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ENGINEERS:
DATE: 2021-10-28

CLIENT
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APPROVED
CLIENT:
DATE:

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
TYPICAL DETAIL OF AIR VALVE

SCALE on A2	SHEET
N.T.S.	1 OF 1
CONTRACT No.	PROJECT No. C21108

DRAWING No. 21108-C-205 REV A

COORDINATE SYSTEM: N/A

PIPE SCHEDULE

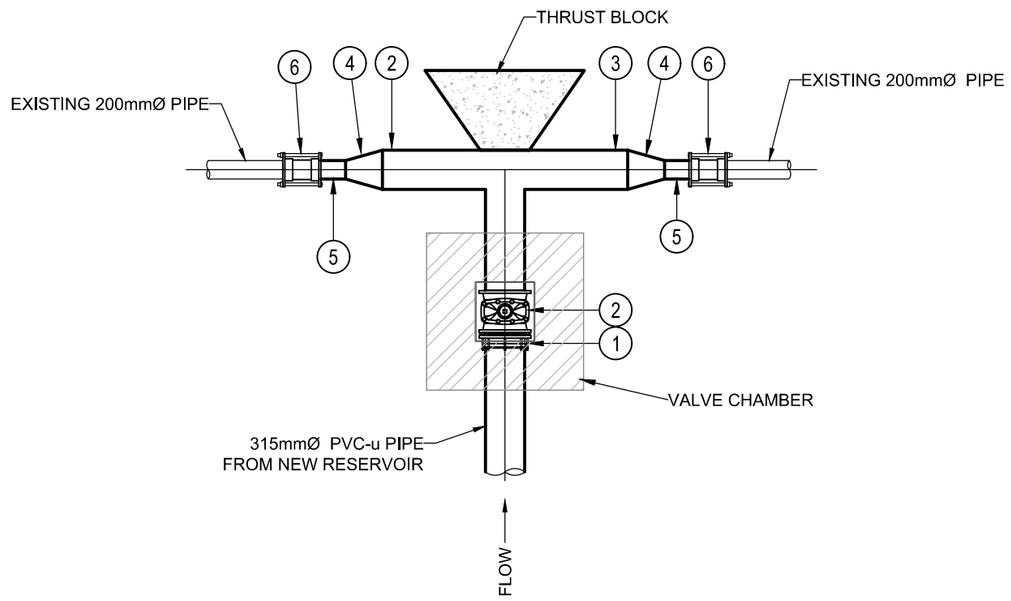
Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges			Quantity
								a	b	c	
1	FA1	300	-	-	-	-	-	x	-	-	1
2	GV	300	-	-	-	-	-	x	x	-	1
3	▲V2	300	300	500	500	-	-	W	W	X	1
4	▲V4	300	200	300	-	-	-	W	W	-	2
5	▲V7	200	-	-	-	-	-	-	-	-	2
6	VJ	200	-	-	-	-	-	-	-	-	2

DESCRIPTION OF COUPLINGS AND VALVES

SHAPE	DESCRIPTION
VJ	KLAMFLEX BLACK DEDICATED COUPLING TO SUIT STEEL TO STEEL AND STEEL TO PVC-U PIPE
FA 1	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC-U PIPE, ENTIRELY WRAPPED
FA2	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT STEEL PIPE, ENTIRELY WRAPPED
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, ANTI-CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 16 BAR AVK 02/20 OR SIMILAR APPROVED
NC	"NORMALLY CLOSED" - INDICATES NORMAL STATUS OF GATE VALVE

LEGEND

☐	EXACT LENGTH TO BE DETERMINED ON SITE
X	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED



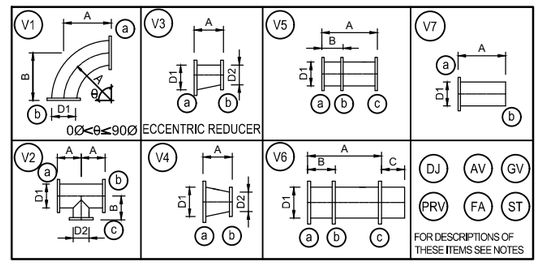
DETAIL 1

NOTES:

1. STEEL AND STAINLESS STEEL PIPES SHALL COMPLY WITH THE FOLLOWING.
   a) STAINLESS STEEL PIPES SHALL BE GRADE 304 AND SHALL COMPLY WITH ANSI B36.19M SCHEDULE 10S.
   b) MILD STEEL PIPES SHALL BE COATED WITH THREE LAYERS OF CARBOGUARD 891, 125 MICRON DRY FILM THICKNESS (DFT) PER LAYER
   c) MILD STEEL PIPES UP TO 150mm Ø SHALL BE SEAMLESS, MEDIUM CLASS STEEL PIPES MANUFACTURED IN ACCORDANCE WITH SANS 62.
   d) MILD STEEL PIPES OF 200mm Ø AND GREATER SHALL BE MANUFACTURED IN ACCORDANCE WITH SANS 719 SHALL BE GRADE C PIPE MATERIAL AND THE WALL THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 2, COLUMN 3 OF SANS 719.
   e) FLANGE DRILLING SHALL BE IN ACCORDANCE WITH SANS 1123: TABLE 1600/3.
2. DIMENSIONS OF ALL PIPES, FITTINGS, VALVES, ETC. MUST BE SUBMITTED FOR APPROVAL ON A SHOPDRAWING BEFORE ANY MATERIAL IS ORDERED
3. STEP IRONS TO BE CALCAMITE-TYPE OR APPROVED EQUIVALENT
4. ALL STRUCTURAL CONCRETE SHALL BE 30MPa/19mm CONCRETE, UNLESS STATED OTHERWISE ON DRAWING - WITH MINIMUM 40mm COVER FOR REINFORCING
5. ALL STEEL PIPE WORK OR FITTINGS BURIED IN THE GROUND SHALL BE EXTERNALLY PROTECTED BY A WRAPPING SYSTEM
   THE SPECIFICATION FOR THE WRAPPING SYSTEM IS AS FOLLOWS:
   a) CLEAN SURFACE TO REQUIRED STANDARD (MINIMUM PREPARATION ST2 ACCORDING TO SI6 055900-1967)
   b) BRUSH OR SPRAY DENSO PRIMING SOLUTION OR DENSO S105 PASTE DENSO MASTIC TO CREATE PROFILE FOR DENSO TAPE, SO AS TO ENSURE THAT THERE ARE NO AIR VOIDS FORMING BENEATH THE DENSO TAPE
   c) DENSO TAPE (PETROLATUM TAPE) WRAPPED SPIRALLY AROUND PREPARED AREA
   d) DOUBLE WRAP POLYETHELENE TAPE (MINIMUM 300 MICRON THICK)
6. SABS APPROVAL CERTIFICATES OF ALL COATINGS TO BE DELIVERED TO THE ENGINEER FOR APPROVAL
7. BACKFILLED MATERIAL COMPACTED TO 93% MOD AASHTO (100% FOR SAND) UNLESS OTHERWISE SPECIFIED

GENERAL :

1. ALL DIMENSIONS SHOWN ON THIS DRAWING SHALL BE VERIFIED BY THE CONTRACTOR IN ORDER TO ENSURE THAT ON-SITE REQUIREMENTS ARE MET. DIMENSIONS MAY VARY DEPENDING ON THE TYPE AND MAKE OF ITEMS SUCH AS VALVES. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER PRIOR TO THE ORDERING OF ANY MATERIALS



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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

DESIGNED	AL	
DRAWN	ES	
CHECKED	CD	

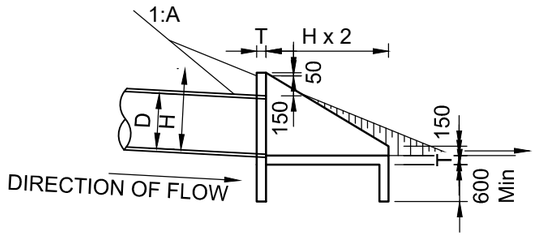
CONSULTING ENGINEERS
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email: bellville@lyners.co.za

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
TYPICAL DETAIL OF TIE IN CONNECTION

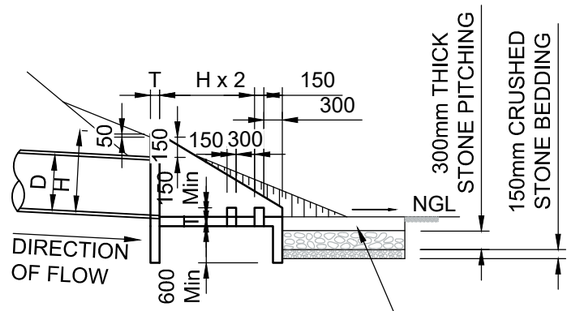
SCALE on A3: N.T.S.	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-207	REV: A
COORDINATE SYSTEM: N/A	

NOTE:
FOR "T" SEE TABLE



SECTION A-A

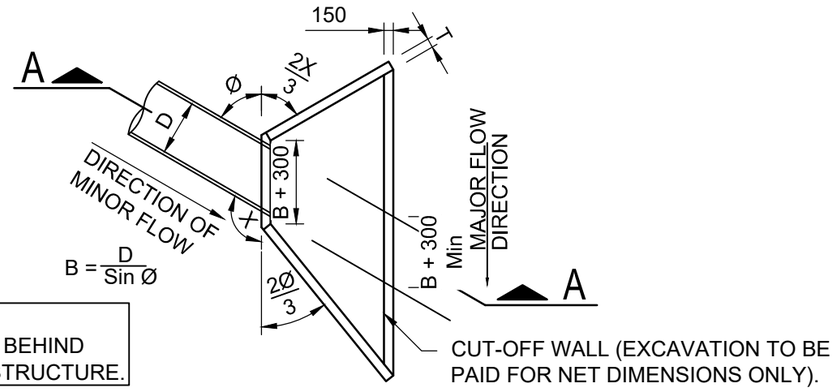
NTS



MAX PIPE DIAMETER OR MAX PRE-FABRICATED CULVERT HEIGHT	T
600 & 750	150
900	200
BIGGER THAN 900	250

SECTION B-B

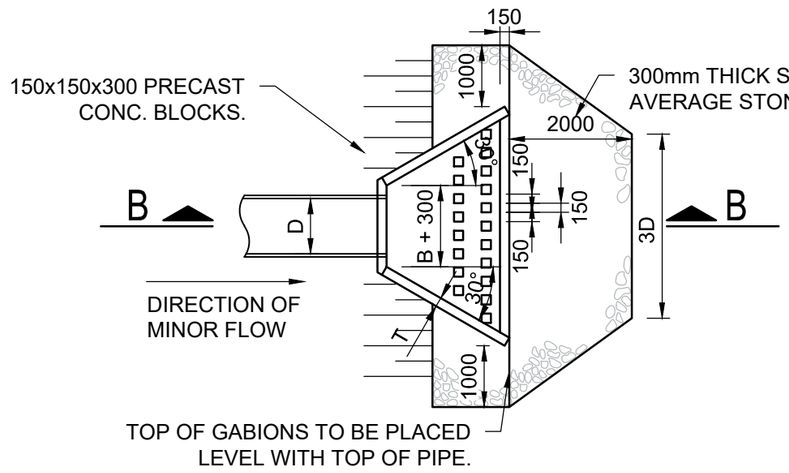
NTS



NOTE:
BACKFILL BEHIND OUTLET STRUCTURE.

PLAN - TYPE 1

NTS



PLAN - TYPE 2

NTS

NOTES:

1. ALL CONCRETE TO BE CLASS 20/19.
2. PIPE OUTLETS WITHOUT ANY WALLS ARE NOT PERMISSIBLE.
3. WHERE THE TOP LEVEL OF THE HEADWALL IS LESS THAN 500mm BELOW THE SHOULDER HEIGHT, THIS LEVEL MUST BE CONSTRUCTED USING THE SAME GRADE AS USED ON THE ROAD WITH A MINIMUM HEADWALL HEIGHT AS SHOWN ON THE DRAWING.
4. ALL EXPOSED CORNERS TO HAVE 25mm CHAMFER.
5. REINFORCEMENT IN RINGWALL AND HEAD-WALL FOR PIPES AND CULVERTS 900mm AND BIGGER: IN FRONT: Y6,3 - 200x200 - 245 MESH BEHIND:Y8 - 200x200 - 395 MESH WITH 600mm LENGTH IN FLOOR SLAB.

DETAILS OF INLET/OUTLET STRUCTURES

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REVISIONS

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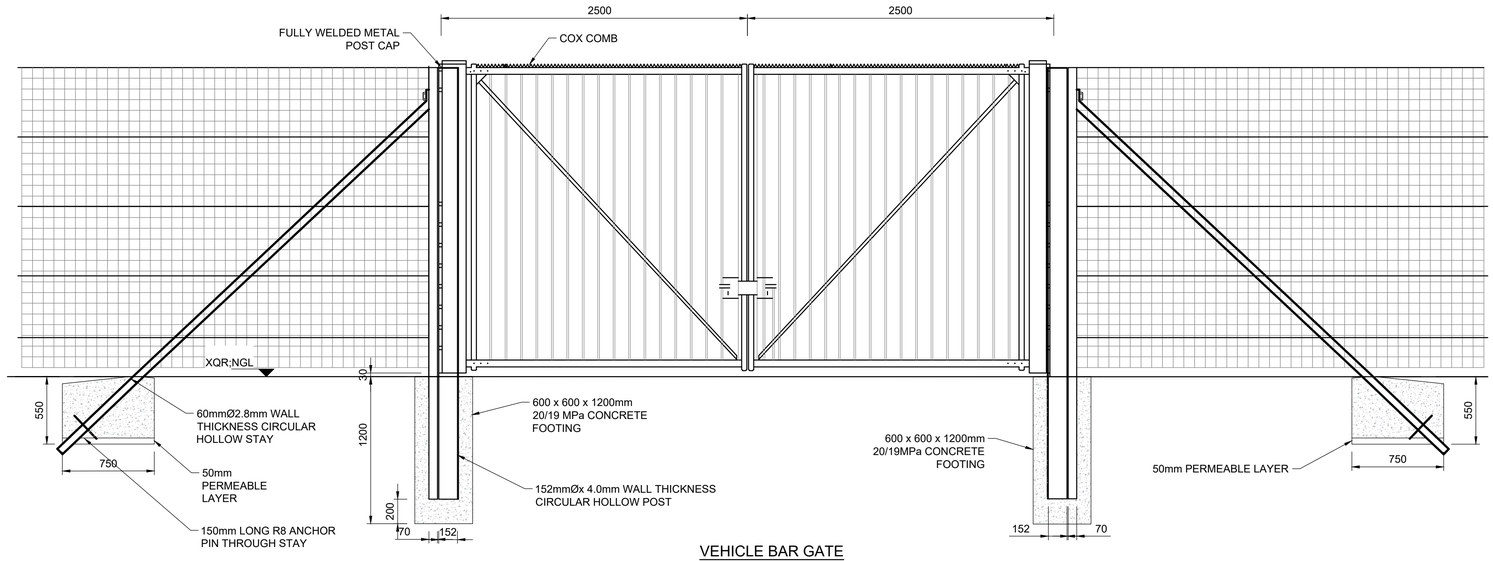
PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
TYPICAL DETAIL OF
STORM WATER INLET-OUTLET STRUCTURES

SCALE	on A3	SHEET
1:10		1 OF 1
CONTRACT No.		PROJECT No. C21108

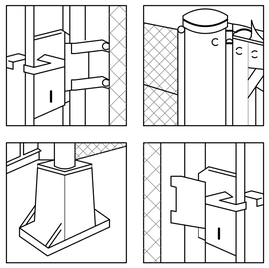
DRAWING No. 21108-C-208 REV A

COORDINATE SYSTEM: N/A



VEHICLE BAR GATE

SCALE 1:25



DETAIL OF DOUBLE LEAF GATE

NTS

TECHNICAL DESCRIPTION OF VEHICLE GATE

GATE FRAME MADE FROM SQUARE 60x60x3mm TUBING

BARS:
25mmØ x2mm BARS AT 110mm CENTRES, FULLY WELDED VERTICALLY INTO GATE FRAME.

