mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

TENDER DOCUMENT

FOR

UPGRADE OF BATHURST BULK SEWER: WASTEWATER TREATMENT WORKS

TENDER NO: T11/2526

TENDERER:

TENDER AMOUNT:

CIDB REGISTRATION NUMBER & GRADING: 7CE

CLOSING DATE: 02 March 2026

CLOSING TIME: 12:00 PM

CSD:

CONTACT PERSON:

CONTACT NUMBER:

CONTACT ADRESS:

BENIFICIARY:	**FUNDER:**
Ndlambe Local Municipality PO Box 13 Port Alfred 6170	Municipal Infrastructure Grant Private Bag X804 Pretoria, 0001
ENGINEER:	
Newground Projects 17 St Andrews Road Selborne East London, 5201 Tel: (043) 722-5864	
newground projects	

Tender No. T11/2526

Contents

Number Heading
The Contract
Part T1: Tendering Procedures
T1.1 Tender Notice and Invitation to Tender
T1.2 Tender Data
Part T2: Returnables
T2.1 Returnable Documents (Compulsory Submissions)
T2.2 Returnable Documents - Municipal Bid Documents (MBD)
T2.3 Returnable Documents for Scoring
Part C1: Agreement and Contract Information
C1.1 Form of Offer and Acceptance
C1.2 Contract Information
C1.3 Performance Guarantee
C1.4 Adjudication
C1.5 Agreement in terms of the occupational health and safety act
Part C2: Pricing Data
C2.1 Pricing Instructions
C2.2 Bill of Quantities
Part C3: Specifications
C3.1 Scope of Works
C3.2 General Specifications
C3.3 Particular Specifications
C3.4 SMME Specifications
C3.5 Labour and Community Specifications
C3.6 Health and Safety Specifications
C3.7 Environmental Specifications
C3.8 Labour Intensive Construction Specifications
C3.9 Training Specifications
Part C4: Site Information
C4.1 Site Report
C4.2 Drawing Register
C4.3 Drawings
C4.4 Geotechnical Report
C4.5 Survey

PART T1: TENDERING PROCEDURES

T1.1 TENDER NOTICE

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

BID NO: T11/2526

NDLAMBE LOCAL MUNICIPALITY

TENDER NOTICE AND INVITATION TO TENDER

FOR THE UPGRADE OF BATHURST BULK SEWER: WASTEWATER TREATMENT WORKS

TENDER NOTICE AND INVITATION TO TENDER

Tenders are hereby invited from suitably qualified, experienced and skilled Civil Engineering Contractors with a minimum CIDB grade of 7 CE (or higher) for the construction of the Upgrade of Bathurst Bulk Sewer: Wastewater Treatment Works.

The scope of work for this project includes the construction of the components listed below.

Scope of Work – Upgrade of WWTW (1 050 kℓ Capacity)	
Scope Components	**Description**
Site	Site establishment and site clearance.
Earthworks	Bulk excavation for platform and structures. Restricted excavation for minor structures.
Inlet alterations	Partial demolition, construction of new canals, and mechanical installations.
Anaerobic Ponds	Construct new ponds and ancillaries (pipework, subsoil drainage, sumps, etc.)
Aerobic pond	Construct new pond and ancillaries (HDPE liners, pipework, subsoil drainage, etc..)
Settling pond	Construct new pond and ancillaries (pipework, subsoil drainage, sumps, etc.)
Drying beds	Construct new drying beds and ancillaries (HDPE liners, pipework, sumps, etc..)
Refurbish existing ponds	Emptying existing ponds, removing sludge, and repairing as needed.
New building (pump, chlorination, guard, office, and lab)	Construct new building and install ancillaries (plumbing, furniture, pipework, mechanical, and electrical.)
Pipelines	Install pipelines, ancillary structures, and fittings for potable water, sewer, de-sludging, aeration, chlorination, recycling, and recovery.
Access and internal roads	Upgrade the existing access road and construct internal roads.
Fencing	Demolition, refurbishment, supply and erection of perimeter fencing and gates.

Canals	Construction of required canals.
Mechanical works	Supply, installation, and commissioning of mechanical works.
Electrical works	Supply, installation, and commissioning of Electrical works.
ESKOM connection	Construct a new medium voltage overhead line and step-down transformer to connect WWTW.

The bid evaluation process will be based on below steps, and the qualified tenderers will be subject to negotiations of the most acceptable rate as outlined in the Standard for Uniformity in Engineering and Construction Works Contracts as contained in the Government Gazette No 42622 of August 2019.

The bid evaluation process will be based on the steps set out in this document. Clarification of information may be requested from tenderers in accordance with the Ndlambe LM SCM policy, Clause C.3.11 of the Standard Conditions of Tender. Where applicable, negotiations will only be conducted with the preferred tenderer in accordance with the Ndlambe LM SCM policy, Clause C.3.13 of the Standard for Uniformity in Engineering and Construction Works Contracts (Government Gazette No. 42622 of August 2019), as guided by CIDB Best Practice Guideline A6.

STEP 1: DETERMINE COMPLETENESS OF TENDER OFFER

STEP 2: FUNCTIONALITY

STEP 3: RISK ANALYSIS

STEP 4: PRICE AND SPECIFIC GOALS

Local SMMEs are required to be appointed as subcontractor(s) by the appointed Contractor to complete portions of the Works. Local SMME's are defined as being from the Ndlambe Local Municipal area only.

Tender documents can be obtained electronically from https://www.ndlambe.gov.za/quotations-and-tenders/ from **02 February 2026 at 10:00**.

Tender clarification meeting:

- Compulsory clarification meeting: Will be held at Bathurst Community Hall (Nolukhanyo), on the 09 February 2026 at 10:00

Hard copy tender documents are, if required, obtainable from the offices of the **SUPPLY CHAIN MANAGEMENT UNIT, 44 CAMPBELL STREET, PORT ALFRED** between 08h00 and 15h30 upon email request and payment of a fee of **R584-33** (VAT included) per set. Payments must be made at the cashiers at the Directorate Financial Services, 47 Campbell Street, Port Alfred prior to collecting the tender document and proof of payment must be submitted when collecting the tender document from the Supply Chain Management Office

Late submitted, unmarked, faxed, falsified, incomplete or e-mailed proposals will not be considered and will be disqualified. Completed Tender documents, supporting documents and externally endorsed documents must be placed in sealed envelopes marked "**NOTICE 13/2526 - UPGRADE OF BATHURST BULK SEWER: WASTEWATER TREATMENT WORKS"**, and deposited in the Tender Box at the Supply Chain Management Unit office, 44 Campbell Street, Port Alfred not later than **12h00 on 02 March 2026**. Tenders will be opened at the Supply Chain Management Unit at 12h05 on the same day.

N.B. ENVELOPES NOT MARKED AS INDICATED ABOVE WILL NOT BE OPENED AND SUCH BIDS WILL, AS A RESULT, BE DISQUALIFIED.

For bid enquiries contact: SCM related: Supply Chain Management Unit email: **tenders@ndlambe.gov.za** , Technical related: Gerhard Teseling email: **gerhard@newground.co.za** , and copy Vuyokazi Tshangana email**: vtshangana@ndlambe.gov.za**

NOTICE NUMBER: 13/2526 DV R DUMEZWENI

30 JANUARY 2026 MUNICIPAL MANAGER

NOTICE BOARDS, WEBSITE, DAILY DISPATCH

- END OF SECTION -

INVITATION TO TENDER MBD 1

YOU ARE HEREBY INVITED TO TENDER FOR THE FOLLOWING PROJECT:

TENDER NO: T11/2526

UPGRADE OF BATHURST BULK SEWER: WASTEWATER TREATMENT WORKS

NOTE THE FOLLOWING REQUIREMENTS

TENDER NUMBER:	**T11/2526**	CLOSING DATE:	**02 March 2026**	CLOSING TIME:	**12:00**

All tenderers must fill in and sign the Form of Offer and Acceptance.

Tender documents must be deposited in the tender box situated at Ndlambe LM in the Tender Box at the Supply Chain Management Unit office, 44 Campbell Street, Port Alfred. The documents must be submitted in a sealed envelope clearly marked with the Contract number and project name.

Tenderers must ensure that tenders are delivered timeously to the correct address. If the tender is late, it will not be accepted for consideration.

Tender box is accessible weekdays during office hours from 08:00 – 16:00.

All tenders must be submitted on the official forms – **(Do not re-type or supplement the contents of this document)**

THE FOLLOWING PARTICULARS MUST BE FURNISHED

Name of Tenderer	
Postal Address	
Street Address	
Telephone Number	Code: Number:
Cell phone Number	
Facsimile Number	Code: Number:
Vat Registration Number	

Has a valid tax clearance certificate or Tax compliance PIN Document been submitted?	YES / NO
Are you the accredited representative in South Africa for the goods/services offered	YES / NO (IF YES ENCLOSE PROOF)

SIGNATURE OF TENDERER	
DATE	
CAPACITY UNDER WHICH THIS TENDER IS SIGNED	
TOTAL TENDER PRICE (INCL. VAT)	

T1.2 TENDER DATA

Tender Data comprises three sections:

- T1.2.1 refers to the Standard Conditions of Tender
- T1.2.2 refers to the Variations to the Standard Conditions of Tender
- T1.2.3 refers to the Additional Conditions of Tender

T1.2.1 Standard Conditions of Tender

CIDB Standard Conditions of Tender

(August 2019 edition)

The Standard Conditions of Tender are those contained in the Construction Industry Development Board (CIDB) Standard for Uniformity in Engineering and Construction Works Contracts (August 2019) as published in Board Notice 423 of 2019, in Government Gazette No. 42622, on 08 August 2019. (Refer to www.cidb.org.za and/or www.gpwonline.co.za).

Annex C of the above-mentioned Board Notice is reproduced below, without amendment or alteration, for the convenience of Tenderers.

C.1 GENERAL

C.1.1 Actions

C.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 C.2 and C.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

C.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.

C.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.

C.1.2 Tender Documents

The documents issued by the Employer for the purpose of a tender offer are listed in the Tender Data.

C.1.3 Interpretation

C.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.

C1.3.2 These conditions of tender, the Tender Data and tender schedules which are required for tender evaluation purposes, shall form part of any Contract arising from the invitation to tender.

C1.3.3 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 fulfil his or her duties impartially;
- ii) an individual or Tenderer 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 Tenderer who 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;

C.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.

C.1.5 Cancellation and Re-invitation of Tenders

C.1.5.1 An Employer 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 engineering and construction Works specified in the invitation;

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

c) no acceptable tenders are received.

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

C.1.5.2 The decision to cancel a tender invitation must be published in the same manner in which the original tender invitation was advertised.

C.1.5.3 An Employer may only with the prior approval of the relevant treasury cancel a tender invitation for the second time.

C.1.6 Procurement Procedures

C.1.6.1 General

Unless otherwise stated in the Tender Data, a Contract will, subject to C.3.13, be concluded with the Tenderer who in terms of C.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.

C.1.6.2 Competitive Negotiation Procedure

C.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 C.3.4, the Employer shall announce only the names of the Tenderers who make a submission. The requirements of C.8 relating to the material deviations or qualifications which affect the competitive position of Tenderers shall not apply.

C.1.6.2.2 All responsive Tenderers, or at least a minimum of not less than three responsive Tenderers that are highest ranked in terms of the evaluation criteria stated in the Tender Data, shall be invited to enter into competitive negotiations, based on the principle of equal treatment, keeping confidential the proposed solutions and associated information.

Notwithstanding the provisions of C.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.

C.1.6.2.3 At the conclusion of each round of negotiations, Tenderers shall be invited by the Employer to revise their 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.

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

C.1.6.3 Proposal Procedure Using the Two-Stage System

C.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.

C.1.6.3.2 Option 2

C.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.

C.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.

C.2 TENDERER'S OBLIGATIONS

C.2.1 Eligibility

C.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.

C.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.

C.2.2 Cost of Tendering

C.2.2.1 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 comply with requirements.

C.2.2.2 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.

C.2.3 Check Documents

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

C.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.

C.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.

C.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.

C.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.

C.2.8 Seek Clarification

Request clarification of the tender documents, if necessary, by notifying the Employer at least five (5) working Days before the closing time stated in the Tender Data.

C.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.

C.2.10 Pricing the Tender Offer

C.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 fourteen (14) Days before the closing time stated in the Tender Data.

C.2.10.2 Show VAT payable by the Employer separately as an addition to the tendered total of the prices.

C.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.

C.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.

C.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.

C.2.12 Alternative Tender Offers

C.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.

C.2.12.2 Accept that an alternative tender offer must be based only on the criteria stated in the Tender Data or criteria otherwise acceptable to the Employer.

C.2.12.3 An alternative tender offer must only be considered if the main tender offer is the winning tender.

C.2.13 Submitting a Tender Offer

C.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 identified in the Contract Data and described in the Scope of Works, unless stated otherwise in the Tender Data.

C.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.

C.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.

C.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.

C.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.

C.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 proposal” and place the remaining returnable documents in an envelope marked “technical proposal”. 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.

C.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.

C.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.

C.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.

C.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.

C.2.15 Closing Time

C.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.

C.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.

C.2.16 Tender Offer Validity

C.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.

C.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.

C.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. If the validity period stated in C.2.16 lapses before the Employer evaluating tender, the Contractor reserves the right to review the price based on Consumer Price Index (CPI).

C.2.16.4 Where a tender submission is to be substituted, a Tenderer must submit a substitute tender in accordance with the requirements of C.2.13 with the packages clearly marked as “SUBSTITUTE”.

C.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 C.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.*

C.2.18 Provide Other Material

C.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.

C.2.18.2 Dispose of samples of materials provided for evaluation by the Employer, where required.

C.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.

C.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.

C.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.

C.2.22 Return of Other Tender Documents

If so instructed by the Employer, return all retained tender documents within twenty-eight (28) Days after the expiry of the validity period stated in the Tender Data.

C.2.23 Certificates

Include in the tender submission or provide the Employer with any certificates as stated in the Tender Data.

C.3 THE EMPLOYER'S UNDERTAKINGS

C.3.1 Respond to Requests from the Tenderer

C.3.1.1 Unless otherwise stated in the Tender Data, respond to a request for clarification received up to five (5) working Days before the tender closing time stated in the Tender Data and notify all Tenderers who collected tender documents.

C.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.

C.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 (3) working Days before the tender closing time stated in the Tender Data. If, as a result a Tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all Tenderers who collected tender documents.

C.3.3 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.

C.3.4 Opening of Tender Submissions

C.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.

C.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.

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

C.3.5 Two-Envelope System

C.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.

C.3.5.2 Evaluate capability of the technical proposals offered by Tenderers, then advise Tenderers who remain in contention for the award of the Contract at the time and place when the financial proposals will be opened. Open only the financial proposals of Tenderers, who comply with the capability requirements as set out in the Tender Data and announce the compliance for the technical proposals and the total price and any specific goals. Return unopened financial proposals to Tenderers whose technical proposals failed to achieve the capability requirements.

C.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.

C.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.

C.3.8 Test for Responsiveness

C.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.

C.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.

C.3.9 Arithmetical Errors, Omissions and Discrepancies

C.3.9.1 Check responsive tenders for discrepancies between amounts in words and amounts in figures. Where there is a discrepancy between the amounts in figures and the amounts in words, the amount in words shall govern.

C.3.9.2 Check the highest ranked tender or Tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with C.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.

C.3.9.3 Notify the Tenderer of all errors or omissions that are identified in the tender offer and either confirm the tender offer as tendered or accept the corrected total of prices.

C.3.9.4 Where the Tenderer elects to confirm the tender offer as tendered, correct the errors as follows:

a) 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.
b) 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.

C.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.

C.3.11 Evaluation of Tender Offers

The Standard Conditions of Tender standardize the procurement processes, methods and procedures from the time that tenders are invited to the time that a Contract is awarded. They are generic in nature and are made project specific through choices that are made in developing the Tender Data associated with a specific project.

Conditions of tender are by definition the document that establishes a Tenderer's obligations in submitting a tender and the Employer's undertakings in soliciting and evaluating tender offers. Such conditions establish the rules from the time a tender is advertised to the time that a Contract is awarded and require Employers to conduct the process of offer and acceptance in terms of a set of standard procedures.

The CIDB Standard Conditions of Tender are based on a procurement system that satisfies the following system requirements:	
Requirement	**Qualitative interpretation of goal**
Fair	The process of offer and acceptance is conducted impartially without bias, providing simultaneous and timely access to participating parties to the same information.
Equitable	Terms and conditions for performing the work do not unfairly prejudice the interests of the parties.
Transparent	The only grounds for not awarding a Contract to a Tenderer who satisfies all requirements are restrictions from doing business with the Employer, lack of capability or capacity, legal impediments and conflicts of interest.
Competitive	The system provides for appropriates levels of competition to ensure cost effective and best value outcomes.
Cost effective	The processes, procedures and methods are standardized with sufficient flexibility to attain best value outcomes in respect of quality, timing and price, and least resources to effectively manage and control procurement processes.

The activities associated with evaluating tender offers are as follows:

a) Open and record tender offers received
b) Determine whether or not tender offers are complete

c) Determine whether or not tender offers are responsive
d) Evaluate tender offers
e) Determine if there are any grounds for disqualification
f) Determine acceptability of preferred Tenderer
g) Prepare a tender evaluation report
h) Confirm the recommendation contained in the tender evaluation report

C.3.11.1 General

The Employer must appoint an evaluation panel of not less than three persons conversant with the proposed Scope of Works to evaluate each responsive tender offer using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the Tender Data.

C.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.

C.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 (No. 71 of 2008) bankrupt or being wound up, has his/her affairs administered by a court or a judicial officer, has suspended his/her 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.

C.3.14 Prepare Contract Documents

C.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.

C.3.14.2 Complete the schedule of deviations attached to the Form of Offer and Acceptance, if any.

C.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.

C.3.16 Registration of the Award

An Employer must, within twenty-one (21) working Days from the date on which a Contractor's offer to perform a construction Works Contract is accepted in writing by the Employer, register and publish the award on the CIDB Register of Projects.

C.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.

C.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.

T1.2.2 Variations to the Standard Conditions of Tender

The Standard Conditions of Tender make several references to the Tender Data for details that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender. Each item of data given below is cross-referenced to the clause in the Standard Conditions of Tender to which it mainly applies.

The following variations, amendments and additions to the Standard Conditions of Tender shall apply to this tender:

Clause No.	Variation, Amendment or Addition
C.1	**General**
C.1.1	**Actions**
C.1.1.1	***Add the following:*** The Employer is the Ndlambe LM, represented by the Ndlambe LM Municipal Manager.
C.1.1.2	***Add the following clauses after the first paragraph:*** The parties agree that this tender and its acceptance shall also be subject to the terms and conditions contained in the Employer's Supply Chain Management Policy ('SCM Policy'). Abuse of the supply chain management system is not permitted and may result in actions as set out in the SCM Policy.
C.1.2	**Tender Documents** **Add the following to the end of Clause C.1.2:** The Tender Document for this Contract comprises the following: Not issued to Tenderer's, but available from the S.A. Federation of Civil Engineering Contractors, the S.A. Institution of Civil Engineering, the S.A. Bureau of Standards, the Government printers, the Construction Industry Development Board, and the Employer, as applicable: 1. CIDB, "The Standard for Uniformity in Construction Procurement", Board Notice 423 of 2019, in Government Gazette No. 42622 of 08 August 2019. 2. General Conditions of Contract for Construction Works (GCC2015), Third Edition, 2015, published by the South African Institute of Civil Engineering (SAICE) 3. S.A. National Standards SANS 1200 Standardized Specifications for Civil Engineering Construction. 4. SANS 1921 (2004) Construction and Management Requirements for Works Contracts: Part 6. 5. Other National Standards as listed in Part C3.3 (Volume 2) 6. The Preferential Procurement Policy Framework Act No. 5 of 2000, read together with the Preferential Procurement Regulations, 2022 (effective 16 January 2023). 7. The Occupational Health and Safety Act No 85 and Amendment Act No 181 of 1993, and the Construction Regulations (2014). The tender documents issued by the Employer comprise: **Part T1: Tendering Procedures** T1.1 Tender Notice and Invitation to Tender T1.2 Tender Data **Part T2: Returnables** T2.1 Returnable Documents (Compulsory Submissions) T2.2 Returnable Documents - Municipal Bid Documents (MBD) T2.3 Returnable Documents for Scoring **Part C1: Agreement and Contract Information** C1.1 Form of Offer and Acceptance C1.2 Contract Information C1.3 Performance Guarantee C1.4 Agreement in terms of OHS Act **Part C2: Pricing Data** C2.1 Pricing Instructions C2.2 Bill of Quantities **Part C3: Specifications** C3.1 Scope of Works C3.2 General Specifications C3.3 Particular Specifications C3.4 SMME Specifications C3.5 Labour and Community Specifications C3.6 Health and Safety Specifications C3.7 Environmental Specifications C3.8 Labour Intensive Construction Specifications C3.9 Training Specifications **Part C4: Site Information** C4.1 Site Report

C4.2 Drawing Register
C4.3 Drawings
C4.4 Geotechnical report
C4.5 Survey

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

C.1.4 Communication and Employer's Agent

Delete the first sentence of the clause and replace with the following:

Verbal or any other form of communication, from the Employer, its employees, agents or advisors 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, unless communicated by the Employer in writing to Contractors by its Manager: Supply Chain Management, or his nominee.

The Employer's Representative is:

Name: Ms. S Mbenga-Smaile
Address: Ndlambe LM
44 Campbell Street
Port Alfred
6170
Tel: 046 504 5671 or 046 604 5500
E-mail: ssmaile@ndlambe.gov.za

Name: Ms. V Tshangana
Address: Ndlambe LM
44 Campbell Street
Port Alfred
6170
Tel: 046 604 5594 or 046 604 5500
E-mail: vtshangana@ndlambe.gov.za

The Employer's Agent is:

Name: Mr L Fourie
Address: Newground Projects
17 St Andrews Road, East London, 5247
Tel: 082 576 6828
Email: louis@newground.co.za

C.1.6.3 Proposal Procedure Using the Two-Stage System

Add the following to C.1.6.3:

A two-stage system will not be followed.