BRACING: A DIAGONAL BRACE, MADE FROM 30x6mm FLAT IRON AND HOT DIP GALVANIZED AFTER MANUFACTURE, IS FITTED TO STRENGTHEN THESE LARGE GATES.

COMB: RAZOR SHARP POINTED COMB, 32mm HIGH, IS WELDED TO TOP OF GATES

FINISH: COMPLETE GATE IS HOT DIP GALVANIZED AFTER MANUFACTURE TO S.A.B.S SPECIFICATION 763/1977 GATE TO BE PAINTED SIMILAR GREEN TO EXISTING GATES.

GATES, CONSISTING OF HOLLOW SECTION TUBULAR FRAME WITH ROUND TUBULAR BARS, ALL FULLY WELDED. HUNG FROM ROUND TUBULAR POSTS OR FROM WALL CONNECTIONS. LOCKING WITH MORTICE LOCK AND SLAMPLATE.

152mmØ HANGING POST, 60X60mm GATE FRAME HORIZONTALS, 60X60mm GATE FRAME, VERTICALS, 25mm Ø VERTICAL BARS.

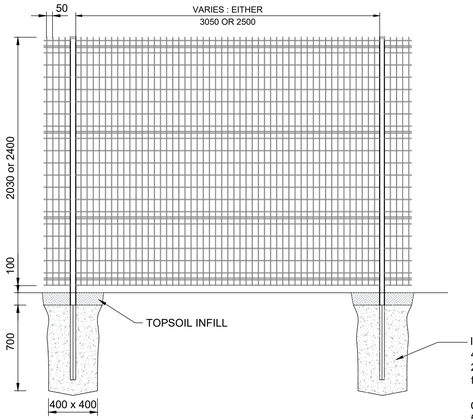
TECHNICAL DESCRIPTION OF PEDESTRIAN GAT

GATE
60x60x3mm SQUARE TUBING GATE FRAME WITH 25mmØ x 2mm BARS WELDED TO FRAME AT 110mm c/c

GATE POSTS
102mmØ x 2.8mm WALL THICKNESS HANGING POST
POST HEADS: THE TOPS OF THE Ø 102mm POSTS ARE SEALED OFF WITH A PLASTIC CAP WHICH HAS A METAL INSERT.
HINGES: GATE IS HUNG INBETWEEN BOTTOM PINTLE AND TOP PLATE WHICH ARE WELDED TO THE HANGING POST.
SLAMPLATE: A SLAMPLATE TO RECEIVE THE MORTICE LOCK IS WELDED TO THE LATCHING POST.
COMB: RASOR SHARP POINTED COMB 32mm HIGH IS WELDED TO TOP OF GATES WITH A HEIGHT OF 2m OR HIGHER.

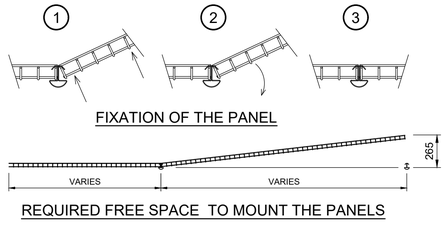
FINISH
THE COMPLETE UNIT IS HOT DIP GALVANIZED AFTER MANUFACTURE TO S.A.B.S SPECIFICATION 763-1977 AND REMAINS UNPAINTED.PAINTED GREEN SIMILAR TO EXISTING GATES.

LOCKING
A MORTICE LOCK CASE IS WELDED INTO THE GATE FRAME BEFORE GALVANIZING. A BRASS MORTICE LOCK IS FITTED INSIDE THE MORTICE LOCK CASE.



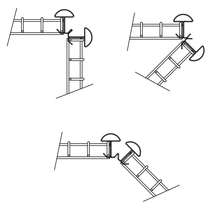
NOTES:

1. CONTRACTOR MUST ERECT FENCING STRICTLY IN ACCORDANCE WITH THE MANUFACTURE'S INSTRUCTIONS
2. FINAL DIMENSIONS OF FENCING, POSTS, CONCRETE FOUNDATIONS AND FIXING DETAILS TO BE CONFIRMED WITH ENGINEER PRIOR TO MANUFACTURING.

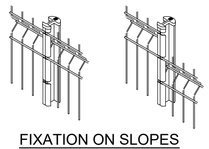


FIXATION OF THE PANEL

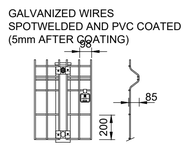
REQUIRED FREE SPACE TO MOUNT THE PANELS



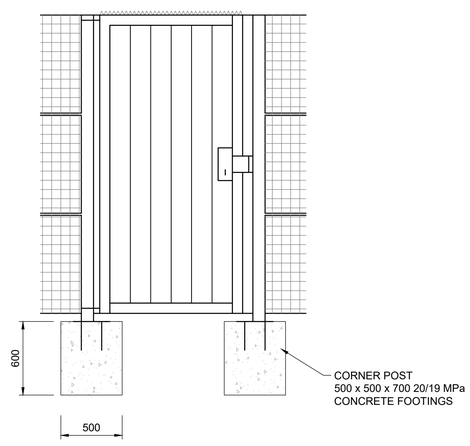
CORNER-SOLUTIONS



FIXATION ON SLOPES



DETAIL OF THE PANEL



PEDESTRIAN GATE

SCALE 1:25

NYLOFOR 3M WITH BEKAFAST POSTS

NTS

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 0.75 1.5
Meters 1:25

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A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

DESIGNED	ML	
DRAWN	ES	
CHECKED	CD	

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email: bellville@lyners.co.za

APPROVED
ENGINEERS: _____
DATE: 2021-10-28

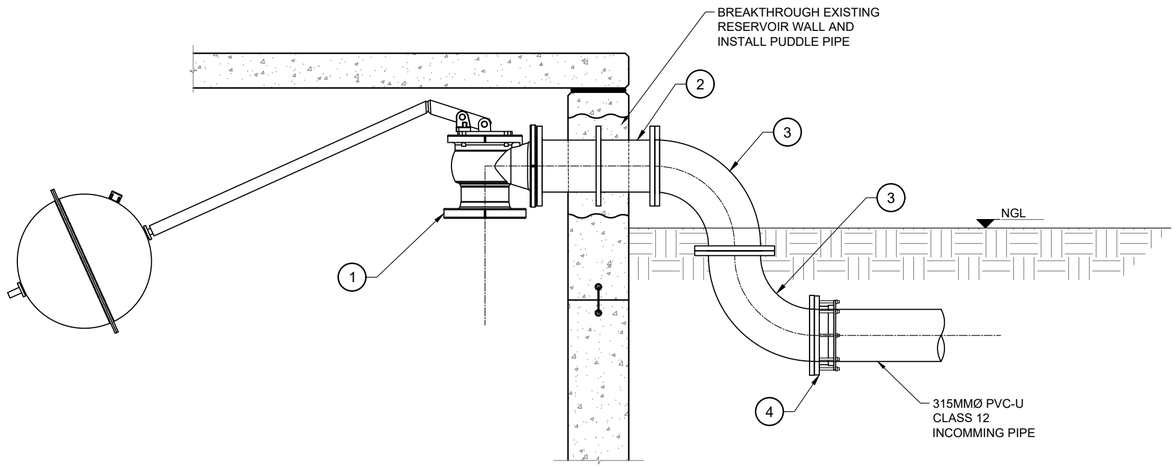
APPROVED
CLIENT: _____
DATE: _____

CLIENT
LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
TYPICAL DETAIL OF SECURITY FENCE

SCALE	on A1	SHEET
AS SHOWN		1 OF 1
CONTRACT No.		PROJECT No. C21108
DRAWING No. 21108-C-209		REV A
COORDINATE SYSTEM: N/A		



PIPE CONNECTION

SCALE 1:25

NOTES:

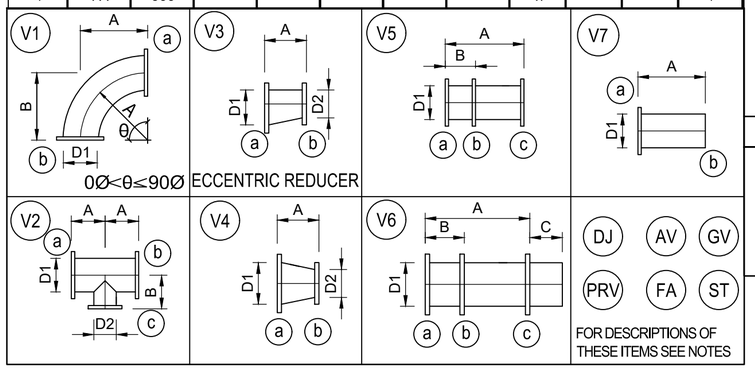
1. STEEL AND STAINLESS STEEL PIPES SHALL COMPLY WITH THE FOLLOWING.
   a) STAINLESS STEEL PIPES SHALL BE GRADE 304 AND SHALL COMPLY WITH ANSI B36.19M SCHEDULE 10S.
   b) MILD STEEL PIPES SHALL BE COATED WITH THREE LAYERS OF CARBOGUARD 891, 125 MICRON DRY FILM THICKNESS (DFT) PER LAYER
   c) MILD STEEL PIPES UP TO 150mm Ø SHALL BE SEAMLESS, MEDIUM CLASS STEEL PIPES MANUFACTURED IN ACCORDANCE WITH SANS 62.
   d) MILD STEEL PIPES OF 200mm Ø AND GREATER SHALL BE MANUFACTURED IN ACCORDANCE WITH SANS 719 SHALL BE GRADE C PIPE MATERIAL AND THE WALL THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 2, COLUMN 3 OF SANS 719.
   e) FLANGE DRILLING SHALL BE IN ACCORDANCE WITH SANS 1123: TABLE 1600/3.
2. DIMENSIONS OF ALL PIPES, FITTINGS, VALVES, ETC. MUST BE SUBMITTED FOR APPROVAL ON A SHOPDRAWING BEFORE ANY MATERIAL IS ORDERED
3. STEP IRONS TO BE CALCAMITE-TYPE OR APPROVED EQUIVALENT
4. ALL STRUCTURAL CONCRETE SHALL BE 30MPa/19mm CONCRETE, UNLESS STATED OTHERWISE ON DRAWING - WITH MINIMUM 40mm COVER FOR REINFORCING
5. ALL STEEL PIPE WORK OR FITTINGS BURIED IN THE GROUND SHALL BE EXTERNALLY PROTECTED BY A WRAPPING SYSTEM
   THE SPECIFICATION FOR THE WRAPPING SYSTEM IS AS FOLLOWS:
   a) CLEAN SURFACE TO REQUIRED STANDARD (MINIMUM PREPARATION ST2 ACCORDING TO SI6 055900-1967)
   b) BRUSH OR SPRAY DENSO PRIMING SOLUTION OR DENSO S105 PASTE DENSO MASTIC TO CREATE PROFILE FOR DENSO TAPE, SO AS TO ENSURE THAT THERE ARE NO AIR VOIDS FORMING BENEATH THE DENSO TAPE
   c) DENSO TAPE (PETROLATUM TAPE) WRAPPED SPIRALLY AROUND PREPARED AREA
   d) DOUBLE WRAP POLYETHELENE TAPE (MINIMUM 300 MICRON THICK)
6. SABS APPROVAL CERTIFICATES OF ALL COATINGS TO BE DELIVERED TO THE ENGINEER FOR APPROVAL
7. BACKFILLED MATERIAL COMPACTED TO 93% MOD AASHTO (100% FOR SAND) UNLESS OTHERWISE SPECIFIED

GENERAL :

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PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges a	Flanges b	Flanges c	Quantity
1	BFV	300	-	-	-	-	-	x	-	-	1
2	▲ V5	300	-	□ 650	□ 325	-	-	x	x	x	1
3	▲ V1	300	-	460	460	-	90	x	x	x	2
4	FA	300	-	-	-	-	-	x	-	-	1



DESCRIPTION OF COUPLINGS AND VALVES

SHAPE	DESCRIPTION
VJ	KLAMFLEX BLACK RANGER COUPLING TO SUIT AC PIPES TO STEEL PIPE CONNECTION ENTIRELY WRAPPED
FA2	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC-U PIPES, ENTIRELY WRAPPED
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, ANTI-CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 16 BAR AVK 02/20 OR SIMILAR APPROVED
BFV	AVK BALL FLOAT VALVE PN12

LEGEND

□	EXACT LENGTH TO BE DETERMINED ON SITE
x	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED

SCALEBAR

0 — 0.75 — 1.5

Meters 1:25

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A	ISSUED FOR TENDER	'21-10-25	LV	CD

REVISIONS

DESIGNED	HM	
DRAWN	HM	
CHECKED	CD	

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email: bellville@lyners.co.za

APPROVED
ENGINEERS:
DATE: 2021-10-28

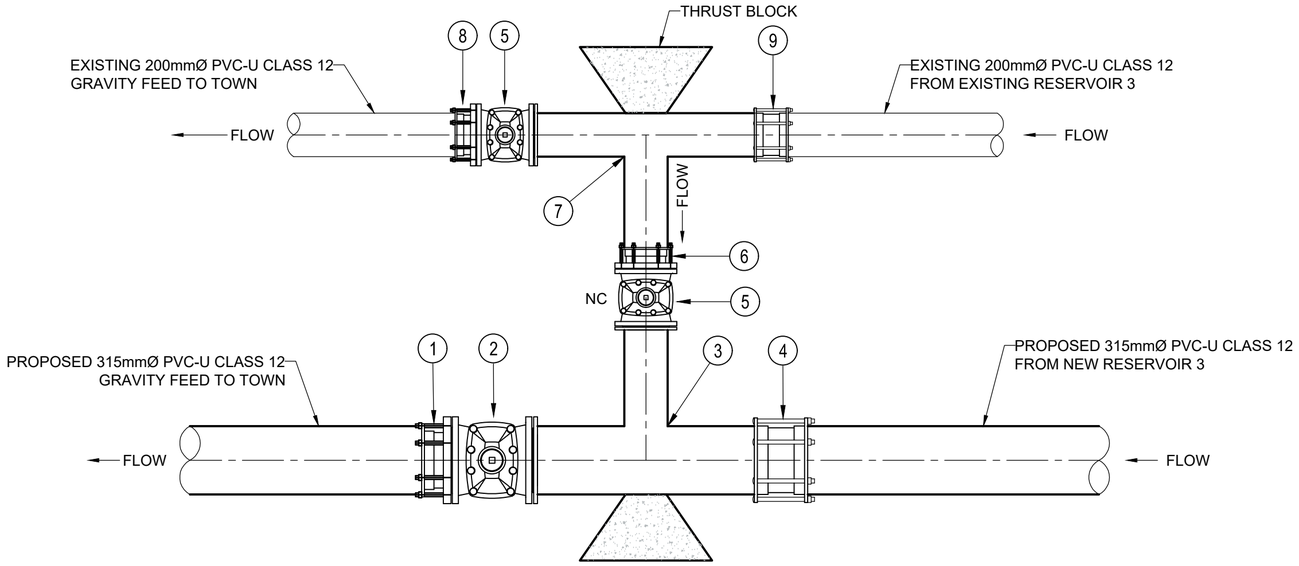
CLIENT
LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

APPROVED
CLIENT:
DATE:

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
DETAIL OF CONNECTION
AT RESERVOIR 2