Add the following after C.1.6.3.2.2:

C.2 TENDERER'S OBLIGATIONS

C.2.1 Eligibility

Delete the heading ***Eligibility*** and replace with ***Responsiveness Criteria***

Delete the clause and replace with the following:

C.2.1.1 Tenderers must submit a tender offer that complies in all aspects to the conditions as detailed in this document. Only those tenders that comply in all aspects with the tender conditions, specifications, pricing instructions and Contract conditions will be declared responsive.

Add the following after C.2.1.2:

C.2.1.3 Only those tender submissions from which it can be established that a clear and unambiguous offer has been made to Employer, by whom the offer has been made, and what the offer constitutes, will be declared responsive.

C.2.1.4 Only those tenders that satisfy the following criteria will be declared responsive:

C.2.1.4.1 **Construction Industry Development Board (CIDB) Registration**

Only those tenderers who are registered (as "Active") with the CIDB (at time of tender closing), 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, with a minimum CIDB grading of **7 CE** (or higher) class of construction work, will be declared responsive. Tenderers must obtain such active status upon being requested to do so in writing and within the period contained in such a request, failing which their tenders will be declared non-responsive.

Joint Ventures are eligible to submit tenders provided that:

a) every member of the joint venture is registered with an active status with the CIDB.
b) the lead partner has a Contractor grading designation of not lower than one level below the required grading designation in the CE class of construction work; and
c) the combined Contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a Contractor grading designation determined in accordance with the sum tendered for a CE class of construction work or a

value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction Industry Development Regulations.

C.2.1.4.2 **National Treasury Central Supplier Database Registration**

Only Tenderers who are currently registered on the National Treasury Central Supplier (CSD) Database and have provided proof of their registration will be eligible to submit a tender offer. Proof of registration must be in the form of the Tenderer's CSD registration number.

In the case of Joint Venture partnerships this requirement will apply individually to each party to the Joint Venture.

Tenderers who wish to register as service providers on the CSD can register online at https://secure.csd.gov.za/Account/Register.

For further enquiries contact the Supply Chain Management Unit on Tel: 046 504 5671.

C.2.1.4.4 **Tenderer's Tax Clearance Certificate**

Tenderers shall be registered and in good standing with the South African Revenue Services (SARS).

Each party to a Consortium/Joint Venture shall submit a separate Tax Clearance PIN Number and/or Tax Number.

C.2.1.4.5 **Compliance with Requirements of Ndlambe LM SCM Policy and Procedures**

Only those tenders that are compliant with the requirements below will be declared responsive:

1 Completion of the Compulsory Enterprise Questionnaire;
2 Completion of the Form of Offer and Acceptance;
3 Registration with CSD –Compliance in terms of restriction and taxes;
4 VAT registration number (if any) to be provided;
5 A completed **Certificate of Authority for Partnerships / Joint Ventures / Consortiums** to be provided authorising the tender to be made and the signatory to sign the tender on the partnership / joint venture / consortium's behalf (applicable schedule to be completed);
6 A copy of the partnership / joint venture / consortium agreement to be provided;
7 The tenderer (including any of its directors or members), has not been restricted in terms of abuse of the Supply Chain Management Policy;
8 The tenderer's tax matters with SARS are in order;
9 The tenderer is not an advisor or consultant contracted with the Employer;
10 The tenderer is not a person, advisor, corporate entity or a director of such corporate entity, involved with the bid committees of Ndlambe LM. 0873120001 1

C.2.1.4.6 **Functionality**

Tenderers not complying with the minimum qualifying criterion for functionality will be considered non-compliant and not proceed to the next stage of evaluation. Refer to C.3.11.1 for details related to the evaluation of functionality.

C.2.3 Check Documents

Delete the clause and replace with the following:

The Tenderer should check the tender documents on receipt for completeness, missing or duplicated pages, indistinct figures or writing and any obvious errors. The Tenderer must notify the Employer's Agent at once of any such problems identified.

C.2.6 Acknowledge Addenda

Add the following:

All tenderers are to ensure that they take into consideration the contents of the addenda in their tender submissions, acknowledge receipt of any Addenda issued and to complete the relevant form in the Returnable Schedules.

C.2.7 Clarification Meeting

Add the following:

The arrangements for the Site visit/clarification meeting are as stated on the General Tender Information page and in the Responsiveness Criteria (if applicable).

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

The Tenderer shall, in addition to providing full valid contact details (contact person's name, phone number and e-mail address) in the Clarification Meeting Attendance Register, write-in the same contact details on Returnable Schedule A2 (Certificate Of Attendance At Clarification Meeting/Site Inspection) included in the tender document.

Tenderers must sign the Clarification Meeting Attendance Register in the name of the tendering entity. Addenda will only be issued to, and tenders will only be received from, those entities appearing on the Clarification Meeting Attendance Register.

Failure to attend and sign the Clarification Meeting Attendance Register shall deem the bid submission non-responsive.

C.2.8 Seek Clarification

Delete the clause and replace with the following:

Request clarification of the tender documents, if necessary, by notifying the Employer timeously.

Last day for queries and clarification shall be at least eight (8) calendar Days before the closing time stated in the Tender Data.

The tenderer warrants that it has:

a) Inspected the Specifications and read and fully understood the Conditions of Contract.

b) Read and fully understood the whole text of the Specifications and Price Schedule and thoroughly acquainted itself with the nature of the goods proposed and generally of all matters which may influence the Contract.
c) Visited the Site(s) where delivery of the proposed Works will take place, carefully examined existing conditions, the means of access to the Site(s), the conditions under which the delivery is to be made, and acquainted itself 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(s) and made the necessary provisions for any additional costs involved thereby.
d) Requested the Employer to clarify the requirements contained in the Specifications and Price Schedule, the exact meaning or interpretation of which is not clearly intelligible to the tenderer.
e) Received any notices to the tender documents which have been issued in accordance with the Employer's SCM Policy.

The Employer will therefore not be liable for the payment of any extra costs resulting from any claim submitted by the tenderer arising from any alleged ambiguity or uncertainty contained in the tender document.

C.2.11 Alterations to Documents

Add the following:

In the event of an error having been made on the price schedule, it shall be crossed out in non-erasable ink and shall be accompanied by the signatory to the Tender at each and every price alteration.

If correction fluid has been used on any specific item price, such item will not be considered. Corrections in terms of price may not be made by means of correction fluid such as Tippex or similar product. No correction fluid may be used in a Price Schedule where prices are calculated to arrive at a total amount. If an error has not been corrected and initialled as required and/or correction fluid has been used, the tender as a whole will be classified non-responsive and shall not be considered.

C.2.13 Submitting a Tender Offer

Add the following to C.2.13.1, at the end of the first sentence:

C.2.13.1 Where the tendering entity is a joint venture it is recommended that the standard CIDB Joint Venture Agreement be used.

Replace C.2.13.2 with the following:

C.2.13.2 Return all returnable documents to the Employer after completing them in their entirety by writing legibly in non-erasable ink. Notwithstanding the format in which the tender documents are issued to Tenderers, no electronic form of tender offers will be accepted.

The Original to be submitted shall comprise:

- Tender Document, as proof of specifications tendered on and duly completed and signed.
- All supporting documentation clearly marked with tenderer's name and the Employer's Bid Number

Failure to comply with these requirements may result in the tender being declared non-responsive.

The Schedule of Quantities must be fully and correctly filled in in by hand in black ink.

Add the following to C.2.13.3 at the end of the first sentence:

C.2.13.3 Only authorised signatories may sign the original and all copies of the tender offer where required in terms of C.2.13.3.

In the case of a **ONE-PERSON CONCERN** submitting a tender, this shall be clearly stated.

In the case of a **COMPANY** submitting a tender, include a copy of a resolution by its board of directors authorising a director or other official of the company to sign the documents on behalf of the company.

In the case of a **CLOSE CORPORATION** submitting a tender, include a copy of a resolution by its members authorising a member or other official of the corporation to sign the documents on each member's behalf.

In the case of a **PARTNERSHIP** submitting a tender, all the partners shall sign the documents, unless one partner or a group of partners has been authorised to sign on behalf of each partner, in which case proof of such authorisation shall be included in the Tender.

In the case of a **JOINT VENTURE / CONSORTIUM** submitting a tender, include a resolution of each company of the Joint Venture together with a resolution by its members authorising a member of the Joint Venture to sign the documents on behalf of the Joint Venture.

Add the following to C.2.13.5 at the end of the first sentence:

C.2.13.4 The tender submission details are all described on the General Tender Information page.

Add the following to C.2.13.6:

C.2.13.5 A two-envelope procedure will **not** be followed (C.3.5).

Add the following after C.2.13.9:

C.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.

C.2.14 Information and Data to be Completed in all Respects

Add the following:

The tenderer is required to provide all the data or information as requested below:

- All the documents and schedules as listed under T2.1: Returnable Schedules required for tender evaluation purposes.
- All the documents and schedules as listed under T2.3: Returnable Schedules that will be incorporated in the Contract.

Should a Tenderer not provide all of the above-mentioned data or information, the Tenderer may be considered non-responsive.

Accept that the Employer shall in the evaluation of tenders take due account of the Tenderer's past performance in executing similar construction Works of comparable magnitude, and the degree to which he possesses the necessary technical, financial and other resources to enable him to complete the Works successfully within the Contract period. Satisfy the Employer and Employer's Agent as to his ability to perform and complete the Works timeously, safely and with satisfactory quality, by furnishing details in Part T2 – Returnable Documents.

Accept that the Employer is restricted in accordance with clause 4.(4) of the Constructions Regulations, 2014, to only appoint a Contractor who he is satisfied has the necessary competencies and resources to carry out the work safely. Accept that submitting inferior and inadequate information relating to health and safety (as required in clause C.2.23) shall be regarded as justifiable and compelling reasons not to award a Contract to a Tenderer.

C.2.15 Closing Time

Add the following to C.2.15.1 after the first sentence:

C.2.15.1 The closing time for submission of tender offers is as stated in the Tender Notice and Invitation to Tender.

C.2.16 Tender Offer Validity

Add the following to C.2.16.1 after the first sentence:

C.2.16.1 The tender offer validity period is **4 months (120 calendar Days)**.

C.2.16.2 ***Delete the clause and replace with the following:***

Tender offers shall be deemed to remain valid until formal acceptance by the Employer of an offer at any time after the expiry date of the original tender offer validity period, unless the Employer is notified in writing of anything to the contrary, including any further conditions, by the tenderer.

Any further conditions introduced by the tenderer will be considered at the sole discretion of the Employer.

C.2.17 Clarification of Tender Offer after Submission

Add the following to C.2.17 at the end of the third sentence:

A tender will be rejected as non-responsive if the tenderer fails to provide any clarification or supporting documents requested by the Employer within the time for submission stated in the Employer's written request for such clarification or documents.

C.2.18 Provide Other Material

C.2.18.1 ***Delete the following word in C.2.18.1:***

notarized

C.2.18.2 ***Add the following after C.2.18.2:***

Tenderers shall fully co-operate with the Employer's external service provider appointed to perform a due diligence review and risk assessment upon receipt of such written instruction from the Employer.

Failure to fully cooperate could result in a tender being declared as non-responsive.

C.2.18.3 **Compliance with Occupational Health and Safety Act, 85 of 1993**

Tenderers are to note the requirements of the Occupational Health and Safety Act, 85 of 1993 and the Construction Regulations, 2014 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 or upon request, appended to Schedule 18: Health and Safety Plan in T2.2: Returnable Schedules, a draft Health and Safety Plan in respect of the Works in sufficient detail to demonstrate the necessary competencies and resources to perform the construction work all in accordance with the Act, Regulations and Health and Safety Specification in Part C3.5 Management in the Scope of Work.

C.2.23 Certificates

Add the following after the first sentence:

The tenderer is required to submit the following:

C.2.23.1 **Evidence of Tax Compliance**

Tenderers shall be registered with the South African Revenue Service (SARS) and their tax affairs must be in order and they must be tax compliant. In this regard, the tax status of the Tendering company/ies shall be verified by Ndlambe LM using their National Treasury Central Supplier Database number/s. The tenderer must also provide its Tax Compliance Status PIN number on the **Compulsory Enterprise Questionnaire**.

Tenderers are to note that the Employer will not award a Contract to a Tenderer whose tax matters are not in order.

C.2.23.2 **Specific Goals**

Bidders must complete and sign MBD 6.1 in order to claim points for Specific Goals. Failure will lead to non-awarding of points for Specific Goals.

Add the following new clause:

C.2.24 Amendments, Alterations and Qualifications

No amendments, alterations or qualifications to the tender document will be accepted. Any such changes will result in the tender submission being declared non-responsive.

C.3 THE EMPLOYER'S UNDERTAKINGS

C.3.1 Respond to Requests from the Tenderer

Amend C.3.1.1 as follows:

C.3.1.1 The Employer will respond to a request for clarification received up to seven working Days before the tender closing time stated in the Tender Data and notify all tenderers who attended the Clarification Meeting.

C.3.2 Issue Addenda

Add the following to C.3.2, at the end of the paragraph:

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.

The Employer or his Agent shall not be held liable or responsible for non-receipt of any Addenda issued (and consequent rejection of tender submitted) where communication of such Addenda using the supplied contact e-mail address fails for whatever reason.

C.3.4 Opening of Tender Submissions

Add the following to C.3.4.2 at the end of the paragraph:

C.3.4.2 The location for opening of the tender offers is the Tender Submission Office at the address as stated on the General Tender Information page.

C.3.5 Two-Envelope System

A two-envelope procedure will **not** be followed.

C.3.7 Grounds for Rejection and Disqualification

Add the following to the end of C.3.7:

Tenderers will be disqualified:

a) If any of the directors/shareholders of the Tenderer are listed on the National Treasury Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business in the public sector;
b) If from information given in the completed Compulsory Enterprise Questionnaire, the Employer considers that there is a potential conflict of interest which may potentially compromise the tender process.
c) If a tender has failed to perform satisfactorily and had their contract terminated due to the non-performance.

C.3.8 Test for Responsiveness

C.3.8.2 ***Delete clause C.3.8.2 (c)***

Replace the final sentence of clause C.3.8.2 with the following:

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

Add the following after C.3.8.2:

C.3.8.3 A tender offer that does not meet the requirements as specified below, will be deemed non-responsive:

- The Tender offer does not meet any one of the eligibility criteria specified in Clause C.2.1.1 as amended.
- The Tenderer has not fully and correctly completed the Offer portion of C1.1 Form of Offer and Acceptance i.e. the price has not been completed in words and numbers, the Tenderers details are not completed fully and correctly, and the Tenderer has failed to sign the Offer portion of C1.1.
- If requested by the Employer during the tender evaluation process, the Tenderer has failed to clarify or submit any supporting documentation within the time for submission stated in the Employer's written request.
- The Tenderer's price is based on fixed rates or amended percentage allowance in lieu of Contract Price Adjustment or amended percentage allowance for Contingencies.
- There are any other material deficiencies whereby the price submitted is not for the identical requirements and Scope of Work as other correctly completed tenders (such as changing any quantity or percentage allowance in the Pricing Schedule or failing to incorporate the requirements of Addenda where these materially affected the pricing e.g. where the Notice to Tenderers required any amendments or replacements of part or all of the Bill of Quantities and the submitted Bill of Quantities does not reflect these changes).

C.3.8.4 The Employer reserves the right not to accept a tender offer which, in the Employer's opinion, materially and/or substantially deviates from the terms, conditions, and specifications of the tender documents.

C.3.9 Arithmetical Errors, Omissions and Discrepancies

Add the following after clause C.3.9.4:

C.3.9.5 In the event of tendered rates or lump sums being declared by the Employer to be unacceptable to it because they are not priced, are priced 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.
Should the Tenderer fail to amend his tender in a manner acceptable to and within the time stated by the Employer, the Employer may declare the tender as non-responsive.

C.3.10 Clarification of a Tender Offer

Delete the clause and replace with the following:

The Employer may, after the closing date, request additional information or clarification from a tenderer, in writing, on any matter affecting the evaluation of the tender offer, or that could give rise to ambiguity in a Contract arising from the tender offer.

C.3.11 Evaluation of Tender Offers

Add the following to C.3.11.1:

C.3.11.1 General

Tenders will be evaluated in terms of the Ndlambe LM procurement policy. The four (4) steps hereunder define the evaluation process.

STEP 1: DETERMINE COMPLETENESS OF TENDER OFFER

(1) Tender submissions will be screened to identify schedules and required documents that are incomplete or have not been submitted. Refer to the *Returnable Documents (Compulsory Submissions)* in T2.1 and *Returnable Documents - Municipal Bid Documents (MBD)* in T2.2.

(2) Tender offers will be tested for compliance with all the requirements of the Variations to the Standard Conditions of Tender in T1.2.2, including the following:

- Eligibility
- Pricing the tender offer
- Alterations to documents
- Alternative tender offer
- Submitting a tender offer
- MBD4-bidders disclosure where the director/related parties are in the service of the state.

(3) Tender offers will be declared non-responsive should they fail to comply with any one of the requirements of (1) and (2) above.

(4) Non-responsive Tender Offers will not be evaluated further.

STEP 2: FUNCTIONALITY

Bids will be evaluated on the basis of responsiveness first and then functionality. Only responsive bids will be evaluated on price and specific goals.

The functionality assessment will be based on the information submitted in the Returnable Schedules and will assess the likely risk of the Tenderer not being able to successfully perform the work under this contract and meet all his/her contractual obligations.

A minimum of 70% compliance is required for functionality scoring. Bidders who fail to achieve the minimum percentage will be considered non-compliant for functionality and will not be evaluated further in the following steps. **Failure to submit the Completion Certificate or Practical Completion certificate may result in the bid being considered as non-compliant and may not be evaluated further.**

The tenderer must claim the appropriate points under the applicable section allowed for in the tender document.

The staff functionality requirements will be applicable and enforceable after appointment.

Position	Status/ Qualification	Experience	Score	Max Points
Construction Manager	SACPCMP registered Construction Manager. Copies of SACPCMP registration and CV must be attached. Experience will be regarded as the number of years post registration.	10 years or more	15	15
		7-9 years	10	
		1-6 years	5	
		Less than 1 year	0	

Contracts/Project Manager	SACPCMP registered Project Manager. Copies of SACPCMP registration and CV must be attached. Experience will be regarded as the number of years post registration.	10 years or more	15	15
		7-9 years	10	
		1-6 years	5	
		Less than 1 year	0	
Civil Works Foreman	CV indicating relevant experience must be attached.	7-10 years	10	10
		4-6 years	5	
		1-3 years	2	
		Less than 1 year	0	
SMME Manager	Minimum of National Diploma in the Built Environment. Certified copies of qualification and CV must be attached. Experience will be regarded as number of years post qualification.	15 years or more	10	10
		10-14 years	5	
		Less than 10 years	2	
Health & Safety Officer	SACPCMP registered Construction Health and Safety Officer. Copies of SACPCMP registration and CV must be attached. Experience will be regarded as the number of years post registration.	10 years or more	10	10
		7-9 years	5	
		1-6 years	2	
		Less than 1 year	0	
TOTAL POINTS				60

Criteria	Description	Number of Reference or Completion Letters	Score	Max Points
Company Experience	Company's experience in the civil work construction of water or wastewater infrastructure related projects. Bidders must submit reference or completion letters from clients indicating their experience for the required services.	3 or more	40	40
		Less than 3	10	
		no letter	0	
"Experience of company" means the number of comparable projects that were successfully completed. A comparable project is defined to include the civil work construction of water or wastewater infrastructure related projects with a minimum contract value of R 10 000 000.00 a minimum treatment capacity of 750 kℓ/day, and reinforced concrete water retaining structures in the past 10 years.				

STEP 3: 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:

(1) Reasonableness of the financial offer;

(2) Reasonableness of unit rates and prices;

(3) Current workload and capacity available to implement the project successfully;

(4) Financial capability to implement the project successfully; and

(5) Response from reference checks conducted.

The conclusions drawn from this risk analysis will be used by the Employer in determining the acceptability of the tender offer.

The Employer reserves the right to engage with the Tenderer retrospectively to obtain information required for the above risk analysis.

The Employer reserves the right to contact references and make enquiries to determine the tenderer's competence, reliability, experience, reputation, and capability to perform the Contract.

STEP 4: PRICE AND SPECIFIC GOALS

In terms of the Preferential Procurement Policy Framework Act (PPPFA) the 80/20 or 90/10 scoring system will be applicable to this tender.

The maximum points for this tender are allocated as follows:

	POINTS	POINTS
PRICE	80	90
SPECIFIC GOALS	20	10
Total points for Price and Specific Goals	**100**	**100**

Specific goals points are summarised in the table below.

The specific goals allocated points in terms of this tender	Number of points allocated (80/20 system)	Number of points allocated (90/10 system)
B-BBEE Level	10	5
Locality	10	5

Preference Points

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:
- 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 To be completed by the organ of state
a) The lowest acceptable tender will be used to determine the accurate system once tenders are received.

1.3 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:
(a) Price; and
(b) Specific Goals.

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

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

2. DEFINITIONS

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

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

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

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

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

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

3.1.1 THE 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

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

Where

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

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

3.2.1. POINTS AWARDED FOR PRICE
A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 or 90/10

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

Where

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

4. POINTS AWARDED FOR SPECIFIC GOALS

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

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

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

(b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system, then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

(c) Specific goals for the tender and points claimed are indicated in the table below. The tenderer must claim the appropriate points under the applicable section allowed for in the tender document.
(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.
Note to tenderers: The tenderer must indicate how they claim points for each preference point system.)