SCALE on A2: 1:25	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-210	REV: A
COORDINATE SYSTEM: N/A	

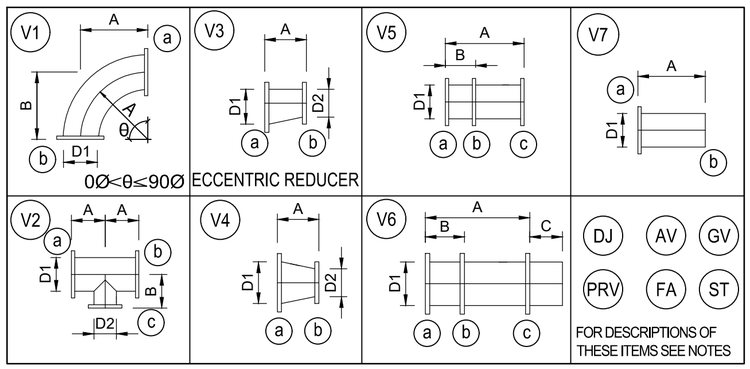


TIE IN CONNECTION AT RESERVOIR 3

SCALE 1:20

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges a	Flanges b	Flanges c	Quantity
1	FA1	300	-	-	-	-	-	X	-	-	1
2	GV	300	-	-	-	-	-	X	X	-	1
3	▲V2	300	200	500	604	-	-	X	-	X	1
4	VJ	300	-	-	-	-	-	X	X	-	1
5	GV	200	-	-	-	-	-	X	X	-	2
6	FA2	200	-	-	-	-	-	X	-	-	1
7	▲V2	200	200	500	604	-	-	X	-	-	1
8	FA1	200	-	-	-	-	-	X	X	-	1
9	VJ	200	-	-	-	-	-	X	X	-	1



NOTES:

1. STEEL AND STAINLESS STEEL PIPES SHALL COMPLY WITH THE FOLLOWING.
   a) STAINLESS STEEL PIPES SHALL BE GRADE 304 AND SHALL COMPLY WITH ANSI B36.19M SCHEDULE 10S.
   b) MILD STEEL PIPES SHALL BE COATED WITH THREE LAYERS OF CARBOGUARD 891, 125 MICRON DRY FILM THICKNESS (DFT) PER LAYER
   c) MILD STEEL PIPES UP TO 150mm Ø SHALL BE SEAMLESS, MEDIUM CLASS STEEL PIPES MANUFACTURED IN ACCORDANCE WITH SANS 62.
   d) MILD STEEL PIPES OF 200mm Ø AND GREATER SHALL BE MANUFACTURED IN ACCORDANCE WITH SANS 719 SHALL BE GRADE C PIPE MATERIAL AND THE WALL THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 2, COLUMN 3 OF SANS 719.
   e) FLANGE DRILLING SHALL BE IN ACCORDANCE WITH SANS 1123: TABLE 1600/3.
2. DIMENSIONS OF ALL PIPES, FITTINGS, VALVES, ETC. MUST BE SUBMITTED FOR APPROVAL ON A SHOPDRAWING BEFORE ANY MATERIAL IS ORDERED
3. STEP IRONS TO BE CALCAMITE-TYPE OR APPROVED EQUIVALENT
4. ALL STRUCTURAL CONCRETE SHALL BE 30MPa/19mm CONCRETE, UNLESS STATED OTHERWISE ON DRAWING - WITH MINIMUM 40mm COVER FOR REINFORCING
5. ALL STEEL PIPE WORK OR FITTINGS BURIED IN THE GROUND SHALL BE EXTERNALLY PROTECTED BY A WRAPPING SYSTEM
   THE SPECIFICATION FOR THE WRAPPING SYSTEM IS AS FOLLOWS:
   a) CLEAN SURFACE TO REQUIRED STANDARD (MINIMUM PREPARATION ST2 ACCORDING TO SI6 055900-1967)
   b) BRUSH OR SPRAY DENSO PRIMING SOLUTION OR DENSO S105 PASTE DENSO MASTIC TO CREATE PROFILE FOR DENSO TAPE, SO AS TO ENSURE THAT THERE ARE NO AIR VOIDS FORMING BENEATH THE DENSO TAPE
   c) DENSO TAPE (PETROLATUM TAPE) WRAPPED SPIRALLY AROUND PREPARED AREA
   d) DOUBLE WRAP POLYETHELENE TAPE (MINIMUM 300 MICRON THICK)
6. SABS APPROVAL CERTIFICATES OF ALL COATINGS TO BE DELIVERED TO THE ENGINEER FOR APPROVAL
7. BACKFILLED MATERIAL COMPACTED TO 93% MOD AASHTO (100% FOR SAND) UNLESS OTHERWISE SPECIFIED

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DESCRIPTION OF COUPLINGS AND VALVES

SHAPE	DESCRIPTION
VJ	KLAMFLEX BLACK DEDICATED COUPLING TO SUIT STEEL TO STEEL AND STEEL TO PVC-U PIPE. ENTIRELY WRAPPED
FA 1	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC-U PIPE, ENTIRELY WRAPPED
FA2	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT STEEL PIPE, ENTIRELY WRAPPED
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, ANTI-CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 16 BAR AVK 02/20 OR SIMILAR APPROVED
NC	"NORMALLY CLOSED" - INDICATES NORMAL STATUS OF GATE VALVE

LEGEND

□	EXACT LENGTH TO BE DETERMINED ON SITE
X	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED

SCALEBAR
0 0.6 1.2
Meters 1:20

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

DESIGNED HM
DRAWN HM
CHECKED CD

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email: bellville@lyners.co.za

APPROVED
ENGINEERS:
DATE: 2021-10-28

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APPROVED
CLIENT:
DATE:

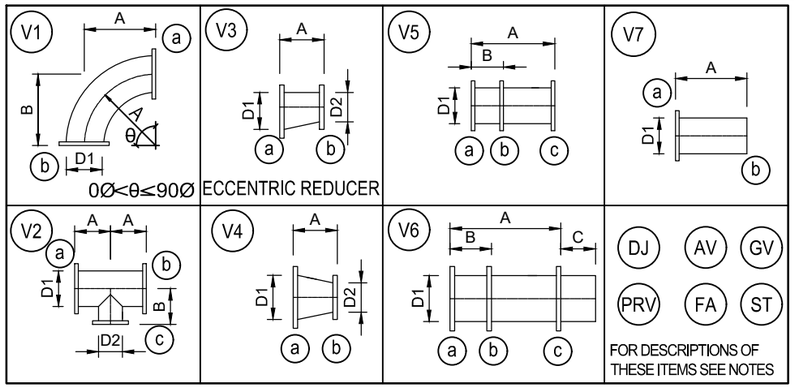
PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
TIE IN CONNECTION AT RESERVOIR 3

SCALE	on A2	SHEET
1:20		1 OF 1
CONTRACT No.		PROJECT No. C21108

DRAWING No. 21108-C-211 REV A

COORDINATE SYSTEM: N/A



DESCRIPTION OF COUPLINGS AND VALVES

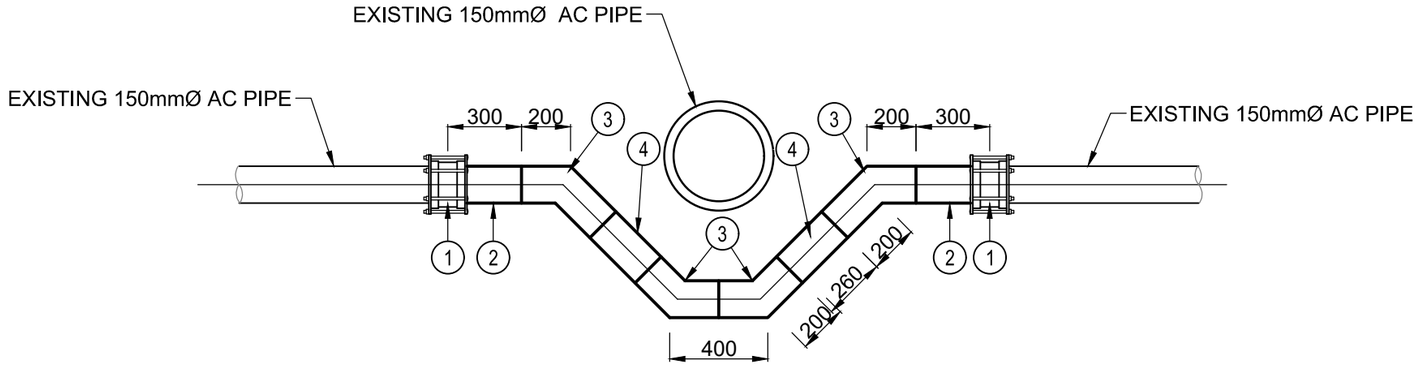
SHAPE	DESCRIPTION
VJ	KLAMFLEX BLACK RANGER COUPLING TO SUIT AC PIPES TO STEEL PIPE CONNECTION ENTIRELY WRAPPED
FA2	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC-U PIPES, ENTIRELY WRAPPED
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, ANTI-CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 16 BAR AVK 02/20 OR SIMILAR APPROVED

LEGEND

□	EXACT LENGTH TO BE DETERMINED ON SITE
x	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges			Quantity
								a	b	c	
1	VJ	80	-	-	-	-	-	x	x	-	2
2	V7	80	-	300	-	-	-	-	W	-	2
3	V1	80	-	200	200	-	45	W	W	-	4
4	V7	80	-	160	-	-	-	W	W	-	2



NOTES:

1. STEEL AND STAINLESS STEEL PIPES SHALL COMPLY WITH THE FOLLOWING.
   a) STAINLESS STEEL PIPES SHALL BE GRADE 304 AND SHALL COMPLY WITH ANSI B36.19M SCHEDULE 10S.
   b) MILD STEEL PIPES SHALL BE COATED WITH THREE LAYERS OF CARBOGUARD 891, 125 MICRON DRY FILM THICKNESS (DFT) PER LAYER
   c) MILD STEEL PIPES UP TO 150mm Ø SHALL BE SEAMLESS, MEDIUM CLASS STEEL PIPES MANUFACTURED IN ACCORDANCE WITH SANS 62.
   d) MILD STEEL PIPES OF 200mm Ø AND GREATER SHALL BE MANUFACTURED IN ACCORDANCE WITH SANS 719 SHALL BE GRADE C PIPE MATERIAL AND THE WALL THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 2, COLUMN 3 OF SANS 719.
   e) FLANGE DRILLING SHALL BE IN ACCORDANCE WITH SANS 1123: TABLE 1600/3.
2. DIMENSIONS OF ALL PIPES, FITTINGS, VALVES, ETC. MUST BE SUBMITTED FOR APPROVAL ON A SHOPDRAWING BEFORE ANY MATERIAL IS ORDERED
3. STEP IRONS TO BE CALCAMITE-TYPE OR APPROVED EQUIVALENT
4. ALL STRUCTURAL CONCRETE SHALL BE 30MPa/19mm CONCRETE, UNLESS STATED OTHERWISE ON DRAWING - WITH MINIMUM 40mm COVER FOR REINFORCING
5. ALL STEEL PIPE WORK OR FITTINGS BURIED IN THE GROUND SHALL BE EXTERNALLY PROTECTED BY A WRAPPING SYSTEM
   THE SPECIFICATION FOR THE WRAPPING SYSTEM IS AS FOLLOWS:
   a) CLEAN SURFACE TO REQUIRED STANDARD (MINIMUM PREPARATION ST2 ACCORDING TO SI6 055900-1967)
   b) BRUSH OR SPRAY DENSO PRIMING SOLUTION OR DENSO S105 PASTE DENSO MASTIC TO CREATE PROFILE FOR DENSO TAPE, SO AS TO ENSURE THAT THERE ARE NO AIR VOIDS FORMING BENEATH THE DENSO TAPE
   c) DENSO TAPE (PETROLATUM TAPE) WRAPPED SPIRALLY AROUND PREPARED AREA
   d) DOUBLE WRAP POLYETHELENE TAPE (MINIMUM 300 MICRON THICK)
6. SABS APPROVAL CERTIFICATES OF ALL COATINGS TO BE DELIVERED TO THE ENGINEER FOR APPROVAL
7. BACKFILLED MATERIAL COMPACTED TO 93% MOD AASHTO (100% FOR SAND) UNLESS OTHERWISE SPECIFIED

GENERAL :

1. ALL DIMENSIONS SHOWN ON THIS DRAWING SHALL BE VERIFIED BY THE CONTRACTOR IN ORDER TO ENSURE THAT ON-SITE REQUIREMENTS ARE MET. DIMENSIONS MAY VARY DEPENDING ON THE TYPE AND MAKE OF ITEMS SUCH AS VALVES. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER PRIOR TO THE ORDERING OF ANY MATERIALS

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

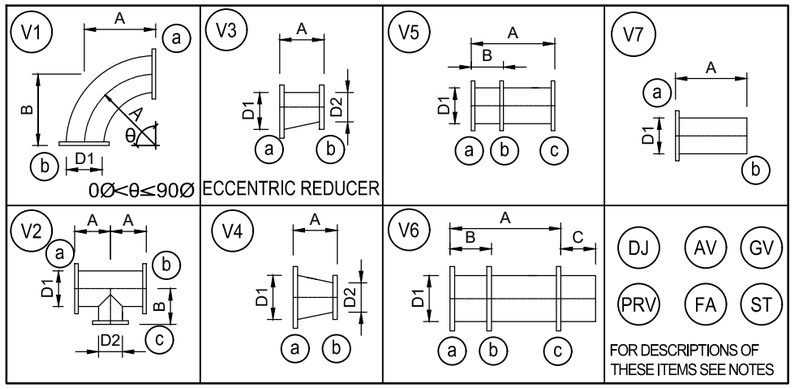
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email: bellville@lyners.co.za

PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
DETAIL OF 150mmØ WATER PIPE CRANKING

SCALE on A3: 1:75	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-212	REV: A
COORDINATE SYSTEM: N/A	



DESCRIPTION OF COUPLINGS AND VALVES

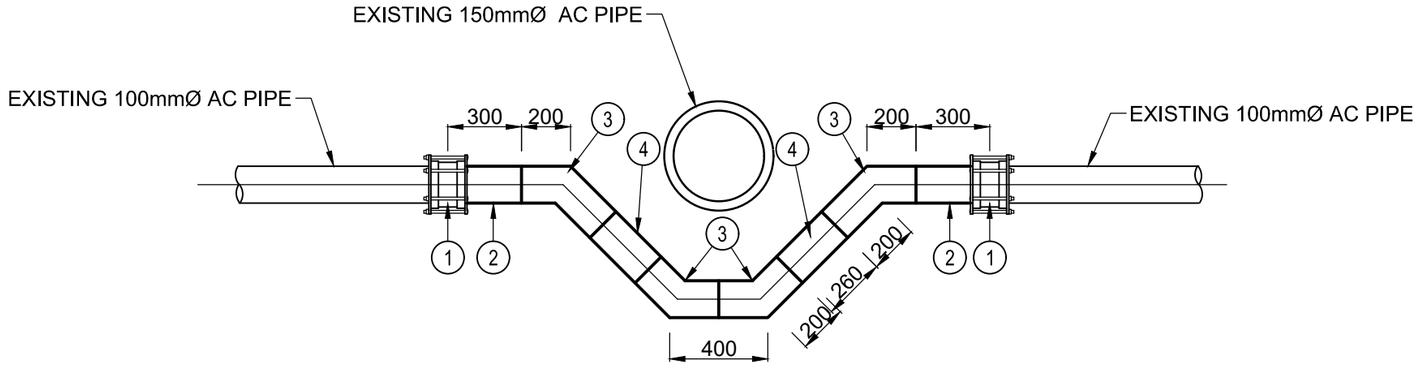
SHAPE	DESCRIPTION
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FA2	KLAMFLEX BLACK FLANGE ADAPTOR TO SUIT PVC-U PIPES, ENTIRELY WRAPPED
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, ANTI-CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 16 BAR AVK 02/20 OR SIMILAR APPROVED

LEGEND

□	EXACT LENGTH TO BE DETERMINED ON SITE
x	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges			Quantity
								a	b	c	
1	VJ	100	-	-	-	-	-	x	x	-	2
2	V7	100	-	300	-	-	-	-	W	-	2
3	V1	100	-	200	200	-	45	W	W	-	4
4	V7	100	-	200	-	-	-	W	W	-	2



NOTES:

1. STEEL AND STAINLESS STEEL PIPES SHALL COMPLY WITH THE FOLLOWING.
   a) STAINLESS STEEL PIPES SHALL BE GRADE 304 AND SHALL COMPLY WITH ANSI B36.19M SCHEDULE 10S.
   b) MILD STEEL PIPES SHALL BE COATED WITH THREE LAYERS OF CARBOGUARD 891, 125 MICRON DRY FILM THICKNESS (DFT) PER LAYER
   c) MILD STEEL PIPES UP TO 150mm Ø SHALL BE SEAMLESS, MEDIUM CLASS STEEL PIPES MANUFACTURED IN ACCORDANCE WITH SANS 62.
   d) MILD STEEL PIPES OF 200mm Ø AND GREATER SHALL BE MANUFACTURED IN ACCORDANCE WITH SANS 719 SHALL BE GRADE C PIPE MATERIAL AND THE WALL THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 2, COLUMN 3 OF SANS 719.
   e) FLANGE DRILLING SHALL BE IN ACCORDANCE WITH SANS 1123: TABLE 1600/3.
2. DIMENSIONS OF ALL PIPES, FITTINGS, VALVES, ETC. MUST BE SUBMITTED FOR APPROVAL ON A SHOPDRAWING BEFORE ANY MATERIAL IS ORDERED
3. STEP IRONS TO BE CALCAMITE-TYPE OR APPROVED EQUIVALENT
4. ALL STRUCTURAL CONCRETE SHALL BE 30MPa/19mm CONCRETE, UNLESS STATED OTHERWISE ON DRAWING - WITH MINIMUM 40mm COVER FOR REINFORCING
5. ALL STEEL PIPE WORK OR FITTINGS BURIED IN THE GROUND SHALL BE EXTERNALLY PROTECTED BY A WRAPPING SYSTEM
   THE SPECIFICATION FOR THE WRAPPING SYSTEM IS AS FOLLOWS:
   a) CLEAN SURFACE TO REQUIRED STANDARD (MINIMUM PREPARATION ST2 ACCORDING TO SI6 055900-1967)
   b) BRUSH OR SPRAY DENSO PRIMING SOLUTION OR DENSO S105 PASTE DENSO MASTIC TO CREATE PROFILE FOR DENSO TAPE, SO AS TO ENSURE THAT THERE ARE NO AIR VOIDS FORMING BENEATH THE DENSO TAPE
   c) DENSO TAPE (PETROLATUM TAPE) WRAPPED SPIRALLY AROUND PREPARED AREA
   d) DOUBLE WRAP POLYETHELENE TAPE (MINIMUM 300 MICRON THICK)
6. SABS APPROVAL CERTIFICATES OF ALL COATINGS TO BE DELIVERED TO THE ENGINEER FOR APPROVAL
7. BACKFILLED MATERIAL COMPACTED TO 93% MOD AASHTO (100% FOR SAND) UNLESS OTHERWISE SPECIFIED

GENERAL :

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REVISIONS

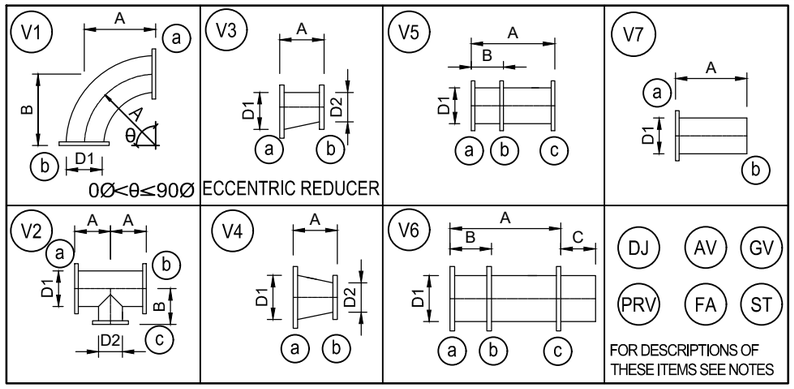
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PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
DETAIL OF 100mmØ WATER PIPE CRANKING

SCALE on A3: 1:75	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-213	REV: A
COORDINATE SYSTEM: N/A	



DESCRIPTION OF COUPLINGS AND VALVES

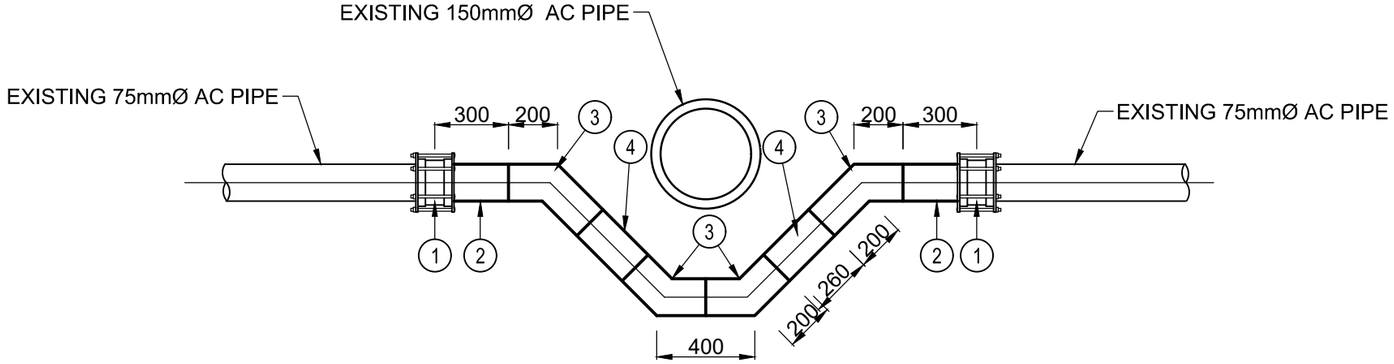
SHAPE	DESCRIPTION
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LEGEND

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x	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
▲	MILD STEEL, CARBOGUARD 891 COATED

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges			Quantity
								a	b	c	
1	VJ	80	-	-	-	-	-	x	x	-	2
2	V7	80	-	300	-	-	-	-	W	-	2
3	V1	80	-	200	200	-	45	W	W	-	4
4	V7	80	-	160	-	-	-	W	W	-	2



NOTES:

1. STEEL AND STAINLESS STEEL PIPES SHALL COMPLY WITH THE FOLLOWING.
   a) STAINLESS STEEL PIPES SHALL BE GRADE 304 AND SHALL COMPLY WITH ANSI B36.19M SCHEDULE 10S.
   b) MILD STEEL PIPES SHALL BE COATED WITH THREE LAYERS OF CARBOGUARD 891, 125 MICRON DRY FILM THICKNESS (DFT) PER LAYER
   c) MILD STEEL PIPES UP TO 150mm Ø SHALL BE SEAMLESS, MEDIUM CLASS STEEL PIPES MANUFACTURED IN ACCORDANCE WITH SANS 62.
   d) MILD STEEL PIPES OF 200mm Ø AND GREATER SHALL BE MANUFACTURED IN ACCORDANCE WITH SANS 719 SHALL BE GRADE C PIPE MATERIAL AND THE WALL THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 2, COLUMN 3 OF SANS 719.
   e) FLANGE DRILLING SHALL BE IN ACCORDANCE WITH SANS 1123: TABLE 1600/3.
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A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

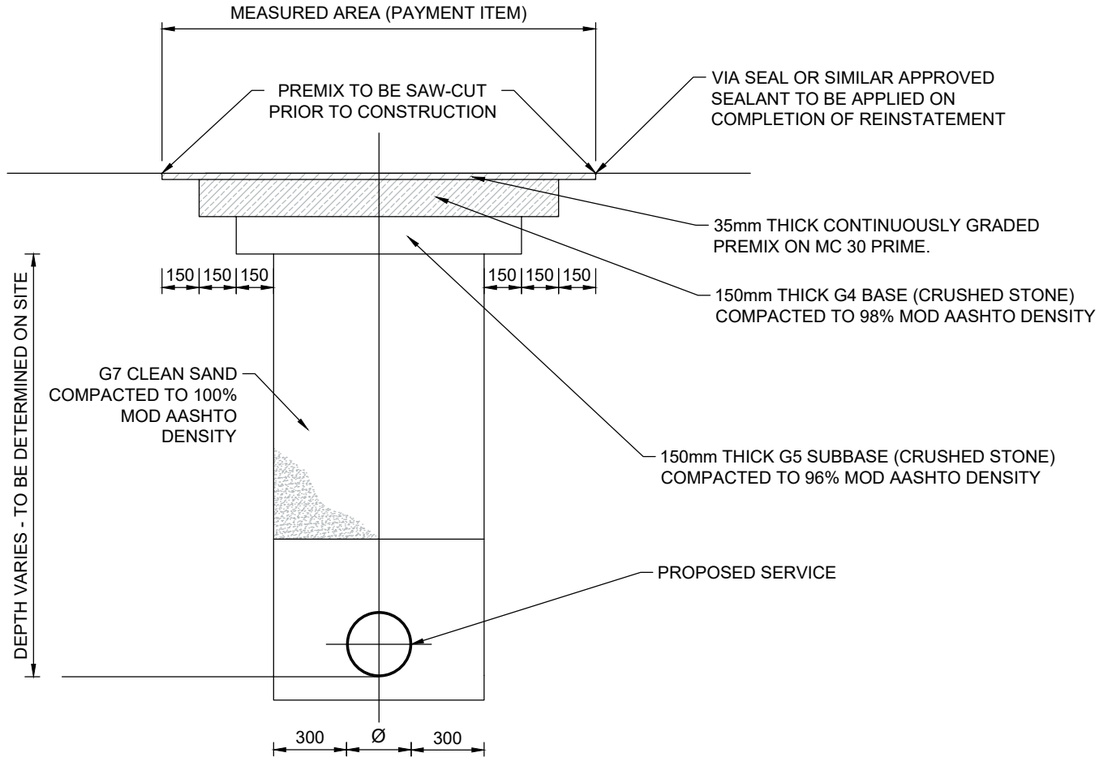
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PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
DETAIL OF 75mmØ WATER PIPE CRANKING

SCALE on A3: 1:75	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: C21108
DRAWING No.: 21108-C-214	REV: A
COORDINATE SYSTEM: N/A	



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A	ISSUED FOR TENDER	'21-10-25	ES	CD

REVISIONS

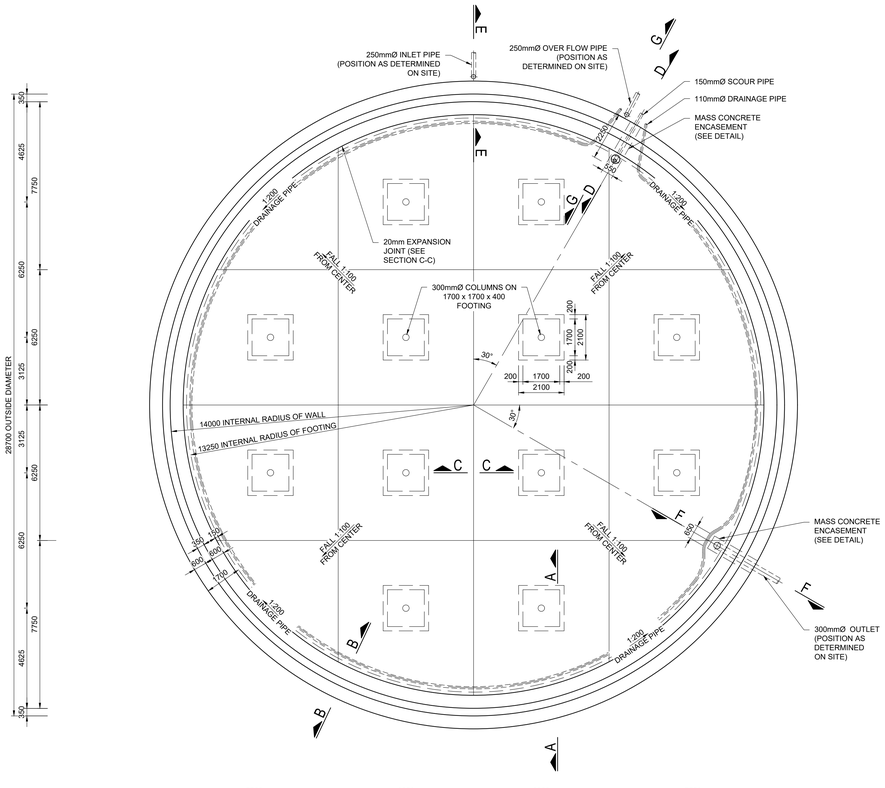
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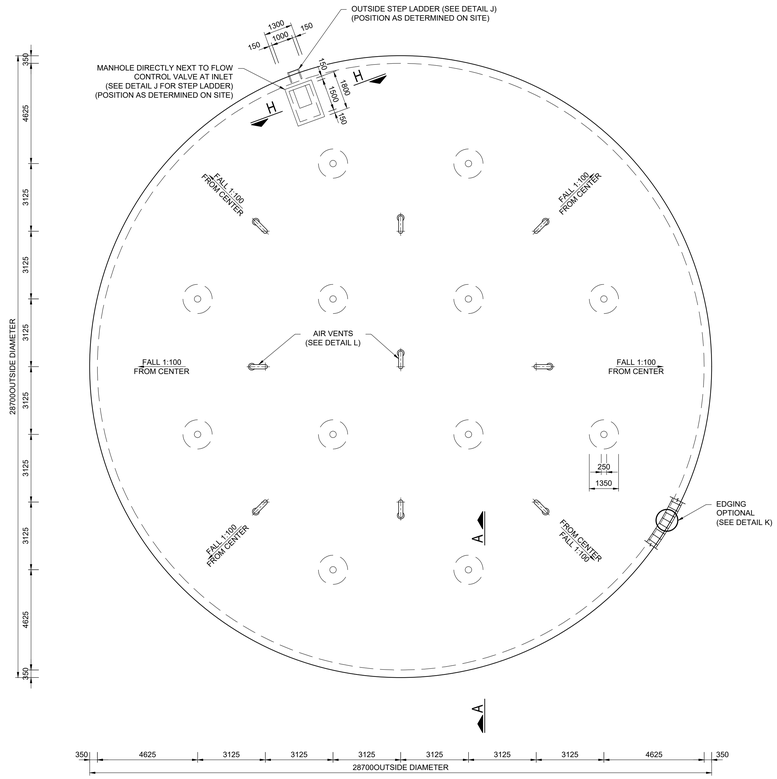
PROJECT
CONSTRUCTION OF 3Mℓ RESERVOIR
ROBERTSON

TITLE
TYPICAL DETAIL OF PREMIX ROAD REINSTATEMENT

SCALE: NTS	SHEET: 1 OF 1
CONTRACT No.	PROJECT No.: 21108C
DRAWING No.: 21108-C-215	REV: A
DATE OF FIRST ISSUE:	



FLOOR PLAN
SCALE 1:100



ROOF PLAN
SCALE 1:100

NOTES:

This drawing should be read in accordance with all other drawings & specifications.