The specific goals allocated points in terms of this tender	**Number of points allocated (80/20 system) (To be completed by the organ of state)**	**Number of points allocated (90/10 system) (To be completed by the organ of state)**
B-BBEE Level	Maximum 10	Maximum 5
Level 1	10	5
Level 2	5	3
Less than Level 2	0	0
Locality	Maximum 10	Maximum 5
Within Ndlambe LM	10	5
Outside of Ndlambe LM	0	0

C.3.13 Acceptance of Tender Offer

Delete the first paragraph of C.3.13 and replace with the following:

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

Delete C.3.13 a) and replace with the following:

C.3.13 a) a) Is not under restrictions, has any principals who are under restrictions, or is not currently a supplier to whom notice has been served for abuse of the supply chain management system, preventing participation in the Employer's procurement;

Add the following at the end of C.3.13:

C.3.13.1 If an award cannot be made in terms of anything contained herein, the Employer reserves the right to consider the next ranked tenderer(s).

C.3.17 Provide Copies of the Contracts

Add the following after the first sentence:

The number of paper copies of the signed Contract to be provided by the Employer is **one**.

Add the following after C.3.18:

C.3.19 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.

The provisions of this clause will be equally applicable to any invitation to negotiate with any other tenderers.

T1.2.3 Additional Conditions of Tender

The additional conditions of tender are:

T.1.2.3.1 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 2014 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.

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 C1.5 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.

T.1.2.3.2 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:

- Inspected the Contract Drawings and read and fully understood the Conditions of Contract.
- 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.
- 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 and Construction Equipment to and from the Site and made the necessary provisions for any additional costs involved thereby.
- 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.

T.1.2.3.3 Community Liaison Officer

A Community Liaison Officer is to be employed for the duration of the construction period.

T.1.2.3.4 Use of Local Labour

It is a requirement for the Contract that the work be executed in such a manner as to maximize the use of labour intensive construction practices in or to provide the local community with the employment opportunities.

The Tenderer is to identify all activities for which it is intended to employ workers from the local community, and full details thereof are to be provided during weekly and monthly reporting.

In applying the principles set out above, it is a specific requirement of this Tender that a successful Tenderer employs, in consultation with the CLO, unemployed persons from the ranks of the local communities and the immediate surroundings, who possess the appropriate skills required for a Contract of this nature.

- In order to achieve the recruitment of local labour, the Local Communities would establish, together with the RDP/Development Forum, a database of unemployed persons, indicating their specialised training, previous experience and employment, etc. The successful Tenderer will be required to liaise with the CLO to recruit his workforce and will be required to produce weekly records suitably detailed to enable the Employer's Agent, or his authorised representative, and Local Communities to ascertain that the above-mentioned labour requirements are achieved.
- The successful Tenderer will be required to provide informal skills training so that the required standards of workmanship are maintained.

Any difficulty experienced by the Tenderer/Contractor in the procurement of the requirement percentages of local labour is to be referred immediately to the Employer's Agent or his authorised representative.

T.1.2.3.5 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) Current workload and capacity available to implement the project successfully;
(d) Financial capability to implement the project successfully; and
(e) Response from reference checks conducted.

The conclusions drawn from this risk analysis will be used by the Employer in determining the acceptability of the tender offer in terms of C.3.13 (b).

The Employer reserves the right to engage with the Tenderer retrospectively to obtain information required for the above risk analysis.

PART T2: RETURNABLES FOR TENDER EVALUATION PURPOSES

General

The Tender Document must be submitted as a whole. All forms must be properly completed as required, and the document shall not be taken apart or altered in any way whatsoever. The Tenderer is required to complete each and every Schedule and Form listed below to the best of his ability as the evaluation of tenders and the eventual Contract will be based on the information provided by the Tenderer. Failure of a Tenderer to complete the Schedules and Forms to the satisfaction of the Employer will inevitably prejudice the tender and may lead to rejection on the grounds that the tender is not responsive.

Returnable Schedules, Forms and Certificates

SCHEDULE	DESCRIPTION	MARK IF INCLUDED AND COMPLETE	
		TENDERER	SCM
T2.1	**Returnable Documents - Compulsory Submissions**		
T2.1.1	Authority to Sign Documents		
T2.1.2	Certificate of Attendance at Clarification Meeting / Site Inspection		
T2.1.3	Certificate of Authority for Joint Ventures		
T2.1.4	Joint Venture Agreement		
T2.1.5	Compulsory Enterprise Questionnaire		
T2.1.6	Tax Clearance Certificate		
T2.1.7	Letter of Good Standing with Compensation Commissioner		
T2.1.8	Valid Contractor Registration with Construction Industry Development Board		
T2.1.9	Valid Central Supplier Database Registration		
T2.1.10	Valid original or certified B-BBEE Certificate		
T2.1.11	Bank Rating Reference		
T2.1.12	Intention to Provide Security		
T2.1.13	Location of Operational Office		
T2.2	**Returnable Documents - Municipal Bid Documents (MBD) Non-disqualifying declaration clarity will be requested from bidders where required**		
MBD4	Bidders disclosure		
MBD5	Declaration for procurements above R10 million (VAT included)		
MBD6.1	Preference Points Claim Form in Terms of The Preferential Procurement Regulations 2022 Note: non-submission/incomplete submission will result in zero points being allocated for the specific goals		
MBD8	Declaration of Bidder's Supply Chain Management Practices		
MBD9	Certificate of Independent BID Determination		
T2.3	**Returnable Documents - Technical and Evaluation**		
T2.3.1	Functionality		
T2.3.2	Skills for Key Personnel		
T2.3.3	Entities Experience (Reference)		
T2.3.4	Proposed organisation and staffing		
T2.3.5	Schedule of Plant and Equipment		
T2.3.6	Schedule of proposed subcontractors		
T2.3.7	Preliminary Quality Assurance Plan		
T2.3.8	Health and Safety Plan		
T2.3.9	Preliminary Programme		
T2.3.10	Schedule of Estimated Monthly Expenditure		
T2.3.11	Amendments/Alternatives and Qualifications by Tenderer		
T2.3.12	Record of Addenda to Tender Documents		

T2.1 RETURNABLE DOCUMENTS – (COMPULSORY SUBMISSIONS)

SCHEDULE	DESCRIPTION
T2.1.1	Authority to Sign Documents
T2.1.2	Certificate of Attendance at Clarification Meeting / Site Inspection
T2.1.3	Certificate of Authority for Joint Ventures
T2.1.4	Joint Venture Agreement
T2.1.5	Compulsory Enterprise Questionnaire
T2.1.6	Tax Clearance Certificate
T2.1.7	Letter of Good Standing with Compensation Commissioner
T2.1.8	Valid Contractor Registration with Construction Industry Development Board
T2.1.9	Valid Central Supplier Database Registration
T2.1.10	Valid original or certified B-BBEE Certificate
T2.1.11	Bank Rating Reference
T2.1.12	Intention to Provide Security
T2.1.13	Location of Operational Office

T2.1.1 Authority to Sign Documents

I/We*, the undersigned, am/are* duly authorised to sign the form of tender on behalf of

.....

by virtue of the Articles of Association/Resolution of the Board of Directors*, of which a certified copy is attached, or

.....

.....

(*Delete whichever is inapplicable)

Indicate the status of the tenderer by ticking the appropriate box hereunder:

A Company	B Partnership	C Joint Venture	D Sole Proprietor	E Close Corporation

1.	**NAME**	**SIGNATURE**	**DATE**
2.	**NAME**	**SIGNATURE**	**DATE**

WITNESSES:

1.	**NAME**	**SIGNATURE**	**DATE**
2.	**NAME**	**SIGNATURE**	**DATE**

T2.1.2 Certificate of Attendance at Clarification Meeting / Site Inspection

This is to Certify that I/We* .....

of (Tenderer) .....

of (address) .....

.....

Telephone number ……Fax number .....

E-mail .....

have attended the clarification meeting and 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, familiarised myself/ourselves* with all information, risks, contingencies and other circumstances which may influence or affect my/our* tender.

Delete whichever is inapplicable

SIGNED BY/ON BEHALF OF TENDERER:

NAME	**SIGNATURE**

SIGNED ON BEHALF OF NDLAMBE LM:

NAME	**SIGNATURE**

CONFIRMATION OF CONTACT DETAILS FOR RECEIVING ANY ADDENDA:

Contact person: …… (alt person name: ……)

Contact number: ...…… (alt contact number: ……...……...)

Contact e-mail address: …… (alt. e-mail address: ……....)

NOTE: The contact e-mail address given shall not have a spam filter which automatically blocks any incoming e-mails where the recipient is one of up to 100 other recipients.

TENDERER TO SCAN THIS PAGE AND E-MAIL IT TO EMPLOYER AND EMPLOYER'S AGENT NEWGROUND PROJECTS WITHIN 5 WORKING DAYS FOLLOWING CLARIFICATION MEETING DATE: gerhard@newground.co.za.

T2.1.3 Certificate of Authority for Joint Ventures

This Returnable Schedule is to be completed only if Tenderer is a joint venture.

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

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
		…… 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.

T2.1.4 Joint Venture Agreement

The Tenderer, if a Joint Venture, must attach the Joint Venture Agreement here.

T2.1.5 Compulsory Enterprise Questionnaire

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

Section 1: Name of enterprise .....

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

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

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	Identity number*	Personal income tax number*

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

Section 5: Particulars of companies and close corporations

Company registration number .....

Close corporation number .....

Tax reference number .....

Section 6: The attached MBD4 must be completed for each attender and be attached as a tender requirement

Section 7: The attached MBD6.1 must be completed for each attender and be attached as a tender requirement

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

i) authorises 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 neither the name of the enterprise nor 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, 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;

v) 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:

NAME	**DATE**	**SIGNATURE**

T2.1.6 Tax Clearance Certificate

It is a condition of Tender that the taxes of the successful Tenderer must be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the Tenderer's tax obligations.

1. In order to meet this requirement, Tenderers are required to complete in full the attached form TCC 001 "Application for a Tax Clearance Certificate" and submit it to any SARS branch office nationally. The Tax Clearance Certificate Requirements are also applicable to foreign Tenderers/individuals who wish to submit Tenders.
2. SARS will then furnish the Tenderer with a Tax Clearance Certificate that will be valid for a period of 1 (one) year from the date of approval.
3. The valid Tax Clearance Certificate or Tax compliance PIN document must be submitted together with the Tender. Failure to submit the valid Tax Clearance Certificate or Tax compliance PIN will result in the invalidation of the Tender.
4. In Tenders where Consortia / Joint Ventures / Subcontractors are involved, each party must submit a separate valid Tax Clearance Certificate or Tax compliance PIN document.
5. Copies of the TCC 001 "Application for a Tax Clearance Certificate" form is available from any SARS branch office nationally or on the website www.sars.gov.za.
6. Applications for the Tax Clearance Certificates may also be made via eFiling. In order to use this provision, taxpayers will need to register with SARS's eFiling through the website www.sars.gov.za.

T2.1.7 Letter of Good Standing with Compensation Commissioner

Supply a valid Letter of Good Standing from the Compensation Commissioner.

T2.1.8 Valid Contractor Registration with Construction Industry Development Board

Supply a valid registration document from CIDB showing the company's grading.

T2.1.9 Valid Central Supplier Database Registration

Submit proof of registration on the Central Supplier Database.

T2.1.10 Valid Original or Certified B-BBEE Certificate

Submit an original B-BBEE Certificate or a certified copy thereof.

T2.1.11 Bank Rating Reference

Provide a bank rating reference letter containing the bank rating code for the Contractors.

Tenders must have a minimum bank rating C letter from their financial institution. Failure to attach or meet the minimum bank rating will result in the tender being deemed non-responsive.

T2.1.12 Intention to Provide Security

Provide a letter of intent from a bank or listed company to provide a performance security of 10% of the tender sum.

T2.1.13 Location of Operation Office

Proof of the location of the operational office.

- Municipal Rates Statement
- Copy of Lease agreement
- Affidavit
- Billing clearance certificate

T2.2 RETURNABLE DOCUMENTS – MUNICIPAL BID DOCUMENTS (MBD)

SCHEDULE	DESCRIPTION
MBD4	Bidder's Disclosure
MBD5	Declaration for procurements above R10 million (VAT included)
MBD6.1	Preference Points Claim Form in Terms of The Preferential Procurement Regulations 2022
MBD8	Declaration of Bidder's Supply Chain Management
MBD9	Certificate of Independent BID Determination

MBD4 BIDDER'S DISCLOSURE

APPLICATION FOR LISTING AS A NDLAMBE LOCAL MUNICIPALITYSUPPLIER

THE APPLICATION MUST BE COMPLETED BY THE PROSPECTIVE SERVICE PROVIDER

NAME OF SUPPLIER:	
CENTRAL SUPPLIER DATABASE REGISTRATION NUMBER:	MAAA_____ *(Proof of CSD Registration to be attached)*
CONTACT NAME:	
EMAIL ADDRESS:	
CONTACT NUMBER:	

THE COMPLETED ORIGINAL DECLARATION OF INTEREST FORM MUST BE MAILED OR DELIVERED TO THE FOLLOWING ADDRESS, FOR THE ATTENTION OF THE SCM UNIT:

Postal Address	Physical Address
Po Box 13	44 Campbell Street
Port Alfred	Port Alfred
6170	6170

ENQUIRIES:

TELEPHONE: (046) 604-5500

FOR OFFICIAL USE

CREDITOR NUMBER: _____

CSD NO. CONFIRMED _____ DATE: _____

1. No bid will be accepted from persons in the service of the state[1].
2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorized representative declare their position in relation to the evaluating/adjudicating authority.
3. In order to give effect to the above, the following questionnaire must completed and submitted with the bid.

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

3.2 Identity Number:.....

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

3.4 Company Registration Number:.....

3.5 Tax Reference Number: .....

3.6 VAT Registration Number:.....

3.7 The names of all directors / trustees / shareholders members, their individual identity numbers and state employee numbers must be indicated in paragraph 4 below. **YES/NO**

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

3.8.1 If yes, furnish particulars

.....

.....

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

3.9.1 If yes, provide particulars

.....

.....

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

3.10.1 If yes furnish particulars

.....

.....

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

(a) a member of –

(i) any municipal council;

(ii) any provincial legislature; or

(iii) the national Assembly or the national Council of provinces;

(b) a member of the board of directors of any municipal entity;

(c) an official of any municipality or municipal entity;

(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);

(e) a member of the accounting authority of any national or provincial public entity; or

(f) an employee of Parliament or provincial legislature.

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

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

3.11.1 If yes furnish particulars

.....

.....

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

3.12.1 If yes furnish particulars

.....

.....

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

3.13.1 If yes furnish particulars

.....

.....

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

3.14.1 If yes furnish particulars

.....

.....

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

Full Name	Identity Number	Name of State institution

Signature **Date**

Capacity **Name of Tenderer**

Note:

1.SHOULD ADDITIONAL SPACE BE REQUIRED FOR ANY OF THE ABOVE REQUIRED INFORMATION, PLEASE COMPLETE (WITH REFERENCE) ON A SEPARATE PAGE/S.

2.THIS DECLARATION FORM AND CONTENTS WITHIN WILL BE VALID FROM DATE OF RECEIPT BY THE SCM UNIT FOR THE DURATION OF THE PROJECT

IN THE EVENT THAT ANY INFORMATION CONTAINED IN THIS DECLARATION CHANGES DURING THE PERIOD FROM SUBMISSION, IT IS THE RESPONSIBILITY OF THE SUPPLIER TO SUBMIT AN UPDATED DECLARATION TO THE NDLAMBE LOCAL MUNICIPALITY. FAILURE TO DO SO, WILL RESULT IN THE INVALIDATION OF THE CONTENTS OF THIS DECLARATION AND THE MUNICIPALITY MAY INVOKE REMEDIES AS PER THE APPROVED SCM POLICY OF THE MUNICIPALITY

MBD5 DECLARATION FOR PROCUMENTS ABOVE R 10 MILLION (VAT INCLUDED)

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

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

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

.....

.....

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

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

2.2 If yes, provide particulars

.....

.....

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

3.1 If yes, furnish particulars

.....

.....

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

4.1 If yes, furnish particulars

.....

.....

CERTIFICATION

I, THE UNDERSTAND (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 MAYBE TAKEN AGAINST ME SHOULD THIS DECLERATION PROVE TO BE FALSE.

.....	.....
Signature	Date
.....	.....
Position	Name of bidder

MBD6.1 PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

SPECIFIC GOALS PREFERENTIAL POINTS CLAIM FORM IN TERMS OF THE MUNICIPALITY'S PREFERENTIAL PROCUREMENT POLICY, 2023 AND THE PREFERENTIAL PROCUREMENT REGULATIONS OF 4 NOVEMBER 2022 (Gazette 47452)

These specific goals preferential points claim form is submitted with bids invited where the estimated procurement amount exceeds R30 000. It contains general information and serves as a claim form for points for **specific goals** as follows:

- Broad-Based Black Economic Empowerment (B-BBEE) Status Level of Contribution, and
- Bidder Locality

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 Points shall be awarded for:

1.2.1 Price;

1.2.2 B-BBEE Status Level of Contributor (Specific Goal 1); and

1.2.3 Locality of bidder (Specific Goal 2)

1.3 The formulae and methodologies to be applied in calculating price and specific goal points shall be those as set out in the 2022 PPPFA Regulations (the Preferential Procurement Regulations made by the Minister on 4 November 2022) 4 to 7, which formulae and methodologies are subject to amendment by the Minister from time to time.

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

#	Component	Maximum Points – value up to R50 million	Maximum Points – value above R50 million
1	Price	80	90
2	B-BBEE Status Level of Contributor	10	5
3	Locality of bidder	10	5
	Total points	**100**	**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 Failure on the part of a bidder to submit proof of locality with the bid, will be interpreted to mean that preference points for Bidder Locality are not claimed.

1.7 Ndlambe Local Municipality 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 specific goals, in any manner required by the municipality.

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) "functionality" means the ability of a tenderer to provide goods or services in accordance with specifications as set out in the tender documents.
(f) "prices" includes all applicable taxes less all unconditional discounts;
(g) "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;
(h) "rand value" means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;
(i) "specific goals" means specific goals as contemplated in Para 4 of Ndlambe Municipality's Preferential Procurement Policy.

3. BID DECLARATION – SPECIFIC GOALS

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

B-BBEE STATUS LEVEL OF CONTRIBUTOR CLAIMED IN TERMS OF PARAGRAPHS 1.4

B-BBEE Status Level of Contributor: = _____ Points claimed = _____(see below)

B-BBEE Level	Points - value up to R50 million	Points - value above R50 million
1	10	5
2	5	2.5

N.B. B-BBEE Certificate or Affidavit to be attached.

3.2 Bidders who wish to claim Locality Points must complete the following:

Full physical address of bidder:

Bidder Locality	Points - value up to R50 million	Points - value above R50 million
Ndlambe LM	10	5

N.B. a recent Municipal Billing Certificate (not dated earlier than two months before the bid closing date) to be attached.

4. DECLARATION WITH REGARD TO COMPANY/FIRM

4.1 Name of company/firm:

4.2 VAT registration number (if a VAT Vendor):

4.3 CSD (Central Supplier Database) number: MAAA:

4.4 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES:

4.5 MUNICIPAL INFORMATION

Municipality where business is situated:

Registered Account Number:

Stand Number:

4.6 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 and Locality in paragraphs 1.4 and 3 of the foregoing certificate, qualifies the company/firm for the preference(s) shown and I/we acknowledge that:

(a) The information furnished is true and correct;

(b) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;
(c) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 3, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;
(d) 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 -
    1 disqualify the person from the bidding process;
    2 recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
    3 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;
    4 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
    5 forward the matter for criminal prosecution.

WITNESSES

1 .....

2 .....

.....
Signature of bidder

...../...../.....
Date

.....
Print Name

MBD8 DECLARATION OF BIDDER'S 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 institutions 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 disregarded 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) wilfully 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 of Restricted Suppliers as companies or persons prohibited from doing business with the public sector? **(Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the *audi alteram partem* rule was applied).** The Database of Restricted Suppliers now resides on the National Treasury's website(**www.treasury.gov.za**) and can be accessed by clicking on its link at the bottom of the home page.	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)? ***For Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.***	Yes ☐	No ☐
4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court outside of the Republic of South Africa) for fraud or corruption during the past five years?	Yes ☐	No ☐

4.3.1	If so, furnish particulars:		
4.4	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 three months?	Yes ☐	No ☐
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and any organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
4.5.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSTAND (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 MAYBE TAKEN AGAINST ME SHOULD THIS DECLERATION PROVE TO BE FALSE.

.....	.....
Signature	Date
.....	.....
Position	Name of bidder

MBD9 CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Municipal Bidding Document (MBD) must form part of all bids[1] invited.
2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).[2] collusive bidding is a pe se prohibition meaning that it cannot be justified under any grounds.
3. Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
   (a) take all reasonable steps to prevent such abuse;
   (b) reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
   (c) cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.
4. This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid- rigging.
5. In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid:

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

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

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description)

In response to the invitation for the bid by:

_____

(Name of Municipality / Municipality Entity)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: _____ that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
   a has been requested to submit a bid in response to this bid invitation;
   b could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
   c provides the same goods and services as the bidder and/or is in the same line of business as the bidder
6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium[1] will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
   a prices;
   b geographical area where product or service will be rendered (market allocation)
   c methods, factors or formulas used to calculate prices;
   d the intention or decision to submit or not to submit, a bid;
   e the submission of a bid which does not meet the specifications and conditions of the bid; or
   f bidding with the intention not to win the bid.
8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.
10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the

1 The 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.

Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

…… ……

Signature Date

…… ……

Position Name of bidder

T2.3 RETURNABLE DOCUMENTS – TECHNICAL EVALUATION

SCHEDULE	DESCRIPTION
T2.3.1	Functionality
T2.3.2	Skills for Key Personnel
T2.3.3	Entities Experience (Reference)
T2.3.4	Proposed organisation and staffing
T2.3.5	Schedule of Plant and Equipment
T2.3.6	Schedule of proposed subcontractors
T2.3.7	Preliminary Quality Assurance Plan
T2.3.8	Health and Safety Plan
T2.3.9	Preliminary Programme
T2.3.10	Schedule of Estimated Monthly Expenditure
T2.3.11	Amendments/Alternatives and Qualifications by Tenderer
T2.3.12	Record of Addenda to Tender Documents

T2.3.1 Functionality

NB: Before completing this form, bidders must study the general conditions, definitions, and directives applicable in respect of specific goals, as prescribed in the Preferential Procurement Regulations, 2022.

The tenderer must complete the tables below to claim points for key personnel and company experience, as outlined in C.3.11.1. In the event that the tables are not completed, no points will be awarded, and the proposal will be scored as not meeting the specific requirement.

1. KEY PERSONNEL

The following functionality criterion is to be utilized. Please note that each person used for tendering purposes must complete a declaration of availability. Should the tenderer submit the tender without the person having signed this form the person will not be valid for evaluation and deem that portion of the functionality assessment non-responsive.

Position	Status/ Qualification	Experience	Score	Max Points
Construction Manager	SACPCMP registered Construction Manager. Copies of SACPCMP registration and CV must be attached. Experience will be regarded as the number of years post registration.	10 years or more	15	15
		7-9 years	10	
		1-6 years	5	
		Less than 1 year	0	
Contracts/Project Manager	SACPCMP registered Project Manager. Copies of SACPCMP registration and CV must be attached. Experience will be regarded as the number of years post registration.	10 years or more	15	15
		7-9 years	10	
		1-6 years	5	
		Less than 1 year	0	
Civil Works Foreman	CV indicating relevant experience must be attached.	7-10 years	10	10
		4-6 years	5	
		1-3 years	2	
		Less than 1 year	0	
SMME Manager	Minimum of National Diploma in the Built Environment. Certified copies of qualification and CV must be attached. Experience will be regarded as number of years post qualification.	15 years or more	10	10
		10-14 years	5	
		Less than 10 years	2	
Health & Safety Officer	SACPCMP registered Construction Health and Safety Officer. Copies of SACPCMP registration and CV must be attached. Experience will be regarded as the number of years post registration.	10 years or more	10	10
		7-9 years	5	
		1-6 years	2	
		Less than 1 year	0	
TOTAL POINTS				60

2. COMPANY EXPERIENCE

To score points, a tenderer must list compliant projects under each applicable table (value, treatment capacity, and reinforced water retaining structures) in T2.3.3.

Criteria	Description	Number of Reference or Completion Letters	Score	Max Points
Company Experience	Company's experience in the civil work construction of water or wastewater infrastructure related projects. Bidders must submit reference or completion letters from clients indicating their experience for the required services.	3 or more	40	40
		Less than 3	10	
		no letter	0	
"Experience of company" means the number of comparable projects that were successfully completed. A comparable project is defined to include the civil work construction of water or wastewater infrastructure related projects with a minimum contract value of R 10 000 000, a minimum treatment capacity of 750 kℓ/day, and reinforced concrete water retaining structures in the past 10 years.				

T2.3.2 Skills for Key Personnel

Provide an adequately resourced project organogram, along with supporting CVs and certified copies of relevant qualifications and professional registrations.

Curriculum Vitae (CV), up to a maximum of five (5) pages must be submitted, for each of the key personnel. The CVs must specifically include the qualifications, professional accreditation and relevant experience in construction projects of a similar nature. Minimum information to be included in the CV's is given hereunder. Each CV must be clearly cross-referenced to and labelled to correspond with the organogram submitted in terms of T2.3.4, so as to indicate which role the person in question is proposed to fulfil in the Contract.

Each key personnel requirement must be incorporated, indicating the required information as per the examples below.

KEY PERSONNEL CVs: MINIMUM INFORMATION TO BE SUPPLIED

- Name:
- Professional:
- Date of Birth:
- Parent Firm:
- Position in Firm:
- Years with Firm:
- Nationality:
- Tertiary Education (and year obtained):
- Professional Registration (and year obtained):
- Years of Relevant Experience: Relevant experience shall relate to their proposed roles in this Contract.

Languages: Indicate first language. If the first language is not English, please indicate proficiency in English. In other languages, including South African indigenous languages, please show speaking, reading and writing ability.

Language	Speaking	Reading	Writing
English			

Countries of Work Experience: ……

Key Qualifications: *Under this heading, give outline of staff members experience and training most pertinent to the assigned work on the team.*

Relevant Experience: *Describe degree of responsibility held by staff member on relevant previous assignments, and give dates, project values and locations. For experience in the last ten years, also give types of activities performed and Client references where appropriate.*

Summary of Other Experience: *Under this heading, list all positions held by staff member since graduation, giving dates, names of employing organisation, title of position held and location, type and value of construction projects.*

SKILLS OF KEY PERSONNEL – CONTRACTS MANAGER, CONSTRUCTION MANAGER, SITE FOREMAN, AND OHS OFFICER

Name and Surname **Tertiary Qualifications** **Years' Experience (Post qualification)**	**References for past projects**	
	Project Description (Similar in Nature)	**Capacity (Contract Manager, Construction Manager, etc.)**

T2.3.3 Entities Experience (Reference)

The experience of the Contractor, in this similar nature projects, will be evaluated. A detailed company profile must be submitted as part of your proposal.

Contractors should very briefly describe their experience in this regard by completing the schedule below by providing details of similar references recently undertaken or in progress. All the required information requested below should be provided and a general listing of contracts completed will not suffice. **Certificates of Completion** and reference letters must be provided for each listed project.

A schedule must be incorporated which summarizes the Contractor's experience. A similar format to the example below is required. Details to be provided in the table of expertise and experience must, as a minimum, include:

- Project name
- Project location
- Employing authority/Client with Contact details (NEEDED FOR REFEREE CHECKS FOR VERIFICATION)
- Supervising Engineer, with Contact details (NEEDED FOR REFEREE CHECKS FOR VERIFICATION)
- Period of construction (commencement and completion)
- Description and value of principle work content.
- Value of Contract

SIMILAR VALUE PROJECTS THAT WERE SUCCESSFULLY COMPLETED OF CONTRACT VALUE OF MORE THAN R 10 000 000 (INCL. VAT) FOR WASTEWATER TREATMENT WORKS

No.	Employer, contact person and telephone number (Only Landline)	Description of Contract	Value of Work Inclusive of VAT (Rand)	Date Completed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

SIMILAR NATURE PROJECTS THAT WERE SUCCESSFULLY COMPLETED OF WASTEWATER TREATMENT WORKS OF CAPACITY MORE THAN 750 kℓ/DAY

No.	Employer, contact person and telephone number (Only Landline)	Description of Contract	Treatment Capacity	Date Completed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

SIMILAR NATURE PROJECTS THAT WERE SUCCESSFULLY COMPLETED OF REINFORCED CONCRETE WATER RETAINING STRUCTURES

No.	Employer, contact person and telephone number (Only Landline)	Description of Contract	Storage Capacity	Date Completed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

T2.3.4 Proposed organisation and staffing

The tender offer shall include an organogram showing the team of key personnel the Tenderer proposes to assign to the Contract and how responsibilities for the various disciplines or work and components of the Works will be assigned. The name, roles and responsibilities of each person must be clearly set out, and corresponding job descriptions must be provided as an addendum to the organogram.

In the case of a Joint Venture or where major sub-contractors are made use of, the organogram must show how respective responsibilities are to be allocated.

As a minimum, the organogram must show how respective responsibilities are to be allocated. As a minimum, the organogram must include for the personnel detailed in T2.3.2.

The Tenderer shall include the requisite organogram and addendums in the Supporting Documentation file, to be submitted in accordance with Clause C.2.13.3 of **T1.2.2 Variations to the Standard Conditions of Tender.**

In addition to the detail request above, the names of the following shall be entered below (these names will be used to assess responsiveness):

Construction Manager (Site Agent)	
Construction Supervisor (Main Foreman)	

SIGNED BY/ON BEHALF OF TENDERER:

NAME	**SIGNATURE**	**DATE**

T2.3.5 Schedule of Plant and Equipment

The Tenderer shall insert in the Schedule hereunder, a list of the major Plant and equipment he proposes to use on this Contract. Failure to complete this schedule will be taken to indicate that Tenderer does not have access to adequate Plant and equipment.

SCHEDULE OF PLANT AND EQUIPMENT

Description of model	Owner	When available

Equipment not owned by the Tenderer must be qualified as hire, on loan, etc.

T2.3.6 Schedule of proposed subcontractors

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

SUBCONTRACTORS			
Category/type	**Subcontractor Name/Address/Contact Person/Phone/e-mail/Details of Organisation/Firm/ Experience**	**Items of work (pay items) to be undertaken by the Subcontractor**	**Estimated Cost of Work (Rand)**
		TOTAL (Excluding VAT)	

If there is insufficient space above, the Tenderer may include the additional sheets in the Supporting Documentation file, to be submitted in accordance with Clause C.2.13.3 of 0 **T1.2.2 Variations to the Standard Conditions of Tender.**

Number of additional sheets submitted by the Tenderer to this Schedule …….... (If nil, enter NIL)

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 above being approved by the Engineer.

T2.3.7 Preliminary Quality Assurance Plan

The Tenderer must submit a Preliminary Quality Assurance Plan showing how the Tenderer will comply with Sub-Clause 4.9 in C1.2: Contract Information.

The Preliminary Quality Assurance Plan must outline processes, procedures and associated resources, applied by whom and when, to meet the requirements and indicate how risks will be managed and what contribution can be made regarding value management. Particular attention in the plan must be given to the following:

a) The preparation and internal approval process for the Contractors Documents in terms of Clause 5 of the General Conditions of Contract.

b) The proposed internal quality management procedures pertaining to the Works and including aspects such as:

- Introduction & Project Information.
- Quality Management System Overview.
- Document Control.
- Design Control (if applicable).
- Procurement & Materials Control.
- Construction Quality Control.
- Testing & Commissioning.
- Calibration & Measurement Control.
- Non-Conformance & Corrective Action.
- Training & Competency.
- Health, Safety & Environmental Integration.
- Audits & Reviews.
- Records & Handover Documentation.

The plan must include a technical description of systems and equipment offered, highlighting the main features, benefits and innovations thereof, and showing how these can meet the Employer's objectives and the specified services requirements. This must be supplemented by technical literature such as brochures, drawings, for the various items of Plant and equipment offered.

This plan must address the Tenderer's plans for completing the Works within the specified Time for Completion, paying particular attention to:

a) Interfacing with (i) the Tenderer's own sub-contractors or Joint Ventures and (ii) the Mechanical and Electrical Contractor; and

b) The sequencing of the Works in terms of the requirements of C3: Scope of Work.

The Tenderer must include the required Quality Assurance Plan and supporting information in the Supporting Documentation file to be submitted in accordance with Clause C.2.13.3: T1.2.2 Variations to the Standard Conditions of **Tender**.

T2.3.8 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 2014 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. The Health and Safety specification for ORTDM is attached. The Tenderer's 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 Scope of Work 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)

T2.3.9 Preliminary Programme

The Tenderer shall provide a preliminary programme in Gantt Chart format showing how the requirements of C1.2: Contract Information and Part C3: Scope of Work will be met; and outlining the key activities and milestones for the Works and the sequencing thereof; including design, approval of the Contractors Documents, fabrication, supply, delivery, installation, construction, testing. In addition, a preliminary cash flow forecast, matching the progress of the programme must be submitted.

The programme must be based on the tendered Time for Completion and take cognisance of the programming limitations given in the Project Specifications.

T2.3.10 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/she estimates will arise based on his/her preliminary programme and tendered rates, in the table below.

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
13	R
14	R
15	R
16	R
17	R
18	R
19	R
20	R
TOTAL	**R**

T2.3.11 Amendments/Alternatives and Qualifications by Tenderer

The Tender should not make any departures from the provisions of this Contract as per Clause C.2.12 in T1.2.1 Standard Conditions of Tender

(The schedules below are not an invitation for amendments, deviations or alternatives)

(a) AMENDMENTS

PAGE, CLAUSE OR ITEM NO	PROPOSED AMENDMENT
	******NO AMENDMENTS ALLOWED******

(b) ALTERNATIVES

PROPOSED ALTERNATIVE	DESCRIPTION OF ALTERNATIVE
	******NO ALTERNATIVES ALLOWED******

(c) QUALIFICATIONS

ITEM ON WHICH QUALIFICATION IS MADE	DESCRIPTION OF QUALIFICATION
	******NO QUALIFICATIONS ALLOWED******

T2.3.12 Record of Addenda to Tender Documents

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

No.	Date	Title or Details
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

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

SIGNED BY/ON BEHALF OF TENDERER:

NAME	**SIGNATURE**	**DATE**

THE CONTRACT

PART C1 AGREEMENT AND CONTRACT INFORMATION

SCHEDULE	DESCRIPTION
C1.1	Form of Offer and Acceptance
C1.2	Contract Information
C1.3	Performance Guarantee
C1.4	Adjudication
C1.5	Occupational Health and Safety

C1.1 FORM OF OFFER AND ACCEPTANCE

OFFER

The Employer, identified in the acceptance signature block, has solicited offers to enter into a Contract for the procurement of:

UPGRADE OF BATHURST BULK SEWER: WASTEWATER TREATMENT WORKS

CONTRACT NO: T11/2526

The tenderer, identified in the offer signature block, has examined the documents listed in the tender data and addenda thereto as listed in the returnable schedules, and by submitting this offer has accepted the conditions of tender.

By the representative of the tenderer, deemed to be duly authorized, signing this part of this Form of Offer and Acceptance, 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 Contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUE ADDED TAX IS:

..... Rand (in words)

R ..... (in figures)

This offer may be accepted by the Employer by signing the acceptance part of this Form of Offer and Acceptance and returning one copy of this 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.

For the tenderer

Signature Date

Name Capacity

(Name and address of organization)

Name and signature of witness:

Signature Date

Name

ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the tenderer's following 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 an agreement between the Employer and the tenderer upon the terms and conditions contained in this agreement and in the Contract that is the subject of this agreement.

The terms of the Contract, are contained in:

Part C1: Agreements and Contract Information, (which includes this agreement)
Part C2: Pricing Data
Part C3: Scope of work.
Part C4: Site information

and drawings and documents or parts thereof, which may be incorporated by reference into Parts 1 `to 4 above.

Deviations from and amendments to the documents listed in the tender data and any addenda thereto 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 agreement. No amendments to or deviations from said documents are valid unless contained in this schedule.

The tenderer shall within four weeks after receiving a completed copy of this agreement, including the schedule of deviations (if any), contact the Employer's Agent (whose details are given in the Contract Data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the conditions of Contract identified in the Contract Data. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this Form of Offer and Acceptance, including the schedule of deviations (if any). Unless the tenderer (now Contractor) within five working Days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding Contract between the parties.

For the Employer

Signature Date

Name Capacity

(Name and address of organization) Ndlambe LM
44 Campbell Street
Port Alfred
6170

Name and signature of witness:

Signature Date

Name

SCHEDULE OF DEVIATIONS

Notes:

1. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
2. A 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 arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the Contract and 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: .....

.....

By the duly authorised representatives signing this agreement, 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 copy of this Agreement shall have any meaning or effect in the Contract between the parties arising from this agreement.

For the Employer

Signature Date

Name Capacity

(Name and address of organization) Ndlambe LM
44 Campbell Street
Port Alfred
6170

Name and signature of witness

Date:

For the tenderer

Signature Date

Name Capacity

(Name and address of organization)

Name and signature of witness

Date:

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:

Signed in the presence of the subscribing witnesses:

At .....for and on behalf of .....

.....

on this the ..... Day of ..... 20.....

SIGNATURE : .....

CAPACITY : .....

ADDRESS : .....

: .....

: .....

AS WITNESSES : 1 .....

2 .....

C1.2 CONTRACT INFORMATION

CONTRACT INFORMATION FOR: UPGRADE OF BATHURST BULK SEWER: WASTEWATER TREATMENT WORKS

CONTRACT NUMBER: T11/2526

PART 1: DATA PROVIDED BY THE EMPLOYER

C1.2.1 Conditions of Contract

The General Conditions of Contract for Construction Works, Third Edition, 2015, published by the South African Institution of Civil Engineering, is applicable to this Contract and is obtainable from www.saice.org.za

Copies of these Conditions of Contract may be obtained from the South African Institution of Civil Engineering, Tel. 011 805 5947.

C1.2.2 Special Conditions of Contract

The following Contract specific conditions are applicable to this Contract

Clause	Specific conditions
	When referring to a Clause in the supplements below, it includes all Sub-clauses.
1.1.1.1	Replace Clause 1.1.1.1: “agreed” means agreed in writing by the Employer and the Contractor.
1.1.1.5	Replace Clause 1.1.1.5: The “Commencement Date” means the date when the tenderer receives one fully completed original copy of this Form of Offer and Acceptance, including the schedule of deviations (if any).
1.1.1.7	Replace Clause 1.1.1.7: “Contract” means the documentation of the agreement between the parties in terms of the Form of Offer and Acceptance, and written amendments or additions to the Contract as may be agreed and signed by both parties.
1.1.1.35	Add the following definition: “Schedule of Documents" means the document so designated in and forming part of the Tender Documents.
1.1.1.36	Add the following definition: “In Good Time” shall be interpreted as to the discretion of the Employer’s Agent
1.2.1	Add to Clause 1.2.1: Provided any notice or claim required in accordance with this Contract shall be communicated in writing, separately from other communications, on a separate cover with specific reference to the clause requiring the same.
1.2.1.2	Replace Clause 1.2.1.2: Delivered at the address, including email, of the addressee as stated in the Contract Data.
4.1.2	Amend in Clause 4.1.2 The fifth line, amend "any drawing" to read "any design, drawing".
4.1.3	Add Clause 4.1.3: The Contractor shall be responsible for the design, construction, erection, inspection, approval and maintenance of all Temporary Works, including formwork, support work and scaffolding.
4.1.4	Add Clause 4.1.4: Prior to the commencement of the Tests on Completion, the Contractor shall submit to the Employer’s Agent the as-built drawings, documents and Operational and Maintenance Manuals in accordance with the Scope of Works and in sufficient detail for the Employer to operate, maintain, dismantle, re-assemble, adjust and repair of this part of the Works. Such part shall not be considered to be completed for the purposes of issuing a Certificate of Completion until these documents and manuals have been submitted to, and accepted by, the Employer’s Agent.

Clause	Specific conditions
4.4.1	Add to Clause 4.4.1: “It is a specific condition, an obligation, and a material term under this Contract that the Contractor shall subcontract 5% of the Contract Price to local SMMEs. For the purposes of this Contract, local SMMEs shall be defined as being from the Ndlambe Local Municipal area only.”
4.12.2	Replace in Clause 4.12.2” The first line with “The Construction Manager, as identified in the tender submitted by the Contractor, or” The last “or” in the Clause with “and”.
5.4.2	Replace in Clause 5.4.2: “Contract Data” with “Contract Data, Scope of Works or Site Information”
5.4.3	Replace Clause 5.4.3: If the Contractor suffers delay to Practical Completion and/or incurs proven additional costs 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.
5.6.1	Add to Clause 5.6.1 at the end of the first sentence: “, taking into account the financial limitations as per the Contract Data.”
5.6.2	Add Clause 5.6.2.8: Health and Safety requirements. Add Clause 5.6.2.9: Critical path. Add Clause 5.6.2.10: Notices issued and claims submitted.
5.6.3	Replace Clause 5.6.3: The Employer’s Agent shall, within 14 Days after the Contractor 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 Agent’s 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 deemed to be approved; and 5.6.3.2 in the event of the submitted programme, being an initial programme, shall not constitute deemed approval.
5.6.4.1	Replace Clause 5.6.4.1: When it no longer reflects the actual progress, or
5.12.1	Add to Clause 5.12.1: "Should the Contractor consider that he may, during the course of the Contract, wish to invoke "abnormal climatic conditions" as a circumstance entitling him to an extension of time for the completion of the Works, he shall, before commencing any of the Permanent Works, establish an approved weather recording station with an approved observer who shall record daily the weather conditions that the Contractor may wish to invoke. The records shall be submitted weekly to the Employer’s Agent 's Representative, together with a statement recording the Contractor's opinion of the effect on his programme of any weather condition that he may consider to be abnormal."
6.2.1	Replace in Clause 6.2.1: “selected” with “prescribed”.
6.6.1.1	Add to Clause 6.6.1.1: “excluding General Items”.
6.6.1.2.1	Insert in Clause 6.6.1.2.1: The first line, after the word "sums", insert ", excluding VAT".
6.6.1.2.2	Insert in Clause 6.6.1.2.2: The third line, after the word "amount" insert ", excluding VAT”.
6.6.2	Insert in Clause 6.6.2: The fifth line, after the word "price", insert ", excluding VAT,"
6.9.1	Add to Clause 6.9.1: "The Contractor shall where practicable before delivery, and in any event not later than 24 hours after delivery to the Site, inform the Employer’s Agent of any materials which are not his sole property."