Specifications:

a. All concrete work to comply with SABS 1200 G.
b. All structural steel to comply with SABS 1200 H.
c. All ground works to comply with SABS 1200 D.

Ground works: (Spec. SABS 1200 D)

a. All excavation & foundation to be approved by engineers.
b. No footings allowed on fill material.
   Excavate up to foundation depth as indicated incase suitable founding material is not found at this depth, excavate deeper & fill with (15MPa/19mm) mass concrete.
c. Compaction of fill material as specified.

Concrete: (Spec. SABS 1200 G)

a. The Alcali content of the cement used for concrete must comply with the specifications to ensure that no AA reaction takes place.
b. Grade of concrete grade & the maximum nominal size of course aggregate for each section of the work to be as indicated below. All strength concrete 30MPa/19mm with XYPEX ADMIX C500NF dosage to be at 1% by weight of Total Cementitious Material (including extenders) - min 3kg / m³ with a W/C ratio to be below 0.60.

Mass concrete & Blinding	- Class 20/19
Columns & Footings	- Class 30/19
Wall & Footing	- Class 30/19
Floor Slab	- Class 30/19
Roof Slab	- Class 30/19

Reinforcing:

a. All reinforcing must be approved by the engineer before concrete is cast. The engineer must be informed in advance.
b. Make use of PVC spacers for minimum reinforcing cover, as follows:

Footings	-Under	-75mm
	-Sides	-50mm
Columns	-Stirrups	-40mm
	-Main Reinforcing	-50mm
Roof Slab	-Bottom	-40mm
	-Top	-30mm
Walls	-Inside	-40mm
	-Outside	-40mm

Standard of concrete finishing

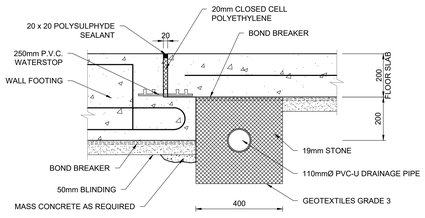
a. Classification of the concrete finishing is as specified.
b. All unshuttered concrete surfaces to be wood float finish unless otherwise shown.
c. All unshuttered concrete baring surfaces to be steel trowel finish.
d. Floor to be cast in panels as indicated on drawing.
e. Care to be taken with adheres in material & concrete that can influence the texture & colour of the exposed concrete surfaces.
f. Removal of timber to be approved by engineer.
g. All exposed concrete edges to have a 20 x 20mm chamfer unless otherwise specified.

Water Stops:

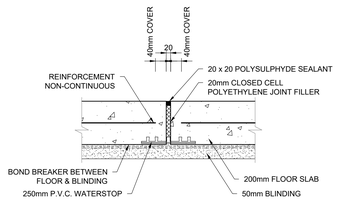
To be installed according to project specifications & as indicated on drawing.

Pipes & Flanges:

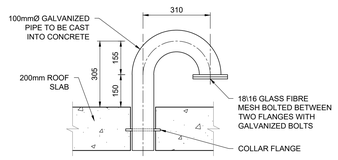
a. All pipe flanges shall comply with SANS 1123 Table 1000/3 unless otherwise stated.
b. Steel pipes underground to be wrapped with denso tape.
c. Steel pipes up to 150mmØ shall comply with SANS 62 & pipes over 150mmØ shall comply with SANS 719.
d. All steel pipes shall be hot dipped galvanized in accordance with SANS 121.



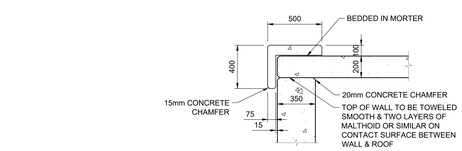
SECTION B-B: TYPICAL SECTION OF DRAINAGE CHANNEL
SCALE 1:10



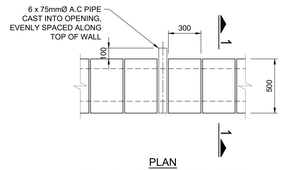
SECTION C-C: TYPICAL EXPANSION JOINT
SCALE 1:10



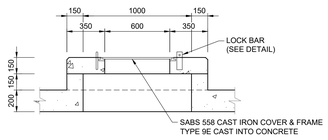
DETAIL L-L: AIR VENTS (No. 12)
SCALE 1:10



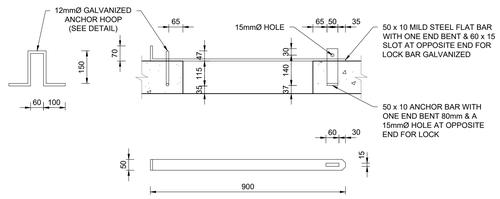
SECTION 1-1



PLAN
DETAIL K-K: EDGING & DOWNPIPE
SCALE 1:20



SECTION H-H
SCALE 1:20



LOCKING BAR DETAIL
SCALE 1:10

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 3 6
Meters 1:100

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REV	DESCRIPTION	DATE	REV BY	CHKD
T	ISSUED FOR TENDER	21-10-29	SM	LB

REVISIONS

DESIGNED	CO	
DRAWN	SM	
CHECKED	LB	

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email: beltville@lyners.co.za

APPROVED
ENGINEER: _____
DATE: 2021-10-28

APPROVED
CLIENT: _____
DATE: _____

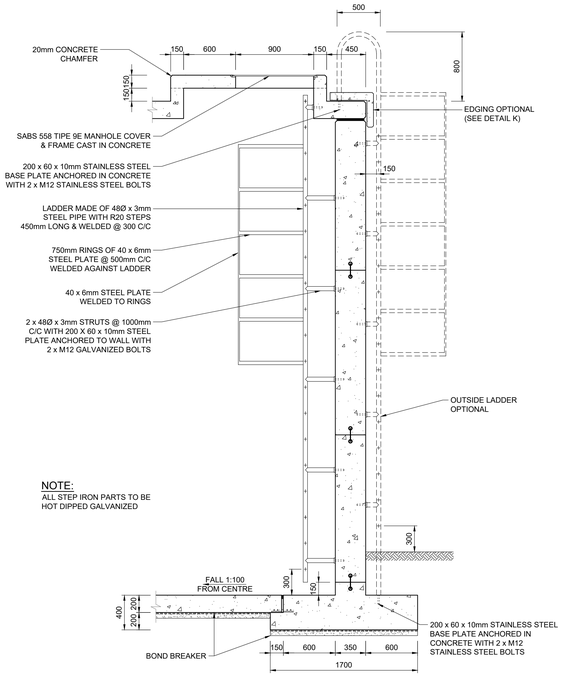
CLIENT
LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT
LANGEBERG MUN.
- CONCSTRUCTION OF 3.0ML RESERVOIR, ROBERTSON

TITLE
3ML RESERVOIR
CONCRETE LAYOUTS & DETAILS 1

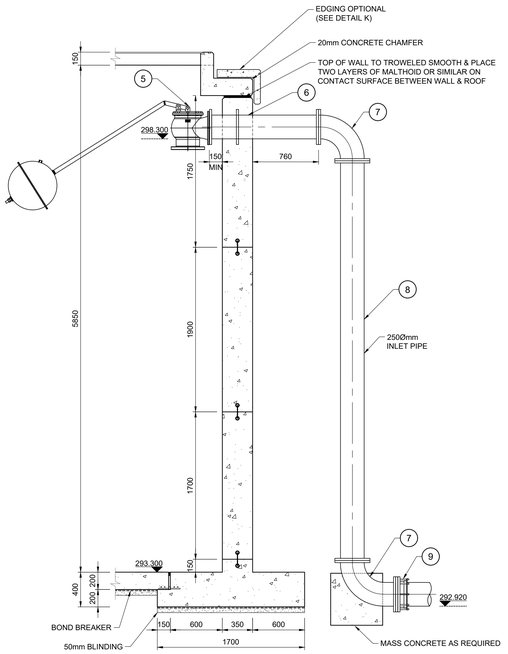
SCALE on A0	SHEET
AS SHOWN	1 OF 5
CONTRACT No.	PROJECT No.
	21108 C
DRAWING No.	REV
21108-S-001	1

COORDINATE SYSTEM: WGS84 / Lo 7°

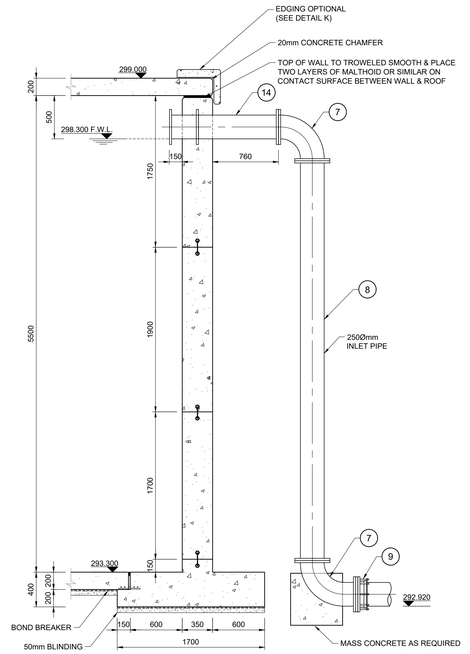


NOTE:
ALL STEP IRON PARTS TO BE HOT DIPPED GALVANIZED

DETAIL J: STEP IRONS
SCALE 1:25



SECTION E-E: INLET PIPE
SCALE 1:25



SECTION G-G: OVER FLOW PIPE
SCALE 1:25

NOTES:

This drawing should be read in accordance with all other drawings & specifications.

Specifications:

a. All concrete work to comply with SABS 1200 G.
b. All structural steel to comply with SABS 1200 H.
c. All ground works to comply with SABS 1200 D.

Ground works: (Spec. SABS 1200 D)

a. All excavation & foundation to be approved by engineers.
b. No footings allowed on fill material.
   Excavate up to foundation depth as indicated incase suitable founding material is not found at this depth, excavate deeper & fill with (15MPa/19mm) mass concrete.
c. Compaction of fill material as specified.

Concrete: (Spec. SABS 1200 G)

a. The Alcali content of the cement used for concrete must comply with the specifications to ensure that no AA reaction takes place.
b. Grade of concrete grade & the maximum nominal size of course aggregate for each section of the work to be as indicated below. All strength concrete 30MPa/19mm with XYPEX ADMIX C500NF dosage to be at 1% by weight of Total Cementitious Material (including extenders) - min 3kg / m³ with a W/C ratio to be below 0.60.

Mass concrete & Blinding	- Class 20/19
Columns & Footings	- Class 30/19
Wall & Footing	- Class 30/19
Floor Slab	- Class 30/19
Roof Slab	- Class 30/19

Reinforcing:

a. All reinforcing must be approved by the engineer before concrete is cast. The engineer must be informed in advance.
b. Make use of PVC spacers for minimum reinforcing cover, as follows:

Footings	-Under	-75mm
	-Sides	-50mm
Columns	-Stirrups	-40mm
	-Main Reinforcing	-50mm
Roof Slab	-Bottom	-40mm
	-Top	-30mm
Walls	-Inside	-40mm
	-Outside	-40mm

Standard of concrete finishing

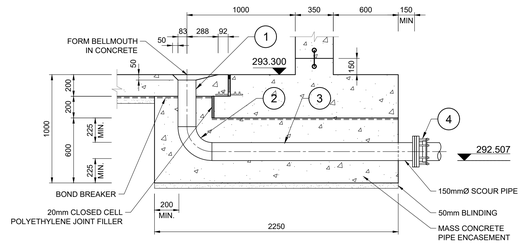
a. Classification of the concrete finishing is as specified.
b. All unshuttered concrete surfaces to be wood float finish unless otherwise shown.
c. All unshuttered concrete baring surfaces to be steel trowel finish.
d. Floor to be cast in panels as indicated on drawing.
e. Care to be taken with adheres in material & concrete that can influence the texture & colour of the exposed concrete surfaces.
f. Removal of timber to be approved by engineer.
g. All exposed concrete edges to have a 20 x 20mm chamfer unless otherwise specified.

Water Stops:

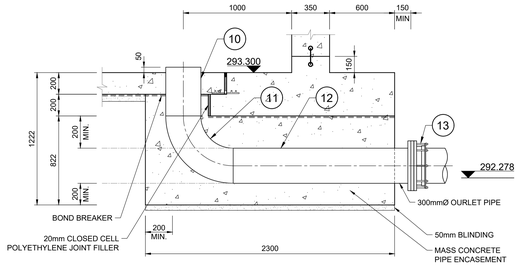
To be installed according to project specifications & as indicated on drawing.

Pipes & Flanges:

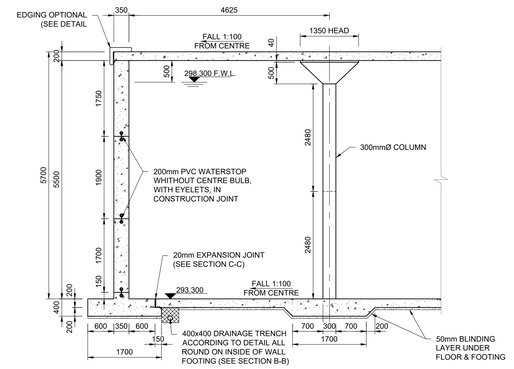
a. All pipe flanges shall comply with SANS 1123 Table 1000/3 unless otherwise stated.
b. Steel pipes underground to be wrapped with denso tape.
c. Steel pipes up to 150mmØ shall comply with SANS 62 & pipes over 150mmØ shall comply with SANS 719.
d. All steel pipes shall be hot dipped galvanized in accordance with SANS 121.



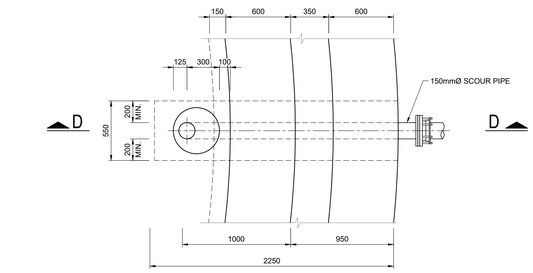
SECTION D-D: SCOUR PIPE
SCALE 1:20



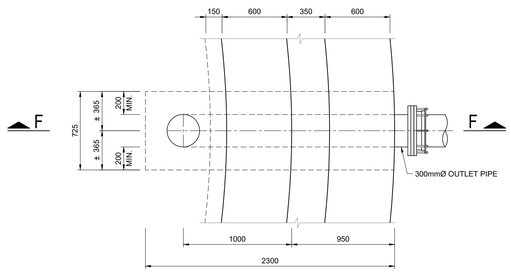
SECTION F-F: OUTLET PIPE
SCALE 1:20



SECTION A-A
SCALE 1:50



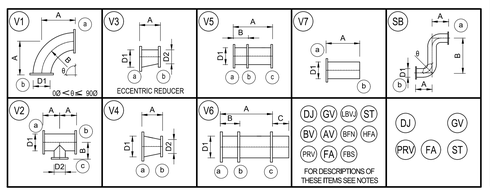
PLAN OF SCOUR PIPE
SCALE 1:20



PLAN OF OUTLET PIPE
SCALE 1:20

LEGEND	
□	EXACT LENGTH TO BE DETERMINED ON SITE
x	FLANGED END
#	SCOUR TEE
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
bW	CONTINUOUSLY BUTT WELDED ON SITE
∞	THREAD FEMALE CONNECTION
8	THREAD MALE CONNECTION

DESCRIPTION OF COUPLINGS AND VALVES	
SHAPE	DESCRIPTION
FA	VIKING JONHSON OR SIMILAR APPROVED FLANGE ADAPTOR PN 10 TO SUIT PVC-U PIPE.
GV	AVK 02/20 OR SIMILAR APPROVED PN10 FLANGED GATE VALVE.
BFV	AVK BALL FLOAT VALVE PN10.



PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges a	Flanges b	Flanges c	Quantity
1	V7	150	-	430	-	-	-	-	-	-	1
2	V1	150	-	230	230	-	90	-	-	-	1
3	V7	150	-	2150	-	-	-	-	x	-	1
4	FA	150	-	-	-	-	-	x	-	-	1
5	BFV	250	-	-	-	-	-	x	-	-	1
6	V5	250	-	1260	325	-	-	x	x	x	1
7	V1	250	-	390	390	-	90	x	x	-	4
8	V7	250	-	4600	-	-	-	x	x	-	2
9	FA	250	-	-	-	-	-	x	-	-	2
10	V7	300	-	450	-	-	-	-	-	-	1
11	V1	300	-	460	460	-	90	-	-	-	1
12	V7	300	-	1640	-	-	-	-	x	-	1
13	FA	300	-	-	-	-	-	x	-	-	1
14	V5	250	-	1410	325	-	-	x	x	x	1

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 0.75 1.5
Meters 1:25

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All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	BY	CHKD
T	ISSUED FOR TENDER	21-10-29	SM	LB

REVISIONS

DESIGNED	CO	
DRAWN	SM	
CHECKED	LB	

CONSULTING ENGINEERS

LYNERS
PO Box 4901
TYGERVALLEY
7530
Tel: 021 914 0300 / Fax: 021 914 0437
email: bellville@lyners.co.za

APPROVED
ENGINEER: _____
DATE: 2021-10-28

APPROVED
CLIENT: _____
DATE: _____

CLIENT
LANGEBERG MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT
LANGEBERG MUN.
- CONCSTRUCTION OF 3.0ML RESERVOIR, ROBERTSON

TITLE
3ML RESERVOIR
CONCRETE LAYOUTS & DETAILS 2

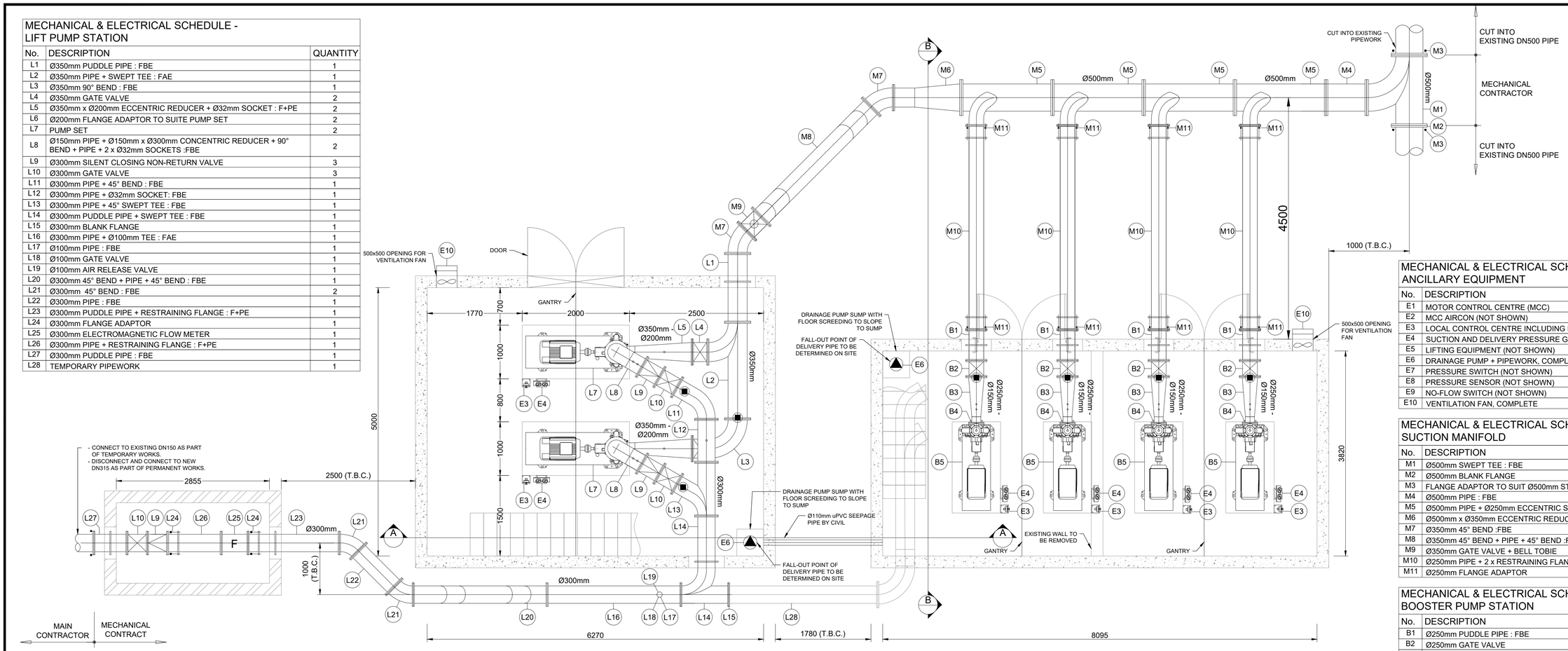
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SHEET: 2 OF 5
CONTRACT No.:
PROJECT No.: 21108 C
DRAWING No.: 21108-S-002
REV: 1
COORDINATE SYSTEM: WGS84 / Lo 7°

Plotted on: 29 October 2021 - 08:44:00
Plotted by: Sharon Smith
Drawn: SM
Checked: LB
2021-10-29

Plot Scale: 0.0 x 0.0 (841.00 x 1189.00 mm)
Lyners_AutoCAD.ctb 2021-10-28
U:\WERKE\21100\21108 C - LANGEBER MUN - CONSTRUCTION OF 3.0ML RESERVOIR, ROBERTSON\DRAWINGS\1.2 ACTIVE\21108-S-002 CONCRETE LAYOUT & DETAILS 2.DWG

MECHANICAL & ELECTRICAL SCHEDULE - LIFT PUMP STATION

No.	DESCRIPTION	QUANTITY
L1	Ø350mm PUDDLE PIPE : FBE	1
L2	Ø350mm PIPE + SWEPT TEE : FAE	1
L3	Ø350mm 90° BEND : FBE	1
L4	Ø350mm GATE VALVE	2
L5	Ø350mm x Ø200mm ECCENTRIC REDUCER + Ø32mm SOCKET : F+PE	2
L6	Ø200mm FLANGE ADAPTOR TO SUITE PUMP SET	2
L7	PUMP SET	2
L8	Ø150mm PIPE + Ø150mm x Ø300mm CONCENTRIC REDUCER + 90° BEND + PIPE + 2 x Ø32mm SOCKETS :FBE	2
L9	Ø300mm SILENT CLOSING NON-RETURN VALVE	3
L10	Ø300mm GATE VALVE	3
L11	Ø300mm PIPE + 45° BEND : FBE	1
L12	Ø300mm PIPE + Ø32mm SOCKET: FBE	1
L13	Ø300mm PIPE + 45° SWEPT TEE : FBE	1
L14	Ø300mm PUDDLE PIPE + SWEPT TEE : FBE	1
L15	Ø300mm BLANK FLANGE	1
L16	Ø300mm PIPE + Ø100mm TEE : FAE	1
L17	Ø100mm PIPE : FBE	1
L18	Ø100mm GATE VALVE	1
L19	Ø100mm AIR RELEASE VALVE	1
L20	Ø300mm 45° BEND + PIPE + 45° BEND : FBE	1
L21	Ø300mm 45° BEND : FBE	2
L22	Ø300mm PIPE : FBE	1
L23	Ø300mm PUDDLE PIPE + RESTRAINING FLANGE : F+PE	1
L24	Ø300mm FLANGE ADAPTOR	1
L25	Ø300mm ELECTROMAGNETIC FLOW METER	1
L26	Ø300mm PIPE + RESTRAINING FLANGE : F+PE	1
L27	Ø300mm PUDDLE PIPE : FBE	1
L28	TEMPORARY PIPEWORK	1



MECHANICAL & ELECTRICAL SCHEDULE - ANCILLARY EQUIPMENT

No.	DESCRIPTION	QUANTITY
E1	MOTOR CONTROL CENTRE (MCC)	1
E2	MCC AIRCON (NOT SHOWN)	1
E3	LOCAL CONTROL CENTRE INCLUDING E-STOP ON STAND	6
E4	SUCTION AND DELIVERY PRESSURE GAUGE ON STAND	6
E5	LIFTING EQUIPMENT (NOT SHOWN)	2
E6	DRAINAGE PUMP + PIPEWORK, COMPLETE	2
E7	PRESSURE SWITCH (NOT SHOWN)	2
E8	PRESSURE SENSOR (NOT SHOWN)	2
E9	NO-FLOW SWITCH (NOT SHOWN)	4
E10	VENTILATION FAN, COMPLETE	2

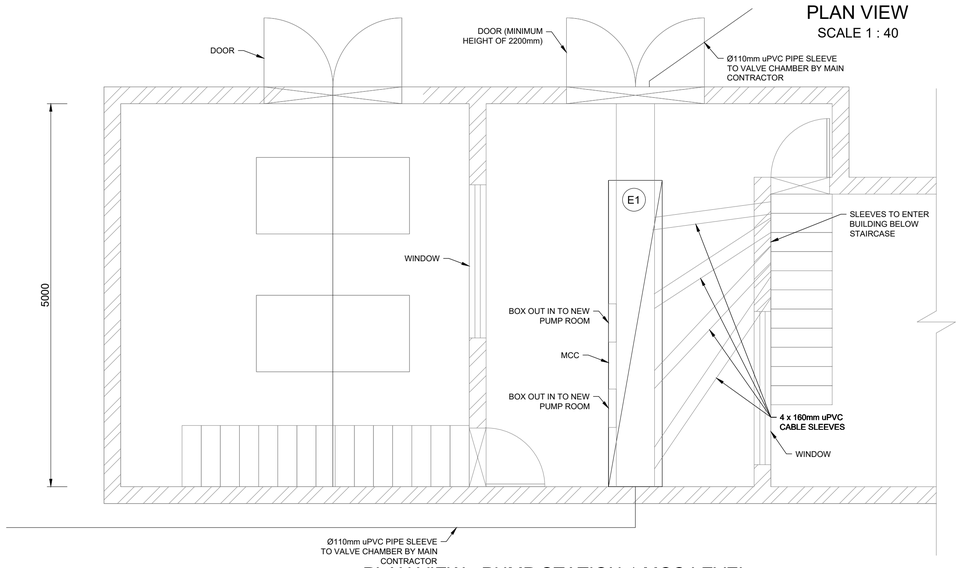
MECHANICAL & ELECTRICAL SCHEDULE - SUCTION MANIFOLD

No.	DESCRIPTION	QUANTITY
M1	Ø500mm SWEPT TEE : FBE	1
M2	Ø500mm BLANK FLANGE	1
M3	FLANGE ADAPTOR TO SUIT Ø500mm STEEL PIPE	2
M4	Ø500mm PIPE : FBE	1
M5	Ø500mm PIPE + Ø250mm ECCENTRIC SWEPT TEE : FAE	4
M6	Ø500mm x Ø350mm ECCENTRIC REDUCER + PIPE :FBE	1
M7	Ø350mm 45° BEND :FBE	2
M8	Ø350mm 45° BEND + PIPE + 45° BEND :FBE	1
M9	Ø350mm GATE VALVE + BELL TOBIE	1
M10	Ø250mm PIPE + 2 x RESTRAINING FLANGES : PEBE	4
M11	Ø250mm FLANGE ADAPTOR	8

MECHANICAL & ELECTRICAL SCHEDULE - BOOSTER PUMP STATION

No.	DESCRIPTION	QUANTITY
B1	Ø250mm PUDDLE PIPE : FBE	4
B2	Ø250mm GATE VALVE	4
B3	Ø250mm x Ø150mm ECCENTRIC REDUCER + 2 x Ø32mm SOCKETS + PIPE : F+PE	4
B4	Ø150mm FLANGE ADAPTOR TO SUIT PUMP	4
B5	PUMP SET, COMPLETE	4
B6	Ø125mm PIPE + Ø125mm x Ø200mm CONCENTRIC REDUCER + 90° BEND + PIPE + Ø32mm SOCKET : FBE	4
B7	Ø200mm SILENT CLOSING NON-RETURN VALVE	4
B8	Ø200mm GATE VALVE	4
B9	Ø200mm PUDDLE PIPE + Ø32mm SOCKET : FBE	2
B10	Ø200mm PUDDLE PIPE + Ø32mm SOCKET : FBE	2
B11	Ø200mm 90° BEND + Ø200mm x Ø350mm CONCENTRIC REDUCER : FBE	2
B12	Ø350mm PIPE SPECIAL : FAE	1
B13	Ø350mm FLANGE + Ø100mm PIPE : FBE	1
B14	Ø100mm GATE VALVE	1
B15	Ø100mm AIR RELEASE VALVE	1
B16	Ø350mm PIPE : FBE	1
B17	Ø350mm 45° BEND + PIPE + 45° BEND : FBE	1
B18	Ø350mm PUDDLE PIPE + RESTRAINING FLANGE : F+PE	1
B19	Ø350mm FLANGE ADAPTOR	1
B20	Ø350mm ELECTROMAGNETIC FLOW METER	1
B21	Ø350mm PIPE + RESTRAINING FLANGE : F+PE	1
B22	Ø350mm SILENT CLOSING NON-RETURN VALVE	1
B23	Ø350mm GATE VALVE	1
B24	Ø350mm PUDDLE PIPE :FBE	1
B25	Ø350mm FLANGE ADAPTOR TO SUITE RISING MAIN	1

PLAN VIEW
SCALE 1 : 40



PLAN VIEW - PUMP STATION 1 MCC LEVEL
SCALE 1 : 40

NOTES:
1. ALL PIPEWORK TO BE HOT-DIPPED GALVANIZED + EPOXY COATED MILD STEEL PIPEWORK, FLANGED TO SANS 1123 1000/3 FOR SUCTION AND DISCHARGE.
2. FBE = FLANGED BOTH END
3. FAE = FLANGED ALL END
4. F+PE = FLANGED PLUS PLAIN
5. VJFA = FLANGE ADAPTOR
6. PEBE = PLAIN END BOTH ENDS
7. CONTRACTOR TO SUBMIT WORKSHOP DRAWING FOR APPROVAL.
8. CONTRACTOR TO PROVIDE PIPE SUPPORTS TO SECURE ALL PIPEWORK
9. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE INDICATED.
10. ALL CIVIL AND BUILDING INFORMATION IS ONLY FOR INFORMATION PURPOSES. THE RESPECTIVE CIVIL AND STRUCTURAL DRAWINGS TAKE PREFERENCE.