Clause	Specific conditions
6.9.2	Amend in clause 6.9.2 **The last line, amend "Works" to read "Permanent Works".**
6.10.1.5	Amend in Clause 6.10.1.5 The sixth line, amend "documentary evidence" to read "a signed statement". Add to clause 6.10.1.5 “and provide a bank guarantee for the full value of the amount claimed, valid until installation or handover of Plant and/ or material.”
6.10.4	Add to Clause 6.10.4: “The Contractor’s attention is directed to Clauses 1.1.1.14 and 5.6.1 as well as that detailed under the Scope of Work regarding completion in portions and the staged availability of the Employer’s funding. In the event of an amount becoming due to the Contractor for the completion of a portion of the Works and where to amount exceed the corresponding available funding, the Employer shall only pay the outstanding amount due to the Contractor during the subsequent portion using the corresponding and available funding. The provisions and terms of Clause 6.10.6.2 shall not be applied for such event.”
6.11	Quantities exceeding 25% (twenty-five)
7.2.1	Add to Clause 7.2.1: "Unless otherwise directed in writing by the Employer’s Agent, materials for the Permanent Works shall be new and unused.”
7.8.1	Amend in Clause 7.8.1 The second line in paragraph 2, after the words "Defects Liability Period", insert "within the period specified by the Employer’s Agent", and amend "thereafter" to read "after the Defects Liability Period".
8.3.1.11	Add to Clause 8.3.1.11: Add at the beginning, "Except where the Contract specifically so provides,"
8.6.1.3	Add to Clause 8.6.1.3: "The minimum amount of insurance required in terms of this Clause, as stated in the Part 1 of the Contract Data, shall be per event, the number of events being unlimited."
8.6.1.6	Add Clause 8.6.1.6: "Insurance of all materials stored off Site, and intended for incorporation in the Permanent Works, including their delivery to the Site and off-loading on Site, to the value of such materials for which payment is made in terms of Clause 6.10.1.1 hereof."
8.6.5	Add to Clause 8.6.5: “The Employer shall approve (or disapprove) the terms of the insurances within the time stated in the Part 1 of the Contract Data from the date of receipt of the policies provided in terms of Clause 8.6.5.”
8.6.6	Add to Clause 8.6.6: "The policies and the proof of payment of premiums and continuity of the policies shall be produced within such time as is stated in the Part 1 of the Contract Data."
8.6.8	Add Clause 8.6.8: "In the event of any claim arising under the policies held in terms of this Clause, the Contractor shall forthwith take all necessary steps to lodge his claim on the joint behalf of himself and the Employer, and to secure settlement of such claim, and he shall submit to the Employer’s Agent copies of all claims and associated documents. The claim submitted by the Contractor shall cover the cost of repairing and making good as required by Clauses 8.2.2.1 and 8.2.2.3."
10.1.1	Replace in Clause 10.1.1: The third line, replace “Permanent Works” with “Works”.
10.1.1.1	Replace Clause 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:"
10.1.1.1.3	Replace Clause 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 of Practical Completion, and."

C1.2.3 CONTRACT DATA

Clause	Item and data
1.1.1.13	The Defects Liability Period is measured from the date of Certificate of Completion.
1.1.1.14	The time for achieving Practical Completion (measured from the Commencement Date) • Portion 1: 137 days • Portion 2: 204 days • Portion 3: 211 days • Portion 4: 335 days • Portion 5: 362 days
1.1.1.15	The name of the Employer is **Ndlambe Local Municipality**.
1.1.1.16	The name of the Employer's Agent is Newground Projects represented by the Employee duly authorised thereto in writing.
1.1.1.26	The Pricing Strategy is Re-measurement Contract
1.2.1.2	The address of the Employer: **Physical address:** 44 Campbell Street Port Alfred, 6170 Telephone: (046) 604-5500 E-mail: info@ndlambe.gov.za The address of the Engineer: **Physical address:** 17 St Andrews Road East London, 5201 Telephone: (043) 722-5864 E-mail: admin@newground.co.za
3.2.3	The Employer's Agent shall obtain specific approval from the Employer before executing the following functions or duties according to the following Clauses of the General Condition of Contract: Existing Clauses: 3.3.1 - Nomination of person as Employer's Agent's Representative. 5.13 - Reduction of penalty for delay. 6.3 - Variations in respect of Variations which are not small (R200 000). 6.4 - For expenditure on the Contract that exceeds the Contract Sum. 6.6 - Instruction to expend on Provisional Sums larger than R300 000. 8.2.2.2 - Order to repair and make good damage arising from any "excepted" risk.
5.1.1 & 5.8.1	The special non-working Days are: 1. Public holidays, 2. The year-end break commencing on 14 December 2026 and ending on 04 January 2027.
5.3.1	The documentation required before commencement with Works execution are: Health and Safety Plan (Refer to Clause 4.3) Initial programme (Refer to Clause 5.6) Security (Refer to Clause 6.2) Insurance (Refer to Clause 8.6) Construction Work Notice to DoL (to be provided before Site establishment can commence)
5.3.2	The time to submit the documentation required before commencement with Works execution is **twenty-eight (28) Days**.
5.4.1	The Contractor shall not have the right to access the Works until he has complied with his obligations in terms of Clause 6.2.1 – Guarantee.
5.4.2	The Contractor does not have exclusive access to the Site. The Ndlambe Local Municipality and any party that are acting under instruction from them, have mutual access to the Sites to the extent that they are able to perform their normal operational and maintenance duties.
5.6.1	Required expenditure per financial year (July to June): 2025/26: R 2 600 000 (Incl. VAT). 2026/27: Balance.

<table>
<tr><th>Clause</th><th>Item and data</th></tr>
<tr><td>5.8.1</td><td>The non-working Days are Saturdays and Sundays</td></tr>
<tr><td>5.12.2.2</td><td>The rainfall records at rainfall station 00375741 Port Alfred - Airport for the period 2000 - 2016 were analysed and the monthly averages (Rn and Nn) for this period is reproduced in the table below.
The values of X and Y shall be 20 and 10 respectively.
<table>
<tr><th></th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Nn</td><td>0.9</td><td>1.2</td><td>1.5</td><td>1.9</td><td>0.9</td><td>1.6</td><td>1.5</td><td>1.9</td><td>1.5</td><td>1.6</td><td>1.6</td><td>1</td></tr>
<tr><td>Rn</td><td>39.9</td><td>50.3</td><td>55.2</td><td>78.3</td><td>50.5</td><td>58.3</td><td>50.1</td><td>60.7</td><td>54.3</td><td>92.3</td><td>57.8</td><td>36.3</td></tr>
</table></td></tr>
<tr><td>5.13.1</td><td>The penalty for failing to complete the Works is 0.1% of the Contract amount per Day (zero comma one percent) or prorate the sum for non-compliance in any progressive portion.</td></tr>
<tr><td>5.16.3</td><td>The latent defect period is ten (10) years for civil engineering Works, 5 years for building Works and 3 years for mechanical and electrical Works.</td></tr>
<tr><td>6.2.1</td><td>The time to deliver the Deed of Guarantee is 28 Days of the Commencement Date.
The Guarantee shall be of an Insurance Company listed on the Johannesburg Stock Exchange or owned by such company, a Registered South African Bank or recognised government sponsored, provincial or national development agency. Unless agreed in writing by the Employer’s Agent, Execution of Work (Clause 5.3.1) shall not commence until the Contractor has complied with his obligations in terms of this Clause.
The Form of Guarantee is to contain the wording of the document included in C1.3.
The guarantee shall be for 10% of the Contract Price.
The Guarantee may not expire sooner than the date on which the Certificate of Completion is affected.</td></tr>
<tr><td>6.5.1.2.3</td><td>The percentage allowance is 10%.</td></tr>
<tr><td>6.8.2</td><td>Contract Price Adjustment is not applicable.</td></tr>
<tr><td>6.10.1.5</td><td>The percentage advance on materials which is delivered to Site but not yet built into Permanent Works is:
80% (eighty percent) of the proven value of the material for sand, stone, gravel, bricks, blocks and the like, and all items not approved in the point below.
100% (one hundred percent) of the proven value of the material for pipes, pumps, reservoirs, fencing, HPDE lining and similar items approved by the Employer’s Agent.
If the related BoQ item includes anything other than supply and delivery, the amount approved for MoS may not exceed 80% of the total amount for the related BoQ item.</td></tr>
<tr><td>6.10.3</td><td>The percentage retention on the amounts due to the Contractor is 10% (ten percent). The “Limit of the retention money” is 5% (five percent) of the Contract Price.</td></tr>
<tr><td>7.8.1</td><td>The Defects Liability Period is 12 (twelve) months.</td></tr>
<tr><td>8.6.1</td><td>Proof of insurance is to be submitted to the Employer’s Agent within 28 Days after the Commencement Date.</td></tr>
<tr><td>8.6.1.1.2</td><td>The value of the materials supplied by the Employer to be included in the insurance sum is Nil.</td></tr>
<tr><td>8.6.1.1.3</td><td>The amount to cover professional fees for repairing damage and loss to be included to the insurance sum is R 500,000.00</td></tr>
<tr><td>8.6.1.3</td><td>The limit of indemnity for liability insurance is R20 million</td></tr>
<tr><td>8.6.6</td><td>28 Days</td></tr>
<tr><td>10.5</td><td>Dispute resolution is to be by means of adjudication</td></tr>
<tr><td>10.7</td><td>Disputes are to be referred for final settlement to arbitration</td></tr>
</table>

Definition of Portions as referred to in Clause 1.1.1.14:

Description of parts of the Works that shall be designated a Portion for the purpose of the Contract	Value: Percentage of the Contract Price (Will be determined before the Commencement Date)	Time for Completion (Due Completion Date will be determined before the Commencement Date)	Delay Damages
Portion 1: ESKOM overhead supply.			0.1% of the Contract Price as stated in the Agreement associated with this portion.
Portion 2 The building (pump room, controller office, security office).			0.1% of the Contract Price as stated in the Agreement associated with this portion.
Portion 3 Access road.			0.1% of the Contract Price as stated in the Agreement associated with this portion.
Portion 4 Mechanical and Electrical Subcontract.			0.1% of the Contract Price as stated in the Agreement associated with this portion.
Portion 5 Balance of remaining scope.			0.1% of the Contract Price as stated in the Agreement associated with this portion.

Part 2: Data provided by the Contractor

Clause	Item and data
1.1.1.9	The name of the Contractor is .....
1.2.1.2	The address of the Contractor is: Telephone: ..... Facsimile: ..... E-mail: ..... Address (physical): .... Address (postal): ....

6.2.1 The security to be provided by the Contractor shall be one of the following, please indicate the selected option:

Performance guarantee of 10% of the Contract Sum plus a retention of 10% per payment certificate to a maximum of 5% of the Contract Sum.	

C1.3 PERFORMANCE GUARANTEE

GUARANTOR DETAILS AND DEFINITIONS

"Guarantor" means: .....

Physical address: .....

"Employer" means: .....

"Contractor" means: .....

"Employer's Agent" means: .....

"Works" means: .....

"Site" means: .....

"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: .....

Type of Performance Guarantee: .....

"Expire Date" means: **The conditions, as set out in 1. and 2**.

CONTRACT DETAILS

Employer's Agent issues: Interim Payment Certificates, Final Payment Certificate and the Certificate of Completion of the Works as defined in the Contract.

1. VARIABLE PERFORMANCE GUARANTEE

1.1. Where a Variable Performance Guarantee has been selected, the Guarantor's liability shall be limited during the following periods to diminishing amounts of the Guaranteed Sum as follows:

1.1.1. From and including the date of signing the Performance Guarantee up to and including the date of the Completion Certificate:

Amount in numbers:.....

Amount in words: .....

1.1.2. From the day following the Completion Certificate up to the date of the issue by the Employer's Agent of the Final Approval Certificate of the Works.

Amount in numbers:.....

Amount in words: .....

1.2. The Employer's Agent and/or Employer shall advise the Guarantor in writing of the date on which the Certificate of Completion and Final Approval Certificate have been issued for the Works.

2. FIXED PERFORMANCE GUARANTEE

2.1. Where a Fixed Performance Guarantee has been selected, the Guarantor's liability shall be limited to the amount of the Guaranteed Sum.

2.2. The Guarantor's period of liability shall be from and including the date on which the Performance Guarantee is signed, up to and including the date of issue by the Employer's Agent of the Certificate of Completion of the Works.

2.3. The Employer's Agent and/or the Employer shall advise the Guarantor in writing of the date on which the Certificate of Completion of the Works has been issued.

3. CONDITIONS APPLICABLE TO FIXED PERFORMANCE GUARANTEES

3.1. The Guarantor hereby acknowledges that:

3.1.1. 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.

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

3.2. Subjects to the Guarantors maximum liability referred to in 1.1 or 2.1, the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 3.2.1 to 3.2.3:

3.2.1. A copy of a first written demand issued by the Employer to the Contractor stating that payment of a sum certified by the Employer's Agent in an interim or final payment certificate has not been made in terms of the Contract and failing such payment within seven (7) calendar days, the Employer intends to call upon the Guarantor to make payment in terms of 3.2.2;

3.2.2. 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 3.2.1 and the sum certified has still not been paid;

3.2.3. A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum certified in 3.2.

3.3. Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, 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:

3.3.1. the Contact has been terminated due to the Contractor's default and that this Performance Guarantee is called up in terms of 3.3; or

3.3.2. 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 3.3; and

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

3.4. It is recorded that the aggregate amount of payments requires to be made by the Guarantor in terms of 3.2 and 3.3 shall not exceed the Guarantors' maximum liability in terms of 1.1 or 2.1.

3.5. Where the Guarantor has made payment in terms of 3.3, 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 Employers bank compounded monthly and calculated from the date payment was made by the Guarantor to the Employer until the date of refund.

3.6. Payment by the Guarantor in terms of 3.2 or 3.3 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.

3.7. Payment by the Guarantor in terms of 3.3 will only be made against the return of the original Performance Guarantee by the Employer.

3.8. The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer may consider 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.

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

3.10. This Performance Guarantee is neither negotiable nor transferable and shall expire in terms of 1.1.2 or 2.2, where after no claim will be considered by the Guarantor. The original of this Guarantee shall be returned to the Guarantor after it has expired.

3.11. The Performance Guarantee, with the required demand notices in terms of 3.2 or 3.3, shall be regarded as a liquid document for the purpose of obtaining a court order.

3.12. Where this Performance Guarantee is issued in the Republic of South Africa the Guarantor hereby consents in terms of Section 45 of the Magistrates' 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 the claim may exceed the jurisdiction of the Magistrate's Court.

At .....for and on behalf of .....

.....

on this the ..... day of ..... 20.....

SIGNATURE (1) : .....

CAPACITY : .....

ADDRESS : .....

: .....

: .....

AS WITNESSES : 1 .....

2 .....

C1.4 ADJUDICATION

Adjudication shall be carried out in terms of Clauses 10.5 and 10.6 of the General Conditions of Contract 2015.

The Disclosure Statement and the Adjudication Board Member Agreement to be used in this Contract are contained Appendices 4 and 5 of the General Conditions of Contract 2015.

C1.5 AGREEMENT IN TERMS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT NO 85 OF 1993)

THIS AGREEMENT made at .....

on this the ..... Day of ..... in the year ……

between .....

(hereinafter called "the Employer") of the one part, herein represented by

.....

in his capacity as .....

and .....

(hereinafter called "the Mandatory") of the other part, herein represented by .....

.....

in his capacity as .....

WHEREAS the Employer is desirous that certain Works be constructed, viz .....

.....

and has accepted a Tender by the Mandatory for the construction, completion and maintenance of such Works and whereas the Employer and the Mandatory have agreed to certain arrangements and procedures to be followed in order to ensure compliance by the Mandatory with the provisions of the Occupational Health and Safety Act, 1993 (Act 85 of 1993);

NOW THEREFORE THIS AGREEMENT WITNESSETH AS FOLLOWS:

1 The Mandatory shall execute the work in accordance with the Contract Documents pertaining to this Contract.

2 This Agreement shall hold good from its Commencement Date, which shall be the date of a written notice from the Employer or Employer's Agent requiring him to commence the execution of the Works, to either

(a) the date of the Final Approval Certificate issued in terms of Clause 5.16.1 (GCC 2015) of the General Conditions of Contract (hereinafter referred to as "the GCC"), or

(b) the date of termination of the Contract in terms of Clauses 9.1, 9.2 or 9.3 (GCC 2015) of the GCC.

3 The Mandatory declares himself to be conversant with the following:

(a) All the requirements, regulations and standards of the Occupational Health and Safety Act (Act 85 of 1993), hereinafter referred to as "The Act", together with its amendments and with special reference to the following Sections of The Act:

(i) Section 8 : General duties of Employers to their employees;

(ii) Section 9 : General duties of Employers and self-employed persons to persons other than employees;

(iii) Section 37 : Acts or omissions by employees or mandatories, and

(iv) Subsection 37(2) relating to the purpose and meaning of this Agreement.

(b) The procedures and safety rules of the Employer as pertaining to the Mandatory and to all his subcontractors.

4 In addition to the requirements of Clause 8.4 (GCC 2015) of the GCC and all relevant requirements of the Contract, the Mandatory agrees to execute all the Works forming part of this Contract and to operate and utilise all machinery, Plant and equipment in accordance with the Act.

5 The Mandatory is responsible for the compliance with the Act by all his subcontractors, whether or not selected and/or approved by the Employer.

6 The Mandatory warrants that all his and his subcontractors' workmen are covered in terms of the Compensation for Occupational Injuries and Diseases Act, 1993 which cover shall remain in force whilst any such workmen are present on Site. A letter of good standing from the Compensation Commissioner to this effect must be produced to the Employer upon signature of the agreement.

7. The Mandatory undertakes to ensure that he and/or subcontractors and/or their respective Employers will at all times comply with the following conditions:

(a) The Mandatory shall assume the responsibility in terms of Section 16.1 of the Occupational Health and Safety Act. The Mandatory shall not delegate any duty in terms of Section 16.2 of this Act without the prior written approval of the Employer. If the Mandatory obtains such approval and delegates any duty in terms of section 16.2 a copy of such written delegation shall immediately be forwarded to the Employer.

(b) All incidents referred to in the Occupational Health and Safety Act shall be reported by the Mandatory to the Department of Labour as well as to the Employer. The Employer will further be provided with copies of all written documentation relating to any incident.

(c) 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 into any incident involving the Mandatory and/or his employees and/or his subcontractors.

In witness thereof the parties hereto have set their signatures hereon in the presence of the subscribing witnesses:

SIGNED FOR AND ON BEHALF OF THE EMPLOYER: .....

WITNESS 1 2

NAME 1 2

SIGNED FOR AND ON BEHALF OF THE MANDATORY: .....

WITNESS 1 ..... 2 .....

NAME 1 2

CERTIFICATE OF AUTHORITY FOR SIGNATORY TO AGREEMENT IN TERMS OF OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT NO 85 OF 1993)

The signatory for the company that is the Contractor in terms of the above-mentioned Contract and the Mandatory in terms of the above-mentioned Act shall confirm his or her authority thereto by attaching to this page a duly signed and dated copy of the relevant resolution of the Board of Directors.

An example is given below:

"By resolution of the Board of Directors passed at a meeting held on ..... 20……,

Mr/Ms ..... whose signature

appears below, has been duly authorised to sign the AGREEMENT in terms of THE OCCUPATIONAL

HEALTH AND SAFETY ACT, 1993 (ACT 85 of 1993) on behalf of .....

.....

SIGNED ON BEHALF OF THE COMPANY : .....

IN HIS/HER CAPACITY AS : .....

DATE : .....

SIGNATURE OF SIGNATORY : .....

WITNESS: 1. ..... 2.

NAME (IN CAPITALS): 1. ..... 2.

PART C2: PRICING DATA

C2.1 Pricing Instructions

1. The General Conditions of Contract, the Contract Data, the Specifications (including the Project Specifications) and the Drawings shall be read in conjunction with the Bill of Quantities.

2 The Bill comprises items covering the Contractor's profit and costs of general liabilities and of the construction of Temporary and Permanent Works.

Although the Tenderer is at liberty to insert a rate of his own choosing for each item in the Bill, he should note the fact that the Contractor is entitled, under various circumstances, to payment for additional work carried out and that the Employer's Agent is obliged to base his assessment of the rates to be paid for such additional work on the rates the Contractor inserted in the Bill.

Clause 8 of each Standardized Specification, and the measurement and payment clause of each Particular Specification, read together with the relevant clauses of the Project Specifications, all set out which ancillary or associated activities are included in the rates for the specified operations.

3 Descriptions in the Bill of Quantities are abbreviated and may differ from those in the Standardized and Scope of Work. No consideration will be given to any claim by the Contractor submitted on such a basis. The Bill has been drawn up generally in accordance with the latest issue of Civil Engineering Quantities1. Should any requirement of the measurement and payment clause of the appropriate Standardized or Project Specification(s) be contrary to the terms of the Bill or, when relevant, to the Civil Engineering Quantities, the requirement of the appropriate Standardized, Project, or Particular Specification as the case may be, shall prevail.

4 Unless stated to the contrary, items are measured net in accordance with the Drawings without any allowance having been made for waste.

5 The amounts and rates to be inserted in the Bill of Quantities shall be the full inclusive amounts to the Employer for the work described under the several items. Such amounts shall cover all the costs and expenses that may be required in and for the construction of the work described, and shall cover the costs of all general risks, profits, taxes (but excluding value-added tax), liabilities and obligations set forth or implied in the documents on which the Tender is based.

6 An amount or rate shall be entered against each item in the Bill of Quantities, whether or not quantities are stated. An item against which no amount or rate is entered will be considered to be covered by the other amounts or rates in the Bill.

The Tenderer shall also fill in a rate against the items where the words "rate only" appear in the amount column. Although no work is foreseen under these items and no quantities are consequently given in the quantity column, the tendered rates shall apply should work under these items actually be required.

Should the Tenderer group a number of items together and tender one sum for such group of items, the single tendered sum shall apply to that group of items and not to each individual item, or should he indicate against any item that full compensation for such item has been included in another item, the rate for the item included in another item shall be deemed to be nil.

The tendered rates, prices and sums shall, subject only to the provisions of the Conditions of Contract, remain valid irrespective of any change in the quantities during the execution of the Contract.

7 The quantities of work as measured and accepted and certified for payment in accordance with the Conditions of Contract, and not the quantities stated in the Bill of Quantities, will be used to determine payments to the Contractor. The validity of the Contract shall in no way be affected by differences between the quantities in the Bill of Quantities and the quantities certified for payment.

Ordering of materials are not to be based on the Bill of Quantities, but only on information issued for construction purposes.

8 For the purposes of this 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 Standardized, Project or Particular Specifications

1 The standard system of measurement of civil Engineering quantities published by the South African Institution of Civil Engineers.