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	FOR TENDER	2021/10/27		

REVISIONS

DESIGNED	PJ	
DRAWN	TB	
CHECKED	TA	

CONSULTING ENGINEERS
LYNERS
PO Box 4901
TYGERVALLEY
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Tel: 021 914 0300/Fax: 021 914 0437
email: bellville@lyners.co.za

APPROVED
ENGINEERS: _____
DATE: _____

APPROVED
CLIENT: _____
DATE: _____

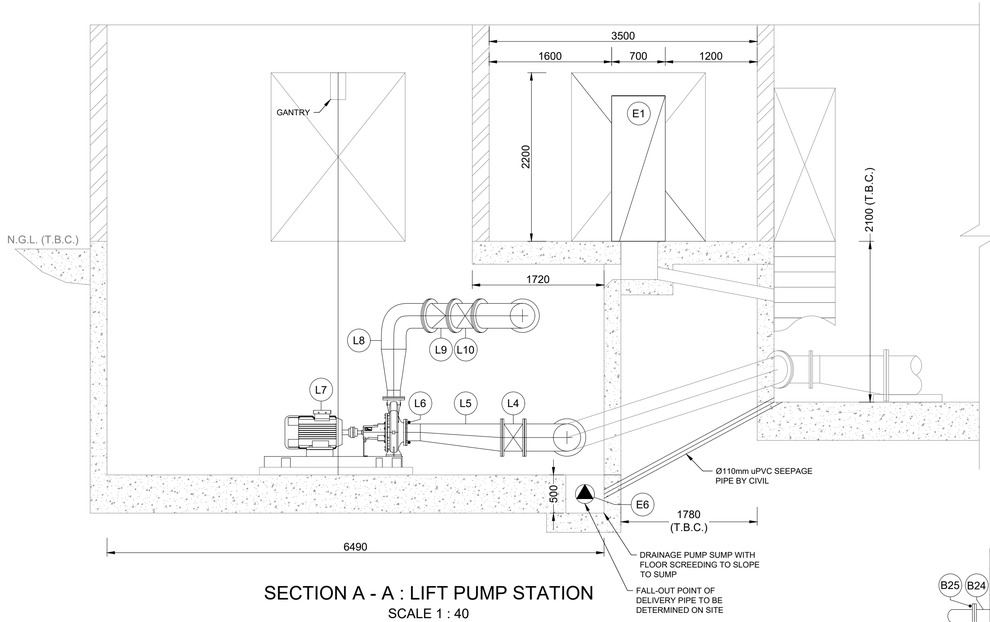
CLIENT
LANGEBERG
MUNISIPALITEIT MUNICIPALITY MASIPALA

PROJECT
CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

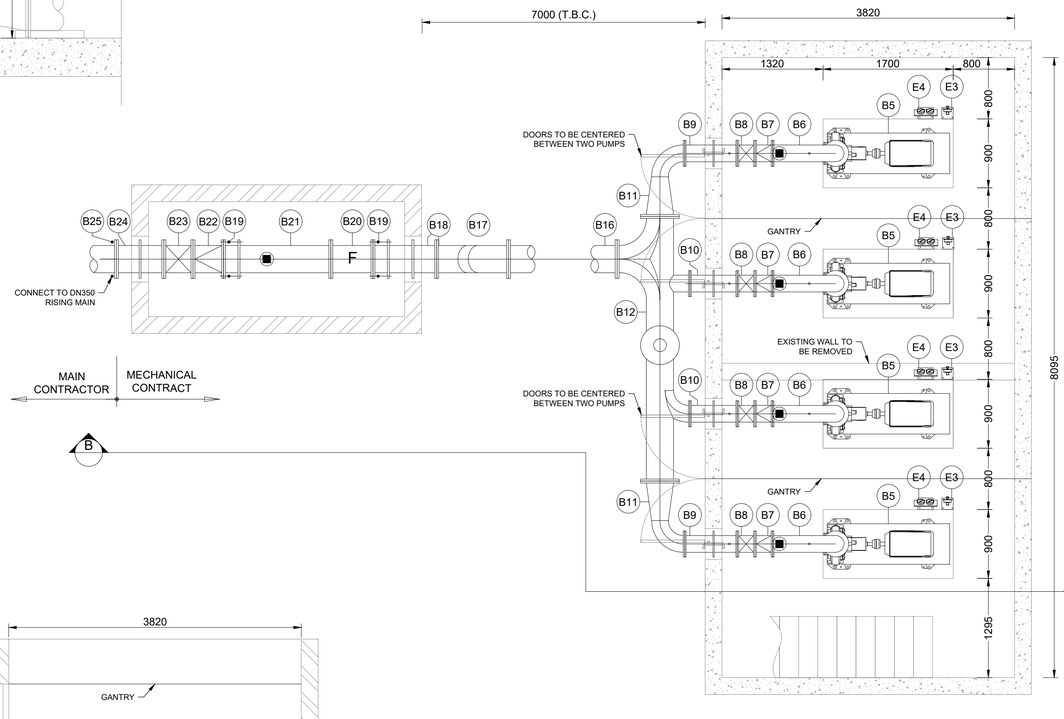
TITLE
MECHANICAL AND ELECTRICAL LAYOUT BOOSTER PUMP STATION & PUMP STATION 1

SCALE	SHEET
1 : 40 on A1	1 OF 2
CONTRACT No.	PROJECT No.
T60-2021	21108
DRAWING No.	REV
21108-M-001	A

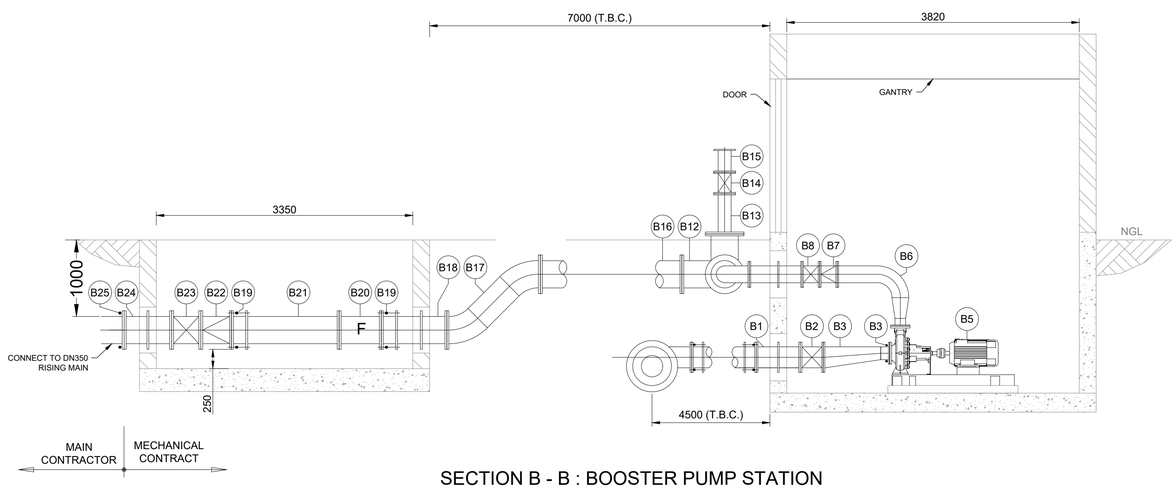
COORDINATE SYSTEM: WGS84 / Lo?°



SECTION A - A : LIFT PUMP STATION
SCALE 1 : 40



PLAN VIEW - BOOSTER PS DELIVERY PIPEWORK
SCALE 1 : 40



SECTION B - B : BOOSTER PUMP STATION
SCALE 1 : 40

MECHANICAL & ELECTRICAL SCHEDULE - ANCILLARY EQUIPMENT		
No.	DESCRIPTION	QUANTITY
E1	MOTOR CONTROL CENTRE (MCC)	1
E2	MCC AIRCON (NOT SHOWN)	1
E3	LOCAL CONTROL CENTRE INCLUDING E-STOP ON STAND	6
E4	SUCTION AND DELIVERY PRESSURE GAUGE ON STAND	6
E5	LIFTING EQUIPMENT (NOT SHOWN)	2
E6	DRAINAGE PUMP + PIPEWORK, COMPLETE	2
E7	PRESSURE SWITCH (NOT SHOWN)	2
E8	PRESSURE SENSOR (NOT SHOWN)	2
E9	NO-FLOW SWITCH (NOT SHOWN)	4
E10	VENTILATION FAN, COMPLETE	2

MECHANICAL & ELECTRICAL SCHEDULE - LIFT PUMP STATION		
No.	DESCRIPTION	QUANTITY
L1	Ø350mm PUDDLE PIPE : FBE	1
L2	Ø350mm PIPE + SWEPT TEE : FAE	1
L3	Ø350mm 90° BEND : FBE	1
L4	Ø350mm GATE VALVE	2
L5	Ø350mm x Ø200mm ECCENTRIC REDUCER + Ø32mm SOCKET : F+PE	2
L6	Ø200mm FLANGE ADAPTOR TO SUITE PUMP SET	2
L7	PUMP SET	2
L8	Ø150mm PIPE + Ø150mm x Ø300mm CONCENTRIC REDUCER + 90° BEND + PIPE + 2 x Ø32mm SOCKETS :FBE	2
L9	Ø300mm SILENT CLOSING NON-RETURN VALVE	3
L10	Ø300mm GATE VALVE	3
L11	Ø300mm PIPE + 45° BEND : FBE	1
L12	Ø300mm PIPE + Ø32mm SOCKET: FBE	1
L13	Ø300mm PIPE + 45° SWEPT TEE : FBE	1
L14	Ø300mm PUDDLE PIPE + SWEPT TEE : FBE	1
L15	Ø300mm BLANK FLANGE	1
L16	Ø300mm PIPE + Ø100mm TEE : FAE	1
L17	Ø100mm PIPE : FBE	1
L18	Ø100mm GATE VALVE	1
L19	Ø100mm AIR RELEASE VALVE	1
L20	Ø300mm 45° BEND + PIPE + 45° BEND : FBE	1
L21	Ø300mm 45° BEND : FBE	2
L22	Ø300mm PIPE : FBE	1
L23	Ø300mm PUDDLE PIPE + RESTRAINING FLANGE : F+PE	1
L24	Ø300mm FLANGE ADAPTOR	1
L25	Ø300mm ELECTROMAGNETIC FLOW METER	1
L26	Ø300mm PIPE + RESTRAINING FLANGE : F+PE	1
L27	Ø300mm PUDDLE PIPE : FBE	1
L28	TEMPORARY PIPEWORK	1

MECHANICAL & ELECTRICAL SCHEDULE - BOOSTER PUMP STATION		
No.	DESCRIPTION	QUANTITY
B1	Ø250mm PUDDLE PIPE : FBE	4
B2	Ø250mm GATE VALVE	4
B3	Ø250mm x Ø150mm ECCENTRIC REDUCER + 2 x Ø32mm SOCKETS + PIPE : F+PE	4
B4	Ø150mm FLANGE ADAPTOR TO SUIT PUMP	4
B5	PUMP SET, COMPLETE	4
B6	Ø125mm PIPE + Ø125mm x Ø200mm CONCENTRIC REDUCER + 90° BEND + PIPE + Ø32mm SOCKET : FBE	4
B7	Ø200mm SILENT CLOSING NON-RETURN VALVE	4
B8	Ø200mm GATE VALVE	4
B9	Ø200mm PUDDLE PIPE + Ø32mm SOCKET : FBE	2
B10	Ø200mm PUDDLE PIPE + Ø32mm SOCKET : FBE	2
B11	Ø200mm 90° BEND + Ø200mm x Ø350mm CONCENTRIC REDUCER : FBE	2
B12	Ø350mm PIPE SPECIAL : FAE	1
B13	Ø350mm FLANGE + Ø100mm PIPE : FBE	1
B14	Ø100mm GATE VALVE	1
B15	Ø100mm AIR RELEASE VALVE	1
B16	Ø350mm PIPE : FBE	1
B17	Ø350mm 45° BEND + PIPE + 45° BEND : FBE	1
B18	Ø350mm PUDDLE PIPE + RESTRAINING FLANGE : F+PE	1
B19	Ø350mm FLANGE ADAPTOR	1
B20	Ø350mm ELECTROMAGNETIC FLOW METER	1
B21	Ø350mm PIPE + RESTRAINING FLANGE : F+PE	1
B22	Ø350mm SILENT CLOSING NON-RETURN VALVE	1
B23	Ø350mm GATE VALVE	1
B24	Ø350mm PUDDLE PIPE :FBE	1
B25	Ø350mm FLANGE ADAPTOR TO SUITE RISING MAIN	1

NOTES:
1. ALL PIPEWORK TO BE HOT-DIPPED GALVANIZED + EPOXY COATED MILD STEEL PIPEWORK, FLANGED TO SANS 1123 1000/3 FOR SUCTION AND DISCHARGE.
2. FBE = FLANGED BOTH END
3. FAE = FLANGED ALL END
4. F+PE = FLANGED PLUS PLAIN
5. VJFA = FLANGE ADAPTOR
6. PEBE = PLAIN END BOTH ENDS
7. CONTRACTOR TO SUBMIT WORKSHOP DRAWING FOR APPROVAL.
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REV	DESCRIPTION	DATE	REV BY	CHKD
A	FOR TENDER	2021/10/27		

REVISIONS

DESIGNED	PJ	
DRAWN	TB	
CHECKED	TA	

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ENGINEERS: _____
DATE: _____

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CLIENT: _____
DATE: _____

CLIENT
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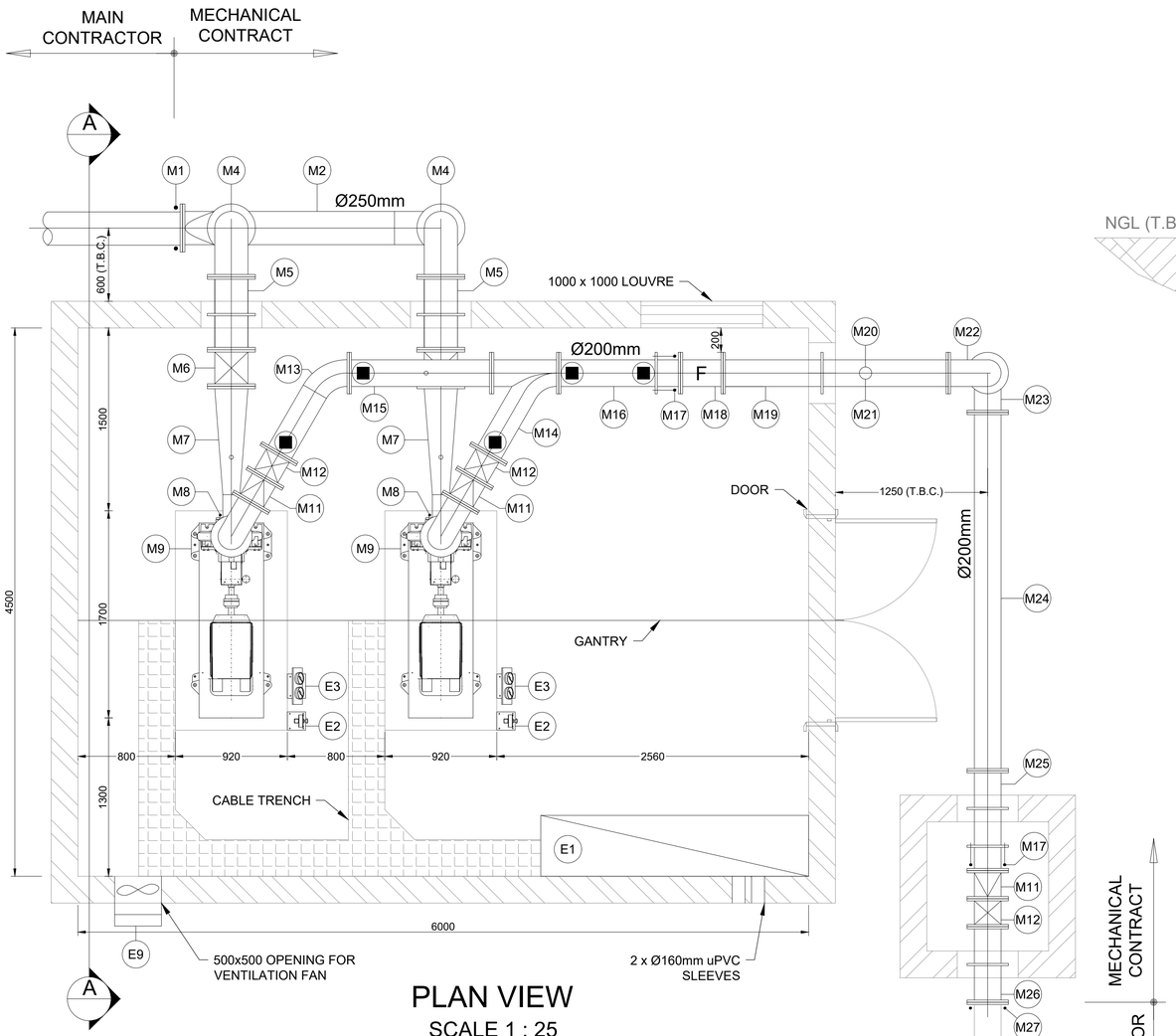
PROJECT
CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