Quantity	:	The number of units of work for each item
Rate	:	The payment per unit of work at which the Tenderer tenders to do the work
Amount	:	The quantity of an item multiplied by the tendered rate of the (same) item
Sum	:	An amount tendered for an item, the extent of which is described in the Bill of Quantities, the Specifications or elsewhere, but of which the quantity of work is not measured in units

9 The units of measurement indicated in the Bill of Quantities are metric units. The following abbreviations may appear in the Bill of Quantities:

%	=	percent
h	=	hour
ha	=	hectare
kg	=	kilogram
kl	=	kilolitre
km	=	kilometre
km-pass	=	kilometre-pass
kPa	=	kilopascal
kW	=	kilowatt
l	=	litre
m	=	metre
mm	=	millimeter
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
PSum	=	Provisional Sum
PC sum	=	Prime Cost sum
R/only	=	Rate only
Sum	=	lump sum
t	=	ton (1000 kg)
W/Day	=	Work Day

C2.2 Bill of Quantities

SUMMARY

SECTION	DESCRIPTION	TENDER AMOUNT
1	PRELIMINARIES AND GENERALS	
2	PROVISIONAL SUMS	
3	EARTHWORKS	
4	INLET WORKS	
5	ANAEROBIC POND	
6	AEROBIC POND	
7	SETTLING POND	
8	DRYING BEDS	
9	PUMP, CHLORINATION, AND GUARD BUILDING	
10	FENCE AND ROADS	
11	DAY WORKS	
ESTIMATED CONSTRUCTION COST (EXCL.VAT)		
SKILLS (0.25%)		
ESCALATION (7.5%)		
CONTINGENCIES (10%)		
SUB TOTAL (EXCL.VAT)		
VAT (15%)		
TOTAL CONTRACT SUM (Incl. VAT)		

SECTION:			1	PRELIMINARIES AND GENERALS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
			PSA/PSAB/ SABS 1200 A	**PRELIMINARY AND GENERAL**				
1	**1**		**8.3**	**Schedule Fixed-Charge and Value-Related Items**				
1	1	1	8.3.1	Contractual Requirements	Sum	1		
1	1	2	8.3.2	Site Establishment				
1	1	2.1	8.3.2.1	Facilities for the Engineer				
1	1	2.1.1		Furnished Offices	Sum	1		
1	1	2.1.2		1 Nameboard	Sum	1		
1	1	2.2	8.3.2.2	Facilities for Contractor				
1	1	2.2.1		Offices and Storage Sheds	Sum	1		
1	1	2.2.2		Workshops	Sum	1		
1	1	2.2.3		Laboratories	Sum	1		
1	1	2.2.4		Living Accommodation	Sum	1		
1	1	2.2.5		Ablution and Latrine facilities	Sum	1		
1	1	2.2.6		Tools and Equipment	Sum	1		
1	1	2.2.7		Water supplies, Electric power and Communications	Sum	1		
1	1	2.2.8		Dealing with water	Sum	1		
1	1	2.2.9		Access	Sum	1		
1	1	2.2.10		Plant	Sum	1		
1	1	2.2.11		Professional Land Surveyor	Sum	1		
1	1	3	8.3.3	Other fixed-charge obligations	Sum	1		
1	1	4	8.3.4	Removal of site establishment and trimming of site	Sum	1		
1	**2**		**8.4**	**Schedule Time Related Items**				
1	2	1	8.4.1	Contractual Requirements	Sum	1		
1	2	2	8.4.2	Operate and maintain site facilities for duration of construction, except where otherwise stated				
1	2	2.1	8.4.2.1	Facilities for the Engineer				
1	2	2.1.1		Furnished Offices	Sum	1		
1	2	2.1.2		1 Nameboard	Sum	1		
1	2	2.1.3		Survey assistants and materials	Sum	1		
1	2	2.2	8.4.2.2	Facilities for Contractor				
1	2	2.2.1		Offices and Storage Sheds	Sum	1		
1	2	2.2.2		Workshops	Sum	1		
1	2	2.2.3		Laboratories	Sum	1		
1	2	2.2.4		Living Accommodation	Sum	1		
TOTAL CARRIED FORWARD								

SECTION:			1	PRELIMINARIES AND GENERALS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD								
1	2	2.2.5		Ablution and Latrine facilities	Sum	1		
1	2	2.2.6		Tools and Equipment	Sum	1		
1	2	2.2.5		Water supplies, Electric power and Communications	Sum	1		
1	2	2.2.8		Dealing with water	Sum	1		
1	2	2.2.9		Access	Sum	1		
1	2	2.2.10		Plant	Sum	1		
1	2	2.2.11		Professional Land Surveyor	Sum	1		
1	2	3	8.4.3	Supervision for duration of construction	Sum	1		
1	2	4	8.4.4	Company and Head Office overhead cost for the duration of the contract	Sum	1		
1	2	5	8.4.5	Other time-related obligations	Sum	1		
1	**3**		**8.8**	**Temporary Works**				
1	3	1	8.8.1	Main access road to works (construction and maintenance)	Sum	1		
1	**4**		**C3.6**	**Health and Safety Management**				
1	4	1		Fixed Obligations				
1	4	1.1		Allowance for Contractor's initial obligations in respect of the OHS Act and Construction Regulations	Sum	1		
1	4	1.2		Allowance for Submission of the Health and Safety File	Sum	1		
1	4	1.3		Personal protective clothing and equipment	Sum	1		
1	4	1.4		Fences, signs and barricades	Sum	1		
1	4	1.5		Medical Certification of Employees	Sum	1		
1	4	2		Time Related Obligations				
1	4	2.1		Allowance for Contractor's time related obligations in respect of the OHS Act and Construction Regulations	Sum	1		
1	4	2.2		Allowance for provision of full time Construction Safety Officer	Sum	1		
1	4	2.3		Allowance for the upkeep of the Health and Safety File	Sum	1		
1	4	2.4		Health and Safety training as required	Sum	1		
1	**5**		**ISD C3.5 ISD 5**	**Institutional and Social Development**				
1	5	1	ISD 5.1	Fixed Obligations				
1	5	1.1		Allowance for Contractor's initial obligations in respect of the ISD	Sum	1		
1	5	1.2		Allowance for Submission of the ISD Plan	Sum	1		
TOTAL CARRIED FORWARD								

SECTION:			1	PRELIMINARIES AND GENERALS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD								
1	5	2	ISD 5.2	Time Related Obligations				
1	5	2.1		Allowance for Contractor's time related obligations in respect of ISD	Sum	1		
1	5	2.2		Allowance for provision of part time ISD	Sum	1		
1	**6**		**C3.7 CEMP 7**	**Environmental Management**				
1	6	1	CEMP 7.4	Fixed Obligations				
1	6	1.1		Compilation of an approved Environmental Management Plan	Sum	1		
1	6	1.2		Other fixed charges	Sum	1		
1	6	2	CEMP 7.5	Time Related Obligations				
1	6	2.1		Compliance to the approved Environmental Management Plan and File	Sum	1		
1	6	2.2		Training	Sum	1		
1	**7**		**Part C3.4**	**SMME's**				
1	7	1	11.3	SMME Contract Manager	Sum	1		
1	7	2	11.4	Guidance and assistance to SMMEs	Sum	1		
1	7	3	11.5	Any other costs related to the management of SMMEs	Sum	1		
1	**8**		**8.4.5**	**Other Obligations. (Tenderer Must Specify)**				
1	8	1		.....				
1	8	2		.....				
1	8	3		.....				
TOTAL FOR SECTION 1 CARRIED FORWARD TO SUMMARY								

SECTION:			2	PROVISIONAL SUMS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
			PSA/PSAB/ SABS 1200 A	**PRELIMINARY AND GENERAL PROVISIONAL SUM**				
2	**1**		**Part C3.4**	**SMME's**				
2	1	1	11.1	Provisional Sum for SMME Work Packages	PSum	1	R 1 550 000.00	R 1 550 000.00
2	1	2	11.2	Overheads, charges, and profit in respect of 2.1.1 above	%			
2	1	3	11.6	Provisional Sum for SMME competency training	PSum	1	R 50 000.00	R 50 000.00
2	1	4	11.7	Overheads, charges, and profit in respect of 2.1.3 above	%			
2	**2**		**ISD 5**	**Institutional and Social Development**				
2	2	1		Allow for Community Liaison Officer (R8000)	PSum	1	R 104 000.00	R 104 000.00
2	2	2		Overheads, charges, and profit in respect of 2.2.1 above	%			
2	2	3		Allow for remuneration of 5 PSC Members (R500p/p per sitting)	PSum	1	R 40 000.00	R 40 000.00
2	2	4		Overheads, charges, and profit in respect of 2.2.3 above	%			
2	**3**			**Other**				
2	3	1		Testing as required by the Engineer	PSum	1	R 50 000.00	R 50 000.00
2	3	2		Overheads, charges, and profit in respect of 2.3.1 above	%			
2	3	3		Electrical & Mechanical subcontractor	PSum	1	R 4 871 450.00	R 4 871 450.00
2	3	4		Overheads, charges, and profit in respect of 2.3.3 above	%			
2	3	5		ESKOM supply installation	PSum	1	R 800 000.00	R 800 000.00
2	3	6		Overheads, charges, and profit in respect of 2.3.5 above	%			
2	3	7		Refurbishment of existing ponds	PSum	1	R 240 000.00	R 240 000.00
2	3	8		Overheads, charges, and profit in respect of 2.3.7 above	%			
2	3	9		Construction of effluent release infrastructure	PSum	1	R 40 000.00	R 40 000.00
2	3	10		Overheads, charges, and profit in respect of 2.3.9 above	%			
2	3	11		Operation of the Wastewater Treatment Works to test and commission	PSum	1	R 40 000.00	R 40 000.00
2	3	12		Overheads, charges, and profit in respect of 2.3.11 above	%			
2	3	13		Procurement of chemicals for operation during testing and after Practical Completion	PSum	1	R 60 000.00	R 60 000.00
2	3	14		Overheads, charges, and profit in respect of 2.3.13 above	%			
2	**4**		**SABS 1200 A 8.7/PSA 8.7**	**Materials**				
2	4	1		Procurement of materials	PSum	1	R 50 000.00	R 50 000.00
2	4	2		Handling costs and profit in respect of above	%			
TOTAL FOR SECTION 2 CARRIED FORWARD TO SUMMARY								

SECTION:			3		EARTHWORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					SITE CLEARANCE AND EARTHWORKS				
3	**1**		**PSC/SABS 1200 C**		**Site Clearance**				
3	1	1	8.2.1		Clear and grub around WWTW, along roads, and as instructed	ha	3.336	SMME	SMME
3	1	2	8.2.2		Remove and grub large trees and tree stumps of girth over 1m and up to and including 2m	No.	4	SMME	SMME
3	1	3	8.2.6		Clearance only of 2m on both sides of fence	m	680	SMME	SMME
3	1	4	8.2.9		Transport materials and debris to unspecified sites and dump	m^3.km	6 444	SMME	SMME
3	1	5	8.2.10		Remove topsoil to nominal depth of 150mm and stockpile	m^3	1 950	SMME	SMME
3	**2**		**PSD/SABS 1200 D**		**Bulk Excavation**				
3	2	1	8.3.2		Excavate in all materials at the following locations and use for the following, as ordered				
3	2	1.1			Bulk platform				
3	2	1.1.1			Basic selection and stockpile for road construction	m^3	132		
3	2	1.1.2			Construct embankments as indicated on the drawings or ordered by the Engineer	m^3	50		
3	2	1.1.3			Dispose	m^3	13 015		
3	2	1.2			Anaerobic ponds				
3	2	1.2.1			Basic selection and stockpile for road construction	m^3	3 513		
3	2	1.2.2			Dispose	m^3	390		
3	2	1.3			Aerobic pond				
3	2	1.3.1			Basic selection and stockpile for road construction	m^3	7 197		
3	2	1.3.2			Dispose	m^3	3 875		
3	2	1.4			Settling Pond				
3	2	1.4.1			Basic selection and stockpile for road construction	m^3	663		
3	2	1.4.2			Dispose	m^3	74		
3	2	1.5			Building				
3	2	1.5.1			Basic selection and stockpile for road construction	m^3	12		
3	2	1.5.2			Dispose	m^3	105		
3	2	1.6			Drying beds				
3	2	1.6.1			Dispose	m^3	885		
3	2	1.7			Extra-over on 3.2.1.1 to 3.2.1.6 for				
3	2	1.7.1			Intermediate excavation	m^3	13 246		
3	2	1.7.2			Hard rock	m^3	786		
TOTAL CARRIED FORWARD									

SECTION:			3		EARTHWORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
3	**3**		**PSD/SABS 1200 D**		**Restricted Excavation**				
3	3	1	8.3.3		Excavate for restricted foundations, footings, structures, canals, and pipe trenches in all materials and dispose				
3	3	1.1			Emergency overflow alteration and canal	m^3	7.2		
3	3	1.2			Alterations and canal from inlet works sump to anaerobic ponds	m^3	8.9		
3	3	1.3			Anaerobic pond sumps	m^3	55.1		
3	3	1.4			Canal from anaerobic to aerobic	m^3	7.0		
3	3	1.5			Canal from aerobic to Settling Pond	m^3	7.0		
3	3	1.6			Settling Pond de-sludge sumps	m^3	5.4		
3	3	1.7			Canal from Settling Pond to 1st Existing Pond	m^3	88.0		
3	3	1.8			Recycle suction pipe entering underneath the 1st Existing Pond, including potential shoring of the existing concrete pond walls	m^3	4.5		
3	3	1.9			Pump room footings	m^3	5.9		
3	3	1.10			Drying bed sumps	m^3	19.4		
3	3	2			Extra-over on 3.3.1.1 to 3.3.1.10 for				
3	3	2.1			Intermediate excavation	m^3	16.4		
3	3	2.2			Hard rock	m^3	5.5		
3	**4**		**PSD/SABS 1200 DB**		**Trench Excavation**				
3	4	1	8.3.2		Excavate in all materials for trenches, backfill, compact and dispose of surplus material				
3	4	1.1			Drying bed to Anaerobic Pond & Aerobic Pond for Ø160mm supernatant recovery delivery pipe for depths:				
3	4	1.1.1			Over 0m and up to 1m	m	91		
3	4	1.1.2			Over 1m and up to 2m	m	116		
3	4	1.2			Aerobic Pond to Pump Room for Ø200mm aeration suction pipe for depths:				
3	4	1.2.1			Over 0m and up to 1m	m	1.0		
3	4	1.2.2			Over 1m and up to 2m	m	1.0		
3	4	1.2.3			Over 2m and up to 3m	m	1.0		
3	4	1.2.4			Over 3m and up to 4m	m	5.0		
3	4	1.3			Around Aerobic Pond for Ø110mm, Ø160mm, and Ø200mm aeration delivery pipe for depths:				
3	4	1.3.1			Over 0m and up to 1.5m	m	282		
3	4	1.4			Settling Pond desludge sumps to Pump Room for Ø160mm pipe desludge suction pipes for depths:				
3	4	1.4.1			Over 0m and up to 1m	m	5.1		
TOTAL CARRIED FORWARD									

SECTION:			3		EARTHWORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
3	4	1.4.2			Over 1m and up to 2m	m	5.1		
3	4	1.4.3			Over 2m and up to 3m	m	5.1		
3	4	1.4.4			Over 3m and up to 4m	m	24.0		
3	4	1.5			Chlorination room to 3rd Existing Pond for Ø50mm sleeve				
3	4	1.5.1			Over 0m and up to 1m	m	173		
3	4	1.6			Anaerobic Ponds to Drying bed for Ø160mm desludge gravity pipes for depths:				
3	4	1.6.1			Over 0m and up to 1m	m	40		
3	4	1.6.2			Over 1m and up to 2m	m	20		
3	4	1.6.3			Over 2m and up to 3m	m	50		
3	4	1.6.4			Over 3m and up to 4m	m	90		
3	4	1.7			1st Existing Pond to Pump Room for Ø160mm recycle suction pipe for depths:				
3	4	1.7.1			Over 0m and up to 1m	m	51		
3	4	1.7.2			Over 1m and up to 2m	m	17		
3	4	1.8			Pump Room to Anaerobic & Aerobic Pond for Ø110mm recycle delivery pipe for depths:				
3	4	1.8.1			Over 0m and up to 1m	m	170		
3	4	1.9			Pump Room to Anaerobic & Aerobic Pond for Ø110mm desludge delivery pipe for depths:				
3	4	1.9.1			Over 0m and up to 1m	m	147		
3	4	1.10			Water pipe for Ø160mm pipe for depths:				
3	4	1.10.1			Over 0m and up to 1m	m	137		
3	4	1.11			Subsoil drain pipes through Anaerobic ponds, Aerobic Pond, and Settling Pond for depths:				
3	4	1.11.1			Over 0m and up to 1m	m	194		
3	4	1.11.2			Over 1m and up to 2m	m	22		
3	4	1.11.3			Over 2m and up to 3m	m	59		
3	4	1.11.4			Over 3m and up to 4m	m	54		
3	4	1.12			Extra-over on 3.4.1.1 to 3.4.1.11 for				
3	4	1.12.1			Intermediate excavation	m^3	323		
3	4	1.12.2			Hard rock	m^3	16		
3	**5**		**PSL/SABS 1200 LB**		**<u>Bedding of Pipes</u>**				
3	5	1	8.2.2.1		Supply bedding				
3	5	1.1			By selection from other necessary excavations on site as per the recommendation in the geotechnical report (2025 / 09 / 09 / GTEC)	m^3	327		
TOTAL CARRIED FORWARD									

SECTION:			3		EARTHWORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
3	5	1.2			By importation from commercial or off-site sources selected by the Contractor	m^3	65		
3	5	2	8.2.2.1		Supply free draining bedding sand for subsoil drainage pipes by importation from commercial or off-site sources selected by the Contractor	m^3	307		
3	**6**		**PSD/SABS 1200 D**		**Topsoiling and Grassing**				
3	6	1	8.3.10		Topsoiling to a nominal depth of 150mm or as ordered by the Engineer	m^2	4 050	SMME	SMME
3	6	2	8.3.11		Grassing	m^2	4 050	SMME	SMME
TOTAL FOR SECTION 3 CARRIED FORWARD TO SUMMARY									

SECTION:			4		INLET WORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					ALTERATIONS				
4	**1**		**PSLD/SABS 1200 LD**		**Manhole alteration at Inlet Works**				
4	1	1			Remove and dispose of unnecessary manhole rings, as indicated by the engineer	No.	2		
4	1	2			Make good the remaining manhole rings, re-construct benching, replace cover, repair arsing damages etc.	Sum	1		
4	**2**		**PSG/SABS 1200 G**		**Concrete alterations for channels**				
4	2	1			Demolish apron as per drawing PC20013-CIV-2401				
4	2	1.1			Cutting and breaking of the existing concrete apron including the existing reinforcing.	Sum	1		
4	2	1.2			Neat cutting and breaking of additional 150mm width of the remaining existing concrete apron without damage to the reinforcement to create a face to re-cast the apron against.	Sum	1		
4	2	1.3			Neat cutting of 50mm of the remaining existing reinforcing to ensure 50mm cover on the apron reinforcing.	Sum	1		
4	2	1.4			Removal, loading, hauling, and disposal of the debris at an approved site	Sum	1		
4	2	2			Demolish wall as per drawing PC20013-CIV-2401				
4	2	2.1			Cutting and breaking to the correct elevation of the existing concrete wall including the existing reinforcing.	Sum	1		
4	2	2.2			Neat cutting and breaking of additional 100mm width of the remaining existing concrete wall without damage to the reinforcement to create a face to re-cast the wall against.	Sum	1		
4	2	2.3			Neat cutting of 50mm of the remaining existing reinforcing to ensure 50mm cover on the wall reinforcing.	Sum	1		
4	2	2.4			Removal, loading, hauling, and disposal of the debris at an approved site	Sum	1		
4	2	3			Reinforcing & wet-to-dry concrete treatment				
4	2	3.1			Cleaning and preparation of reinforcing and concrete to manufacturer's specification	Sum	1		
4	2	3.2			Supply, delivery, and application of reinforcing treatment (abe durarep ZR primer or equivalent approved)	Sum	1		
4	2	3.3			Supply, delivery, and application of wet-to-dry treatment (abe epidermix® 344 or equivalent approved)	Sum	1		
					NEW CHANNELS				
4	**3**				**Joining of HDPE liner to concrete structures**				
4	3	1			Manufacture and supply, deliver, and install watertight seals around channel inlets and outlets as per drawing PC20013-CIV-2402	No.	4		
TOTAL CARRIED FORWARD									

SECTION:			4		INLET WORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
4	**4**		**PSG/SABS 1200 G**		**Inlet channel to Anaerobic Ponds as per drawing PC20013-CIV-2401**				
4	4	1			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2	m^2	14.9		
4	4	2			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	14.9		
4	4	3	8.4.2		50mm thick 15/19 MPa blinding layer underneath channel	m^2	3.3		
4	4	4	8.2.5		Rough narrow width formwork for the channel floor	m	6.6		
4	4	5	8.2.2		Smooth vertical formwork for the channel walls, including chamfers	m^2	17.8		
4	4	6	8.3.2		High tensile welded mesh ref. 395	m^2	7.8		
4	4	7	8.4.3		30/19 MPa concrete for the channel including curing with approved acrylic compound	m^3	1.6		
4	4	8	8.4.4		Wood floated unformed surface finish for the channel floor	m^2	2.0		
4	4	9	8.4.4		Wood floated unformed surface finish for the channel wall	m^2	1.0		
4	4	10	8.3.1		Manufacture, deliver, and installation of high tensile Y8 dowels complete with chemical anchor and other required sundries	No.	28		
4	**5**		**PSG/SABS 1200 G**		**Emergency overflow channel to Anaerobic Ponds as per drawing PC20013-CIV-2401**				
4	5	1			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2	m^2	14.5		
4	5	2			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	14.5		
4	5	3	8.4.2		50mm thick 15/19 MPa blinding layer underneath channel	m^2	3.6		
4	5	4	8.2.5		Rough narrow width formwork for the channel floor	m	7.2		
4	5	5	8.2.2		Smooth vertical formwork for the channel walls, including chamfers	m^2	14.5		
4	5	6	8.3.2		High tensile welded mesh ref. 395	m^2	7.2		
4	5	7	8.4.3		30/19 MPa concrete for the channel including curing with approved acrylic compound	m^3	1.4		
4	5	8	8.4.4		Wood floated unformed surface finish for the channel floor	m^2	2.2		
4	5	9	8.4.4		Wood floated unformed surface finish for the channel wall	m^2	1.1		
4	5	10	8.3.1		Manufacture, deliver, and installation of high tensile Y8 dowels complete with chemical anchor and other required sundries	No.	20		
TOTAL FOR SECTION 4 CARRIED FORWARD TO SUMMARY									

SECTION:			5		ANAEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					APRON & POND CONCRETE				
5	**1**		**PSG/SABS 1200 G**		**Apron**				
5	1	1	8.2.5		Smooth narrow width formwork up to 300mm for the apron edge	m	70.0	SMME	SMME
5	1	2			Supply, deliver, and install 75mm thick geocell to the manufacturer's specification	m^2	298	SMME	SMME
5	1	3	8.4.3		30/19 MPa concrete to fill the geocell to the manufacturer's specification including curing with approved acrylic compound	m^3	31.8	SMME	SMME
5	1	4	8.4.4		Wood floated unformed surface finish for the apron floor	m^2	298	SMME	SMME
5	**2**		**PSG/SABS 1200 G**		**Anaerobic pond reinforced water retaining structure**				
5	2	1	8.4.2		50mm thick 15/19 MPa blinding layer underneath the floor slab.	m^2	534		
5	2	2	8.2.5		Rough narrow width formwork up to 300mm for the floor slabs	m	151		
5	2	3	8.2.5		Rough narrow width formwork up to 300mm for the floor slabs, including allowance for reinforcing through the formwork	m	348		
5	2	4	8.2.2		Smooth vertical formwork for the main structure walls, including chamfers	m^2	1 389		
5	2	5	8.2.2		Smooth vertical formwork for the sump structure walls, including chamfers	m^2	134		
5	2	6	8.2.6		Form voids in the structure walls for the channels, overflows, and pipes				
5	2	6.1			The emergency overflow channel as per drawing PC20013-CIV-2402	No.	1		
5	2	6.2			The inlet works to anaerobic ponds channel as per drawing PC20013-CIV-2402	No.	1		
5	2	6.3			The anaerobic ponds internal overflows as per drawing PC20013-CIV-2402	No.	2		
5	2	6.4			The anaerobic ponds to aerobic pond channel as per drawing PC20013-CIV-2402	No.	1		
5	2	6.5			The de-sludge pipes, including allowance for reinforcement through formwork, as per drawing PC20013-CIV-2402	No.	12		
5	2	7	8.3.1		High tensile reinforcing	t	20.265		
5	2	8	8.3.2		High tensile welded mesh ref. 617	m^2	3 111		
5	2	9	8.4.3		30/19 MPa concrete for the floors including curing with approved acrylic compound	m^3	214		
5	2	10	8.4.3		30/19 MPa concrete for the walls including curing with approved acrylic compound	m^3	152		
TOTAL CARRIED FORWARD									

SECTION:			5		ANAEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
5	2	11			Extra-over item 5.2.10 for waterproofing admixture for concrete to water retaining structures				
5	2	11.1			Supply, deliver, and add a crystalline additive with non-toxic green tracing agent, visible during concrete placement. Dosed at 0.8% by weight of total binder content, with 20- year warranty to manufactures specification. The following on-site product support is required: - Kick off meetings to discuss project details and specific requirements - Pre pour inspections compulsory and ongoing inspections required for warranty purposes - Post pour inspections compulsory to view quality and advise on required repairs - Flood test and sign off compulsory test to verify performance and release warranty	m^3	366		
5	2	12			Crystaline slurry in concrete joints	m	703		
5	2	13	8.5		Base seal PVC waterstop for floor and walls	m	703		
					NEW CHANNELS				
5	**3**		**PSG/SABS 1200 G**		**Anaerobic Ponds to Aerobic Pond channel as per drawing PC20013-CIV-2401**				
5	3	1			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2	m^2	14.0		
5	3	2			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	14.0		
5	3	3	8.4.2		50mm thick 15/19 MPa blinding layer underneath channel	m^2	3.5		
5	3	4	8.2.5		Rough narrow width formwork for the channel floor	m	7.0		
5	3	5	8.2.2		Smooth vertical formwork for the channel walls, including chamfers	m^2	14.0		
5	3	6	8.3.2		High tensile welded mesh ref. 395	m^2	7.0		
5	3	7	8.4.3		30/19 MPa concrete for the channel including curing with approved acrylic compound	m^3	1.4		
5	3	8	8.4.4		Wood floated unformed surface finish for the channel floor	m^2	2.1		
5	3	9	8.4.4		Wood floated unformed surface finish for the channel wall	m^2	1.1		
5	3	10	8.3.1		Manufacture, deliver, and installation of high tensile Y8 dowels complete with chemical anchor and other required sundries	No.	20		
5	**4**				**Joining of HDPE liner to concrete structures**				
5	4	1			Manufacture and supply, deliver, and install watertight seals around Anaerobic inlets as per drawing PC20013-CIV-2401	No.	1		
					PIPES				
5	**5**		**PSL/SABS 1200 L**		**Pipelines**				
5	5	1	8.2.1		Supply, lay, and bed pipes complete with couplings and bends, including flanges and all required fittings etc.				
5	5	1.1			Ø160mm HDPE PN10 for desludge pipework from the ponds to the sumps	m	258		
TOTAL CARRIED FORWARD									

SECTION:			5		ANAEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
5	5	1.2			Ø160mm HDPE PN10 for desludge pipework from the sumps to the drying beds	m	60		
5	5	1.3	PSXC		Ø110mm HDPE subsoil drainage pipes with an open lattice wall structure, including class 2 fill coarse grained free draining material, with the pipe and material wrapped in continuous filament nonwoven needle punched geotextile with a minimum mass of 150 g/m^2, under the Anaerobic Ponds as per drawing PC20013-CIV-2902	m	186		
5	**6**		**SABS 1200 L**		**Pipe bends**				
5	6	1	8.2.2 PSXB		Extra-over item 5.5: Supply, lay, and bed, joint, including cut pipes to length where required, test and disinfect.				
5	6	1.1			Ø160mm 28,9° HDPE PN10 stub flange bend for the desludge pipe at the bottom of the pond as per drawing PC20013-CIV-2402	No.	6		
5	6	1.2			Ø160mm 28.9° HDPE PN10 stub flange bend for the desludge pipe at the bottom of the pond as per drawing PC20013-CIV-2402	No.	6		
5	6	1.3			Ø160mm 28.9° HDPE PN10 stub flange bend for the desludge pipe that enters the sump as per drawing PC20013-CIV-2402	No.	6		
5	6	1.4			Ø160mm 28.9° HDPE PN10 stub flange bend for the desludge pipe that enters the sump as per drawing PC20013-CIV-2402	No.	6		
5	6	1.5			Ø160mm 90° HDPE PN10 stub flange bend for the desludge pipe going to drying bed as per drawing PC20013-CIV-2402	No.	1		
5	6	1.6			Ø160mm 45° HDPE PN10 stub flange bend for the desludge pipe rodding eye at the drying beds as per drawing PC20013-CIV-2402	No.	1		
5	6	2	8.2.11		Grade 25/19 concrete for thrust blocks	m^3	1.5		
5	**7**		**PSL/SABS 1200 L**		**Manholes**				
5	7	1	8.2.14		MH01 downstream of the anaerobic pond sumps as per drawing PC20013-CIV-2901	No.	1		
5	7	2	8.2.14		Extra-over for additional depths exeeding 1.5m for the manhole in item 5.7.1 as per drawing PC20013-CIV-2901	Sum	1		
5	7	3	8.2.14		MH02 downstream of the manhole in item 5.7.1 as per drawing PC20013-CIV-2901	No.	1		
5	7	4	8.2.14		Extra-over for additional depths exeeding 1.5m for the manhole in item 5.7.3 as per drawing PC20013-CIV-2901	Sum	1		
5	**8**		**SABS 1200 L**		**Supply and install pipework in chambers, including sundries**				
5	8	1	8.2.5		Puddle flanged pipe special, stub flange, and valve in the sump as per drawing PC20013-CIV-2403	No.	12		
5	8	2			Stub flange and blank flange to form rodding eye as per drawing PC20013-CIV-2403	No.	1		
TOTAL CARRIED FORWARD									

SECTION:			5		ANAEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
			SABS 1200 H		**ANCILLARIES**				
5	**9**		**8.3.8**		**Ladders as per drawing PC20013-CIV-2402**				
5	9	1			Supply, deliver, and install complete with all sundries for ponds	No.	3		
5	9	2			Supply, deliver, and install complete with all sundries for sumps	No.	3		
5	**10**		SABS 1200 H		**Handrails**				
5	10	1	8.3.7		Supply and erection of medium duty galvanised handrails and complete with all sundries				
5	10	1.1			Stanchions 1m high Ø43mm x 3mm GMS circular tubing with intersections Ø60mm steel balls at 90°, including 150 x 65 x 8mm GMS baseplate	No.	110	SMME	SMME
5	10	1.2			Handrails of Ø38mm x 2.5mm GMS circular tubing			SMME	SMME
5	10	1.2.1			Straight section, including top and bottom rail	m	142	SMME	SMME
5	10	1.2.2			90° short radius bend	No.	16	SMME	SMME
5	10	1.2.3			90° closure	No.	22	SMME	SMME
TOTAL FOR SECTION 5 CARRIED FORWARD TO SUMMARY									

SECTION:			6		AEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					APRON & POND CONCRETE				
6	**1**		**PSG/SABS 1200 G**		**Apron**				
6	1	1	8.2.5		Smooth narrow width formwork up to 300mm for the apron edge	m	235	SMME	SMME
6	1	2			Supply, deliver, and install 75mm thick geocell to the manufacturer's specification	m^2	490	SMME	SMME
6	1	3	8.4.3		30/19 MPa concrete to fill the geocell to the manufacturer's specification including curing with approved acrylic compound	m^3	52.6	SMME	SMME
6	1	4	8.4.4		Wood floated unformed surface finish for the apron floor	m^2	490	SMME	SMME
6	**2**		**PSG/SABS 1200 G**		**Aerobic Pond structure**				
6	2	1	8.4.2		50mm thick no-fines 19mm stone blinding & drainage layer underneath the concrete geocell floor	m^3	209		
6	2	2	8.4.2		Construct, demolish, and dispose of a trial section for 50mm thick no-fines 19mm stone blinding & drainage layer	m^3	0.9		
6	2	3	8.2.6		Form voids in the structure walls and weld the HDPE liner as required for the channels and pipes				
6	2	3.1			The aerobic pond to settling pond channel as per drawing PC20013-CIV-2501	No.	1		
6	2	3.2			The suction pipe as per drawing PC20013-CIV-2501	No.	1		
6	2	3.3			Building sewage outflow as per drawing PC20013-CIV-2501	No.	1		
6	2	4			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2 for the sides/slopes	m^2	2 032		
6	2	5			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 340 g/m^2 for the bottom (above blinding & drainage layer)	m^2	2 153		
6	2	6			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	4 675		
6	2	7			Supply, deliver, and install 75mm thick geocell to the manufacturer's specification	m^2	4 185		
6	2	8	8.4.3		25/19 MPa concrete to fill the geocell to the manufacturer's specification including curing with approved acrylic compound	m^3	314		
6	2	9	8.4.4		Wood floated unformed surface finish	m^2	4 185		
					NEW CHANNELS				
6	**3**		**PSG/SABS 1200 G**		**Aerobic Channel to Settling Pond as per drawing PC20013-CIV-2501**				
6	3	1			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2	m^2	14.0		
6	3	2			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	14.0		
6	3	3	8.4.2		50mm thick 15/19 MPa blinding layer underneath channel	m^2	3.5		
6	3	4	8.2.5		Rough narrow width formwork for the channel floor	m	7.0		
TOTAL CARRIED FORWARD									

SECTION:			6		AEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
6	3	5	8.2.2		Smooth vertical formwork for the channel walls, including chamfers	m^2	14.0		
6	3	6	8.3.2		High tensile welded mesh ref. 395	m^2	7.0		
6	3	7	8.4.3		30/19 MPa concrete for the channel including curing with approved acrylic compound	m^3	1.4		
6	3	8	8.4.4		Wood floated unformed surface finish for the channel floor	m^2	2.1		
6	3	9	8.4.4		Wood floated unformed surface finish for the channel wall	m^2	1.1		
6	3	10	8.3.1		Manufacture, deliver, and installation of high tensile Y8 dowels complete with chemical anchor and other required sundries	No.	20		
6	**4**				**Joining of HDPE liner to concrete structures**				
6	4	1			Manufacture and supply, deliver, and install watertight seals around Aerobic to Settling Pond outlets as per drawing PC20013-CIV-2501	No.	1		
					PIPES				
6	**5**		**PSL/SABS 1200 L**		**Pipelines**				
6	5	1	8.2.1		Supply, lay, and bed pipes complete with couplings and bends, including flanges and all required fittings etc.				
6	5	1.1			Ø200mm HDPE PN10 for the Aeration suction pipework from the Aerobic Pond to the Pump Room	m	13		
6	5	1.2			Ø200mm HDPE PN10 for the Aeration delivery pipework from the Pump Room to the ring pipeline	m	5		
6	5	1.3			Ø200mm HDPE PN10 for the Aeration ring pipeline	m	110		
6	5	1.4			Ø160mm HDPE PN10 for the Aeration ring pipeline	m	54		
6	5	1.5			Ø110mm HDPE PN10 for the Aeration ring pipeline	m	117		
6	5	1.6	PSXC		Ø110mm HDPE subsoil drainage pipes with an open lattice wall structure, including class 2 fill coarse grained free draining material, with the pipe and material wrapped in continuous filament nonwoven needle punched geotextile with a minimum mass of 150 g/m^2 , under the Anaerobic Ponds as per drawing PC20013-CIV-2501	m	105		
TOTAL CARRIED FORWARD									

SECTION:			6		AEROBIC POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
6	6		SABS 1200 L		**Pipe bends and tees**				
6	6	1	8.2.2 PSXB		Extra-over item 6.5: Supply, lay, and bed, joint, including cut pipes to length where required, test and disinfect.				
6	6	1.1			Ø200mm 90° HDPE PN10 buttwelded long radius bend for the ring pipeline	No.	2		
6	6	1.2			Ø110mm 90° HDPE PN10 buttwelded long radius bend for the ring pipeline	No.	2		
6	6	2			Tee for:				
6	6	2.1			Ø200mm HDPE PN10 buttwelded for the delivery pipe to the ring pipeline	No.	1		
6	6	3			Reducers for the ring pipeline:				
6	6	3.1			From Ø160mm HDPE to Ø110mm HDPE buttwelded	No.	2		
6	6	3.2			From Ø200mm HDPE to Ø160mm HDPE buttwelded	No.	2		
6	6	4	8.2.11		Grade 25/19 concrete for thrust blocks	m^3	1.6		
TOTAL FOR SECTION 6 CARRIED FORWARD TO SUMMARY									

SECTION:			7		SETTLING POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					APRON & POND CONCRETE				
7	**1**		**PSG/SABS 1200 G**		**Apron**				
7	1	1	8.2.5		Smooth narrow width formwork up to 300mm for the apron edge	m	58	SMME	SMME
7	1	2			Supply, deliver, and install 75mm thick geocell to the manufacturer's specification	m^2	116	SMME	SMME
7	1	3	8.4.3		30/19 MPa concrete to fill the geocell to the manufacturer's specification including curing with approved acrylic compound	m^3	12.6	SMME	SMME
7	1	4	8.4.4		Wood floated unformed surface finish for the apron floor	m^2	116	SMME	SMME
7	**2**		**PSG/SABS 1200 G**		**Settling Pond reinforced structure**				
7	2	1	8.4.2		50mm thick 15/19 MPa blinding layer underneath the floor slab.	m^2	115		
7	2	2	8.2.5		Smooth narrow width formwork up to 300mm for the sumps inside the floor slabs	m	12		
7	2	3	8.2.5		Rough narrow width formwork up to 300mm for the floor slabs	m	61		
7	2	4	8.2.5		Smooth narrow width formwork up to 300mm for the sump slabs	m	30		
7	2	5	8.2.2		Smooth vertical formwork for the main structure walls	m^2	160		
7	2	6	8.2.2		Smooth vertical formwork for the diffuser baffle wall	m^2	42		
7	2	7	8.2.6		Form voids in the structure walls for the channels, pipes, and diffuser baffle wall openings				
7	2	7.1			Settling pond to 1st existing channel as per drawing PC20013-CIV-2601	No.	1		
7	2	7.2			The de-sludge pipes, including allowance for reinforcement through formwork as per drawing PC20013-CIV-2601	No.	3		
7	2	7.3			Diffuser baffle wall openings as per drawing PC20013-CIV-2601	No.	13		
7	2	8	8.3.1		High tensile reinforcing	t	4.304		
7	2	9	8.3.2		High tensile welded mesh ref. 617	m^2	661		
7	2	10	8.4.3		30/19 MPa concrete for the floors including curing with approved acrylic compound	m^3	46		
7	2	11	8.4.3		30/19 MPa concrete for the walls including curing with approved acrylic compound	m^3	20		
TOTAL CARRIED FORWARD									

SECTION:			7		SETTLING POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
7	2	12			Extra-over item 7.2.11 for waterproofing admixture for concrete to water retaining structures				
7	2	12.1			Supply, deliver, and add a crystalline additive with non-toxic green tracing agent, visible during concrete placement. Dosed at 0.8% by weight of total binder content, with 20- year warranty to manufactures specification. The following on-site product support is required: - Kick off meetings to discuss project details and specific requirements - Pre pour inspections compulsory and ongoing inspections required for warranty purposes - Post pour inspections compulsory to view quality and advise on required repairs - Flood test and sign off compulsory test to verify performance and release warranty	m^3	66		
7	2	13			Crystaline slurry in concrete joints	m	73		
7	2	14	8.5		Base seal PVC waterstop for floor and walls	m	73		
					NEW CHANNELS				
7	**3**		**PSG/SABS 1200 G**		**Settling Pond channel to 1st Existing as per drawing PC20013-CIV-2601**				
7	3	1			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2	m^2	176.0		
7	3	2			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	176.0		
7	3	3	8.4.2		50mm thick 15/19 MPa blinding layer underneath channel	m^2	44.0		
7	3	4	8.2.5		Rough narrow width formwork for the channel floor	m	88.0		
7	3	5	8.2.2		Smooth vertical formwork for the channel walls, including chamfers	m^2	176.0		
7	3	6	8.3.2		High tensile welded mesh ref. 395	m^2	88.0		
7	3	7	8.4.3		30/19 MPa concrete for the channel including curing with approved acrylic compound	m^3	17.6		
7	3	8	8.4.4		Wood floated unformed surface finish for the channel floor	m^2	26.4		
7	3	9	8.4.4		Wood floated unformed surface finish for the channel wall	m^2	13.2		
7	3	10	8.3.1		Manufacture, deliver, and installation of high tensile Y8 dowels complete with chemical anchor and other required sundries	No.	20		
7	**4**				**Joining of HDPE liner to concrete structures**				
7	4	1			Manufacture and supply, deliver, and install watertight seals around Settling Pond inlets and outlets as per drawing PC20013-CIV-2601	No.	1		
7	4	2			Manufacture and supply, deliver, and install watertight seals around 1st Existing Pond inlets as per drawing PC20013-CIV-2601	No.	1		
TOTAL CARRIED FORWARD									

SECTION:			7		SETTLING POND	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
					PIPES				
7	**5**		**PSL/SABS 1200 L**		**Pipelines**				
7	5	1	8.2.1		Supply, lay, and bed pipes complete with couplings and bends, including flanges and all required fittings etc.				
7	5	1.1			Ø160mm diameter HDPE PN10 for desludge pipework from the Settling Pond to Pump Room	m	40		
7	5	1.2	PSXC		Ø110mm HDPE subsoil drainage pipes with an open lattice wall structure, including class 2 fill coarse grained free draining material, with the pipe and material wrapped in continuous filament nonwoven needle punched geotextile with a minimum mass of 150 g/m^2, under the Anaerobic Ponds as per drawing PC20013-CIV-2902	m	28		
7	5	1.3			Ø110mm uPVC class 6 for daylight pipework, connected downstream of the drainage pipes	m	100		
7	**6**		**SABS 1200 L**		**Pipe bends**				
7	6	1	8.2.2 PSXB		Supply, lay, and bed, joint, including cut pipes to length where required, test and disinfect."				
7	6	1.1			Ø160mm varying angles HDPE PN10 buttwelded bends for the deslugde suction pipes that enters the pump room as per drawing PC20013-CIV-2601	No.	3		
7	6	1.2			Ø160mm varying angles HDPE PN10 buttwelded bends for the deslugde suction pipes at the sumps as per drawing PC20013-CIV-2601	No.	3		
7	6	2	8.2.11		Grade 25/19 concrete for thrust blocks	m^3	0.6		
7	**7**		**SABS 1200 L**		**Supply and install pipework in chambers, including sundries**				
7	7	1	8.2.5		Puddle flanged pipe special in the sumps and complete with sundries as per drawing PC20013-CIV-2902	No.	3		
7	**8**		**SABS 1200 H**		**Handrails**				
7	8	1	8.3.7		Supply and erection of medium duty galvanised handrails and complete with all sundries.				
7	8	1.1			Stanchions 1m high Ø43mm x 3mm GMS circular tubing with intersections Ø60mm steel balls at 90°, including 150 x 65 x 8mm GMS baseplate	No.	44	SMME	SMME
7	8	1.2			Handrails of Ø38mm x 2.5mm GMS circular tubing				
7	8	1.2.1			Straight section, including top and bottom rail	m	61	SMME	SMME
7	8	1.2.2			90° short radius bend	No.	4	SMME	SMME
7	8	1.2.3			90° closure	No.	6	SMME	SMME
TOTAL FOR SECTION 7 CARRIED FORWARD TO SUMMARY									