TITLE
MECHANICAL AND ELECTRICAL LAYOUT BOOSTER PUMP STATION & PUMP STATION 1

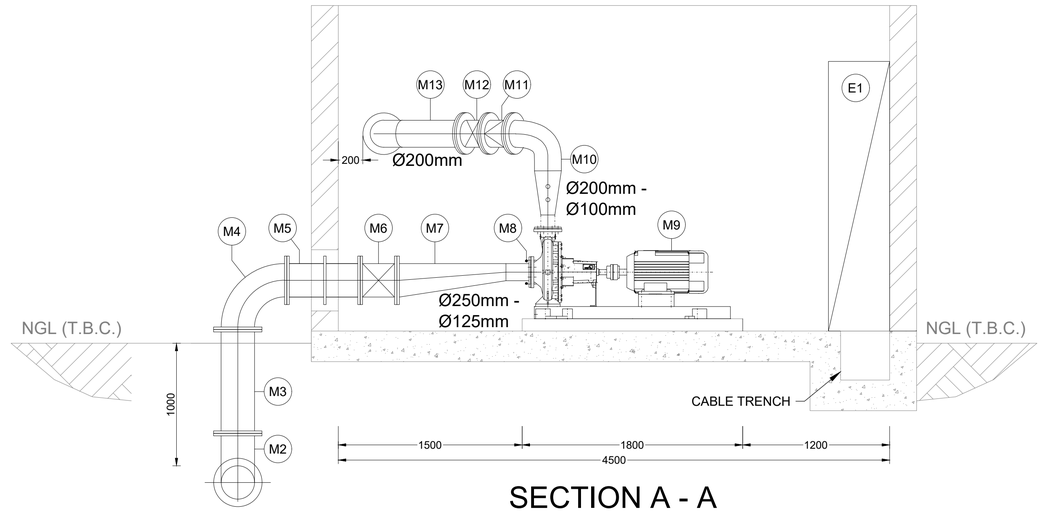
SCALE	on A1	SHEET
1 : 40		2 OF 2
CONTRACT No.		PROJECT No.
T60-2021		21108

DRAWING No. 21108-M-001 REV A

COORDINATE SYSTEM: WGS84 / Lo?°



PLAN VIEW
SCALE 1 : 25



SECTION A - A
SCALE 1 : 25

MECHANICAL AND ELECTRICAL SCHEDULE - ANCILLARY EQUIPMENT

No.	DESCRIPTION	QUANTITY
E1	MOTOR CONTROL CENTRE (MCC)	1
E2	LOCAL CONTROL CENTRE INCLUDING E-STOP ON STAND	2
E3	SUCTION AND DELIVERY PRESSURE GAUGE ON STAND	2
E4	LIFTING EQUIPMENT (NOT SHOWN)	1
E5	PRESSURE SWITCH (NOT SHOWN)	2
E6	PRESSURE SENSOR (NOT SHOWN)	1
E7	VENTILATION FAN, COMPLETE	1

MECHANICAL AND ELECTRICAL SCHEDULE - LIFT PUMP STATION

No.	DESCRIPTION	QUANTITY
M1	Ø250mm FLANGE ADAPTOR : FBE	1
M2	Ø250mm PIPE SPECIAL : FBE	1
M3	Ø250mm PIPE : FBE	2
M4	Ø250mm 90° BEND : FBE	2
M5	Ø250mm PUDDLE PIPE : FBE	2
M6	Ø350mm GATE VALVE	2
M7	Ø250mm x Ø125mm ECCENTRIC REDUCER + Ø32mm SOCKET : F+PE	2
M8	Ø125mm FLANGE ADAPTOR TO SUIT PUMP	2
M9	PUMP SET, COMPLETE	2
M10	Ø100mm PIPE + Ø100mm x Ø200mm CONCENTRIC REDUCER + 2 x Ø32mm SOCKET + 90° BEND : FBE	2
M11	Ø200mm SILENT CLOSING NON-RETURN VALVE	3
M12	Ø200mm GATE VALVE	3
M13	Ø200mm PIPE + 60° BEND : FBE	1
M14	Ø200mm PIPE + 60° SWEPT TEE : FBE	1
M15	Ø200mm PIPE + Ø32mm SOCKET : FBE	1
M16	Ø200mm PIPE RESTRAINING FLANGE : F+PE	1
M17	Ø200mm FLANGE ADAPTOR	2
M18	Ø200mm ELECTROMAGNETIC FLOW METER	1
M19	Ø200mm PUDDLE PIPE + Ø100mm TEE : FAE	1
M20	Ø100mm GATE VALVE	1
M21	Ø100mm AIR RELEASE VALVE	1
M22	Ø200mm 90° BEND + PIPE : FBE	1
M23	Ø200mm 90° BEND : FBE	1
M24	Ø200mm PIPE : FBE	1
M25	Ø200mm PUDDLE PIPE + RESTRAINING FLANGE : FBE	1
M26	Ø200mm PUDDLE PIPE : FBE	1
M27	Ø200mm FLANGE ADAPTOR TO SUITE RISING MAIN	1

NOTES:
1. ALL PIPEWORK TO BE HOT-DIPPED GALVANIZED + EPOXY COATED MILD STEEL PIPEWORK, FLANGED TO SANS 1123 1000/3 FOR SUCTION AND DISCHARGE.
2. FBE = FLANGED BOTH END
3. FAE = FLANGED ALL END
4. F+PE = FLANGED PLUS PLAIN
5. VJFA = FLANGE ADAPTOR
6. CONTRACTOR TO SUBMIT WORKSHOP DRAWING FOR APPROVAL.
7. CONTRACTOR TO PROVIDE PIPE SUPPORTS TO SECURE ALL PIPEWORK
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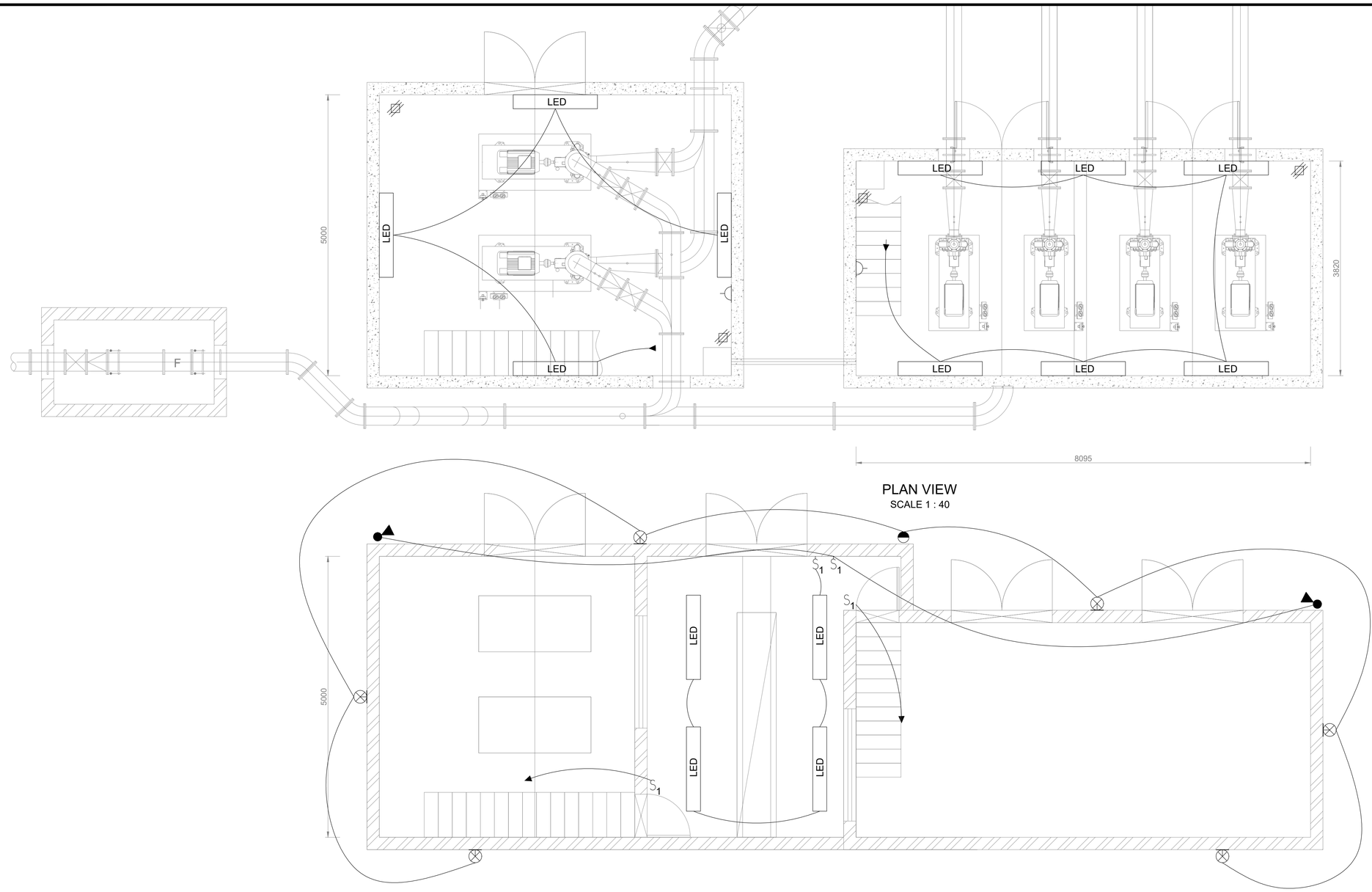
PROJECT
CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

TITLE
MECHANICAL AND ELECTRICAL LAYOUT PUMP STATION 2

SCALE	on A1	SHEET
1 : 25		1 OF 1
CONTRACT No.		PROJECT No.
T60-2021		21108

DRAWING No. 21108-M-002 REV A

COORDINATE SYSTEM: WGS84 / Lo?°



PLAN VIEW
SCALE 1 : 40

PLAN VIEW - PUMP STATION 1 MCC LEVEL
SCALE 1 : 40

LIGHTING AND POWER SCHEDULE

DESCRIPTION	WATTAGE	SYMBOL	QUANTITY
PHOTOCELL			1
SURFACE MOUNTED LED CORROSION PROOF LUMINAIRE	45 W	LED	14
SURFACE MOUNTED LED OUTDOOR LUMINAIRE	20 W		6
SURFACE MOUNTED LED OUTDOOR FLOODLIGHT	60 W		2
ONE-WAY SWITCH		S	4
16A FLUSH-MOUNTED SWITCH SOCKET OUTLET			2
SURFACE-MOUNTED ISOLATOR			2

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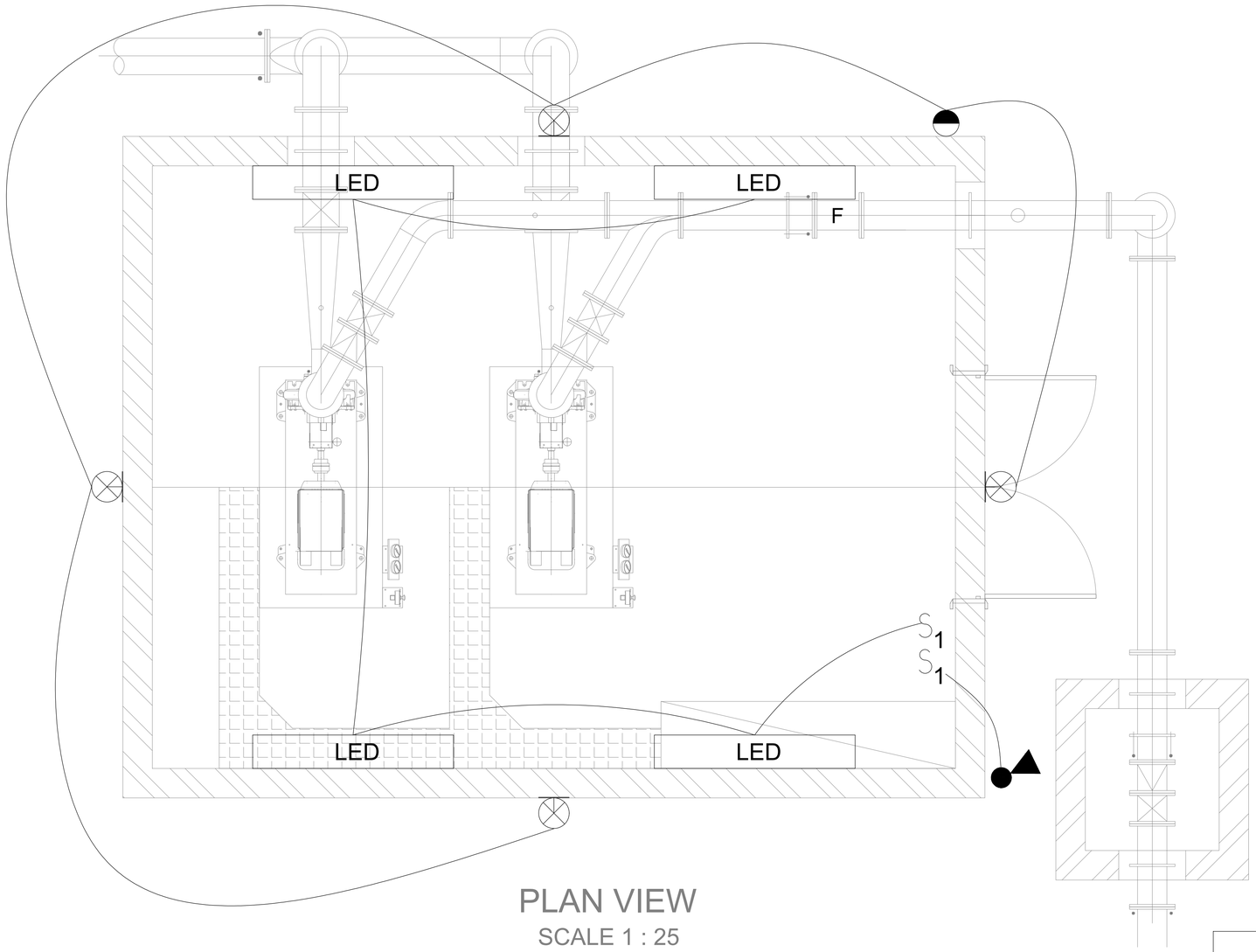
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PROJECT
CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

TITLE
LIGHTING AND POWER LAYOUT
BOOSTER PUMP STATION & PUMP STATION 1

SCALE	SHEET
1 : 40 on A1	1 OF 1
CONTRACT No. T60-2021	PROJECT No. 21108
DRAWING No. 21108-E-001	REV A

COORDINATE SYSTEM: WGS84 / Lo?°



PLAN VIEW

SCALE 1 : 25

LIGHTING AND POWER SCHEDULE

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PROJECT

CONSTRUCTION OF 3ML RESERVOIR, PIPELINES AND RELATED PUMP WORK

TITLE

LIGHTING AND POWER LAYOUT
PUMP STATION 2

SCALE on A1: 1 : 20	SHEET: 1 OF 1
CONTRACT No.: T60-2021	PROJECT No.: 21108
DRAWING No.: 21108-E-002	REV: A
COORDINATE SYSTEM: WGS84 / Lo?°	