SECTION:			8		DRYING BEDS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					LAYERWORKS				
8	**1**		**SABS 1200 MF**		**Drying bed structure**				
8	1	1	8.3.3		Supply, deliver, and construct a 150mm thick layer of G7 from a comercial source	m^3	132		
8	1	2	8.3.3		Supply, deliver, and construct a 150mm thick layer of G5 from a comercial source	m^3	132		
					CONCRETE				
8	**2**		**PSG/SABS 1200 G**		**Drying bed structure**				
8	2	1	8.2.5		Rough narrow widths up to 300mm for the floor slab	m	494		
8	2	2	8.2.5		Rough narrow widths up to 300mm for the sump slab	m	17.3		
8	2	3	8.2.2		Smooth vertical formwork for the drying bed structure walls, including chamfers, as per drawing PC20013-CIV-2701	m^2	326		
8	2	4	8.2.2		Smooth vertical formwork for the sump structure walls, including chamfers, as per drawing PC20013-CIV-2702	m^2	47.2		
8	2	5	8.2.6		Form voids in the structure walls for the pipes				
8	2	5.1			The supernatant pipe as per drawing PC20013-CIV-2701	No.	3		
8	2	5.2			The sluice gate as per drawing PC20013-CIV-2701	No.	4		
8	2	6	8.3.2		High tensile welded mesh ref. 395	m^2	186		
8	2	7	8.4.3		35/19 MPa concrete for the floor slabs including curing with approved acrylic compound	m^3	150		
8	2	8	8.4.3		25/19 MPa concrete for the walls including curing with approved acrylic compound	m^3	37.3		
8	2	9			Supply, deliver, lay, and weld 2mm double textured HDPE Geomembrane according to manufacturer's specifications	m^2	985		
8	2	10			Supply, deliver, and lay, continuous filament nonwoven needle punched geotextile with a minimum mass of 210 g/m^2	m^2	985		
8	2	11	8.4.4		Wood floated unformed surface finish for the floors	m^2	882		
8	2	12			Manufacture, deliver, and installation of 300mm long high tensile Y12 dowels complete with chemical anchor and other required sundries	No.	958		
8	**3**		**PSG/SABS 1200 G**		**Ground beam**				
8	3	1	8.2.2		Smooth narrow widths up to 300mm for the ground beam	m	74.0		
8	3	2	8.3.2		High tensile Y8 reinforcing, including laps, for the ground beam as per drawing PC20013-CIV-2701	kg	34		
8	3	3	8.4.3		35/19 MPa concrete for ground beam including curing with approved acrylic compound	m^3	6.7		
8	3	4	8.4.4		Wood floated unformed surface finish for the beam	m^2	22.2		
TOTAL CARRIED FORWARD									

SECTION:			8		DRYING BEDS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
					PIPES				
8	**4**		**PSL/SABS 1200 L**		**Pipelines**				
8	4	1	8.2.1		Supply, lay, and bed pipes complete with couplings and bends, including flanges and all required fittings etc.				
8	4	0.1			Ø110mm diameter HDPE PN10 for supernatant gravity pipe between the sumps	m	16.4		
					Ø110mm diameter HDPE PN10 for supernatant delivery pipeline from drying bed to Anaerobic and Aerobic Ponds	m	207		
8	**5**		**SABS 1200 L**		**Pipe bends**				
8	5	1	8.2.2 PSXB		Extra-over item ..: Supply, lay, and bed, joint, including cut pipes to length where required, test and disinfect.				
8	5	1.1			Ø110mm 90° HDPE PN10 buttwelded long radius bend for the supernatant delivery pipeline	No.	3		
8	5	1	8.2.11		Grade 25/19 concrete for thrust blocks	m^3	0.3		
8	**6**		**SABS 1200 L**		**Supply and install pipework, including sundries**				
8	6	1	8.2.5		Inlet to Anaerobic Pond as per drawing PC20013-CIV-2702	No.	1		
8	6	2	8.2.5		Inlet to Aaerobic Pond as per drawing PC20013-CIV-2702	No.	1		
TOTAL FOR SECTION 8 CARRIED FORWARD TO SUMMARY									

SECTION:			9		PUMP, CHLORINATION, AND GUARD BUILDING	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					CONCRETE				
9	**1**		**PSG/SABS 1200 G**		**Pump room structure**				
9	1	1	8.4.2		50mm thick 15/19 MPa blinding layer underneath the floor slab.	m^2	113.1		
9	1	2	8.2.5		Smooth narrow width formwork up to 300mm wide for:				
9	1	2.1			Floor slab and footings	m	105.1		
9	1	2.2			First floor slab	m	52.2		
9	1	2.3			Roof slab	m	41.4		
9	1	3	8.2.2		Smooth vertical formwork for the foundation walls	m^2	63		
9	1	4	8.2.2		Smooth horizontal for:				
9	1	4.1			First floor slab	m^2	113		
9	1	4.2			Roof slab	m^2	90		
9	1	5	8.2.6		Form voids in the structure walls for the pipes				
9	1	5.1			Aeration suction pipework through wall	No.	1		
9	1	5.2			Aeration delivery pipework through wall	No.	1		
9	1	5.3			Settling Pond desludge suction pipework through wall	No.	3		
9	1	5.4			Settling Pond desludge delivery pipework through wall	No.	1		
9	1	5.5			1^{st} Existing Pond recovery suction pipework through wall	No.	1		
9	1	5.6			1^{st} Existing Pond recovery delivery pipework through wall	No.	1		
9	1	6	8.3.1		High tensile reinforcing	t	5.910		
9	1	7	8.3.2		High tensile welded mesh ref. 888	m^2	62.8		
9	1	8	8.4.3		Scheduled concrete items:				
9	1	8.1			30/19 MPa for the ground floors and foundation including curing with approved acrylic compound	m^3	33.7		
9	1	8.2			30/19 MPa for the foundation walls including curing with approved acrylic compound	m^3	5.3		
9	1	8.3			30/19 MPa for the first floor including curing with approved acrylic compound	m^3	24.6		
9	1	8.4			30/19 MPa for the roof including curing with approved acrylic compound	m^3	17.5		
9	1	8.5			Layerworks underneath pump room slab and stairs	m^3	30.0		
9	1	8.6			Catchpits	No.	4		
9	**2**		**PSG/SABS 1200 G**		**Stairs**				
9	2	1	8.2.5		Smooth vertical narrow widths up to 300mm wide for risers	m	27.2		
9	2	2	8.2.5		Smooth vertical narrow widths up to 300mm wide for sides of stairs	m	10.0		
9	2	3	8.2.2		Smooth horizontal/inclined formwork for soffit of external stairs	m^2	4.7		
TOTAL CARRIED FORWARD									

SECTION:			9		PUMP, CHLORINATION, AND GUARD BUILDING	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
9	2	4	8.2.2		Smooth horizontal formwork for landing	m^2	2.0		
9	2	5	8.2.2		Smooth vertical formwork for landing columns	m^2	3.0		
9	2	6	8.3.1		High tensile reinforcing	t	0.170		
9	2	7	8.4.3		30/19 MPa concrete for the stairs and columns including curing with approved acrylic compound	m^3	2.2		
			PSXD		**BUILDING**				
9	**3**				**Brickwork**				
9	3	1			Supply, deliver, and install masonry clay bricks, including mortar, brickforce every second course and every course for the top 8 courses, wall ties, and plaster for:				
9	3	1.1			Single skin face brick for external walls (where there is single skin plastered stock brick on inside). Samples must be provided for approval	m^2	246.1		
9	3	1.2			Double skin face brick for external balustrade wall. Samples must be provided for approval	m^2	9.7		
9	3	1.3			Single skin plastered stock brick for internal walls (where there is single skin face brick on outside)	m^2	246.1		
9	3	1.4			Single skin plastered stock brick for internal walls	m^2	34.6		
9	3	1.5			Double skin plastered stock brick for internal walls	m^2	9.6		
9	**4**				**Water proofing**				
9	4	1			Damp proof course	m	90		
9	**5**				**Paint**				
9	5	1			Heavy duty paint for damp environments	m^2	290		
9	**6**				**Furniture**				
9	6	1			Supply, manufacture, deliver, and install furniture complete with all sundries as per drawing PC20013-CIV-3201. Samples must be provided for approval				
9	6	1.1			Saligna office desk, minimum 1.8m wide, with 3 drawers on one side	No.	2		
9	6	1.2			Stackable black office chair with steel square tube frame, armrests, and medium/high density foam	No.	2		
9	6	1.3			Steel storage locker/cabinet with 4 shelves, 2 doors, 1800mm high and 900mm wide	No.	6		
9	**7**				**Kitchen**				
9	7	1			Supply, manufacture, deliver, and install kitchen fittings, built-in furniture, etc. complete with all sundries as per drawing PC20013-CIV-3201. Samples must be provided for approval				
9	7	1.1			Particle board kitchen base cabinet with pine base	No.	2		
9	7	1.2			Double bowl stainless steel sink built into cabinet	No.	2		
9	7	1.3			Fridge with minimum 170ℓ net capacity, top freezer and bottom fridge, minimum class A+ efficiency, and minimum 1-year warranty	No.	2		
TOTAL CARRIED FORWARD									

SECTION:			9		PUMP, CHLORINATION, AND GUARD BUILDING	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
9	7	1.4			Microwave with minimum 30ℓ capacity, minimum 900W rated power, and minimum 1-year warranty	No.	2		
9	**8**				**Bathroom**				
9	8	1			Supply, manufacture, deliver, and install bathroom items, fittings, etc. complete with all sundries as per drawing PC20013-CIV-3201. Samples must be provided for approval				
9	8	1.1			Front flush ceramic toilet with maximum 10ℓ flush capacity and epoxy coated wooden seat	No.	2		
9	8	1.2			Wall mounted ceramic basin with floor pedestal, 2 tap holes, chrome H&C taps with star handles	No.	2		
9	8	1.3			500mm high mirror, wall mounted above the basin	No.	2		
9	8	1.4			Shower with 2m high heavy duty aluminium frame, watertight seal, non-drip design, 4mm toughened safety glass, pivot door, chrome H&C taps with star handles, stainless steel head, and tiling	Sum.	1		
9	8	1.5			Extra-over item 9.8.1.4 to allow for the supply of tiles	m^2	9.6	R 250.00	R 2 400.00
9	8	1.6			600mm chrome towel rail	No.	2		
9	**9**				**Plumbing work**				
9	9	1			Supply, manufacture, deliver, and install plumbing, complete with all sundries for				
9	9	1.1			Externally wall mounted 50ℓ electric geyser with less than 50W/h energy loss and a 5-year warranty	No.	1		
9	9	1.2			H&C pipework for kitchen sinks	No.	2		
9	9	1.3			H&C pipework for bathroom sinks	No.	2		
9	9	1.4			H&C pipework for shower	No.	1		
9	9	1.5			Cold pipework for toilets	No.	2		
9	9	1.6			Drainage pipework for item 9.9.1.1 to 9.9.1.5 with outflow connecting into the Aerobic Pond pipework as per drawing PC20013-CIV-3204	Sum	1		
9	**10**				**Doors**				
9	10	1			Supply, manufacture, and install meranti hardwood exterior door and frame with 5-lever mortice deadlock and marine grade protective coating to manufacturer's specification. Samples must be provided for approval	No.	4		
9	10	2			Supply, manufacture, and install galvanized steel security gate and frame for exterior doors with barrel bolt and waterproof padlock	No.	4		
9	10	3			Supply, manufacture, and install timber internal door and frame with 3-lever mortice deadlock and marine grade protective coating to manufacturer's specification. Samples must be provided for approval	No.	2		
9	10	4			Supply and install roller shutter door for approximately 3x3m opening with minimum 0.8mm thick galvanized slats, internally lockable barrel bolt with padlock, and chain operated spring loaded barrel opening/closing mechanism	No.	2		
TOTAL CARRIED FORWARD									

SECTION:			9		PUMP, CHLORINATION, AND GUARD BUILDING	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
9	**11**				**Windows**				
9	11	1			Supply and install galvanized steel windows with burglar bars, lintels, brick header course and window board, waterproofing, and glazing complete with all sundries as per drawing PC20013-CIV-3202				
9	11	1.1			Industrial type SS21 673x511mm	No.	2		
9	11	1.2			Industrial type SS53 1616x1445mm	No.	4		
9	11	2			Supply and install 800x600mm galvanized steel louvre	No.	8		
9	**12**				**Electricity Installation**				
9	12	1			Supply and install LV electricity wiring and components complete with all sundries as per drawing PC20013-CIV-3201 for the following:				
9	12	1.1			DB (supplied from breaker in pump room MCC)	No.	2		
9	12	1.2			16A double socket outlet	No.	8		
9	12	1.3			Luminaire and switch for 1.5m IP65 vapor proof double LED tube	No.	9		
					STEELWORK				
9	**13**		**SABS 1200 H**		**Handrails**				
9	13	1	8.3.7		Supply and erection of medium duty galvanised handrails and complete with all sundries				
9	13	1.1			Stanchions 1m high Ø43mm x 3mm GMS circular tubing with intersections Ø60mm steel balls at 90°, including 150 x 65 x 8mm GMS baseplate	No.	9	SMME	SMME
9	13	1.2			Stanchions 1m high Ø43mm x 3mm GMS circular tubing with intersections Ø60mm steel balls at 35°, including 150 x 65 x 8mm GMS baseplate	No.	2	SMME	SMME
9	13	1.3			Stanchions 1m high Ø43mm x 3mm GMS circular tubing with intersections Ø60mm steel balls at 40°, including 150 x 65 x 8mm GMS baseplate	No.	4	SMME	SMME
9	13	1.4			Handrails of Ø38mm x 2.5mm GMS circular tubing				
9	13	1.4.1			Straight section, including top and bottom rail	m	14.6	SMME	SMME
9	13	1.4.2			90° short radius bend	No.	4	SMME	SMME
9	13	1.4.3			145° ramp bend	No.	2	SMME	SMME
9	13	1.4.4			140° ramp bend	No.	6	SMME	SMME
9	13	1.4.5			35° closure	No.	1	SMME	SMME
9	13	1.4.6			40° closure	No.	1	SMME	SMME
9	13	1.4.7			Wall end plate	No.	4	SMME	SMME
9	**14**				**Gantry including Pulley**				
9	14	1			Manufacture, supply and erect steel gantry beam complete with supports, brackets and anchor bolts as per drawing PC20013-CIV-3202	Sum	1		
9	14	2			Pulley block tested for load and free travel	Sum	1		
TOTAL CARRIED FORWARD									

SECTION:			9		PUMP, CHLORINATION, AND GUARD BUILDING	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
TOTAL BROUGHT FORWARD									
					PIPES				
9	**15**		**PSL/SABS 1200 L**		**Pipelines**				
9	15	1	8.2.1		Supply, lay, and bed pipes complete with couplings and bends, including flanges and all required fittings etc.				
9	15	1.1			Ø110mm HDPE PN10 for desludge delivery pipework from the Pump room to Anaerobic and Aerobic Ponds	m	147		
9	15	1.2			Ø50mm sleeve HDPE PN10 for Chlorination pipework from the chlorination room to 3rd Existing Pond	m	173		
9	15	1.3			Ø160mm HDPE PN10 recycle suction pipework from 1st Existing Pond to the Pump Room	m	68		
9	15	1.4			Ø110mm HDPE PN10 for recycle delivery pipework from the Pump Room to Anaerobic and Aerobic Ponds	m	170		
9	15	1.5			Ø50mm HDPE PN10 for water pipe to the pump room	m	137		
9	15	1.6			Ø110mm uPVC Class 6 for pump room drain	m	37		
9	**16**		**SABS 1200 L**		**Pipe bends and tees**				
9	16	1	8.2.2 PSXB		Extra-over item 9.15: Supply, lay, and bed, joint, including cut pipes to length where required, test and disinfect.				
9	16	1.1			Ø160mm HDPE PN10 90° buttwelded long radius bend for recycle suction pipework from 1st Existing Pond to the Pump Room	No.	3		
9	16	1.2			Ø110mm HDPE PN10 90° buttwelded long radius bend for desludge and recycle delivery pipework from the Pump Room to Anaerobic and Aerobic Ponds	No.	6		
9	16	1.3			Ø110mm HDPE PN10 tee for desludge and recycle delivery pipework from the Pump Room to Anaerobic and Aerobic Ponds	No.	2		
9	16	2	8.2.11		Grade 25/19 concrete for thrust blocks	m^3	1.7		
9	**17**		**SABS 1200 L**		**Manholes and catchpits**				
9	17	1	8.2.14		Chlorination pipeline manholes as per drawing PC20013-CIV-3204	No.	4		
9	17	2	8.2.14		Catchpit and goosneck as per drawing PC20013-CIV-3201	No.	4		
TOTAL FOR SECTION 9 CARRIED FORWARD TO SUMMARY									

SECTION:			10		FENCE AND ROADS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	LIC	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
					FENCE				
10	**1**		**PSC/SABS 1200 C**		**Perimeter fence**				
10	1	1	8.2.5		Replace damaged existing fence sections to match existing	m	195	SMME	SMME
10	1	2	8.2.5		Take down and dispose existing fence as indicated	m	25	SMME	SMME
10	1	3	8.2.5		Take down existing fence, store safely, and reconstruct as indicated	m	265	SMME	SMME
10	1	4			Supply, deliver, and install new fence to match existing, including all required materials and sundries	m	185	SMME	SMME
10	1	5			Supply, deliver, and install new access gate to match existing, including all required materials and sundries	Sum	1	SMME	SMME
			COTO 2020 DS		**ROAD**				
10	**2**				**Construction of gravel access road to WWTW**				
10	2	1	C5.1.1.2		Preperation of roadbed underneath carriageway and shoulders by rip and recompaction of a 150mm layer of in-situ material to 93 % of MDD	m^3	3 193		
10	2	2	C5.3.2.1		Construction of 150mm lower selected subgrade layers from the relevant WWTW bulk excavations compacted to 93 % of MDD	m^3	7 601		
10	2	3	C5.3.2.1		Construction of 150mm selected gravel wearing course layer from the relevant WWTW bulk excavations compacted to 95 % of MDD	m^3	2 609		
10	2	4	C5.3.2.1		Construction of 150mm selected gravel shoulder layers from the relevant WWTW bulk excavations compacted to 95 % of MDD	m^3	1 146		
10	**3**		**PSG/SABS 1200 G**		**Construction of concrete filled geocell road sections**				
10	3	1			Supply, deliver, and install 100mm thick geocell to the manufacturer's specification	m^2	650		
10	3	2	8.4.3		25/19 MPa concrete to fill the geocell to the manufacturer's specification including curing with approved acrylic compound	m^3	117		
10	3	3	8.4.4		Wood floated unformed surface finish	m^2	650		
			SABS 1200 DM		**STORMWATER DRAINAGE**				
10	**4**				**Channels**				
10	4	1	8.3.15		Construct catchwater channel along roads as per drawing PC20013-CIV-2802	m^3	208		
TOTAL FOR SECTION 10 CARRIED FORWARD TO SUMMARY									

SECTION:			11	DAY WORKS	SCHEDULE OF QUANTITIES			
ITEM			PAYMENT REFERS	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
11	**1**		**SABS 1200 A 8.7/PSA 8.7**	**Personnel during all hours**				
11	1	1		Unskilled labour	hrs	58		
11	1	2		Semi-skilled labour	hrs	58		
11	1	3		Skilled labour	hrs	29		
11	1	4		Supervisor	hrs	29		
11	**2**		**SABS 1200 A 8.7/PSA 8.7**	**Plant equipment**				
11	2	1		Tipper truck (10m³)	hrs	58		
11	2	2		Water truck (10 000 litre)	hrs	58		
11	2	3		Sewer vacuum truck (10 000 litre)	hrs	29		
11	2	4		Tractor loader backhoe	hrs	86		
11	2	5		Excavator (20 tonne)	hrs	29		
11	2	6		Grader (CAT140G) or similar	hrs	29		
11	2	7		Pedestrian roller (Bomag 90)	hrs	58		
11	2	8		Vibrating plate compactor (4kW capacity)	hrs	29		
11	2	9		Mobile air compressor (10m³ / min. capacity)	hrs	58		
11	2	10		Paving breaker, air driven, including all attachments and hoses	hrs	29		
11	2	11		Concrete mixer (0.6m³ capacity)	hrs	58		
11	2	12		Slurry/trash pump (Ø75mm capacity)	hrs	86		
11	2	13		Generator (2.5kVA capacity)	hrs	86		
11	2	14		Angle grinder (1kw capacity)	hrs	29		
11	**3**		**SABS 1200 A 8.7/PSA 8.7**	**Transport**				
11	3	1		LDV	km	4 000		
11	3	2		Flatbed truck (10 tonnes)	km	1 333		
TOTAL FOR SECTION 11 CARRIED FORWARD TO SUMMARY								

PART C3: SPECIFICATIONS

C3.1: Scope of Works

1. DESCRIPTION OF THE WORKS

1.1. Employers Objectives

The Employer's objective is to provide the communities of Nolukhanyo and Freestone with a safe, reliable, and sustainable waterborne sewer system, thereby improving public health, environmental protection, and quality of life. This will be achieved through the refurbishment and expansion of the existing wastewater treatment works (WWTW).

The Works in this Contract are to be executed in a manner that promotes labour-intensive construction methods where practical and feasible, with the intention of creating local employment opportunities. The temporary employment of local residents will be in accordance with the project specification and in line with the Ndlambe Local Municipality's development goals.

Furthermore, it is essential that local residents are trained and capacitated with the technical skills required for the operation and maintenance of the sewerage infrastructure after commissioning. This ensures that the scheme will remain functional, efficient, and sustainable in the long term.

The onus of quality will rest with the Contractor, who shall be responsible for ensuring that all works meet the specified standards, statutory requirements, and professional engineering practices.

1.2. Overview of the Works

The extended project Works involve the refurbishment and expansion of the Bathurst wastewater treatment works, construction of new sewer ponds for reticulation networks, and connection of all Nolukhanyo and Freestone households to a sustainable bulk sewer system.

1.3. Extent of Works

a) Background

The Ndlambe Local Municipality currently faces challenges with respect to the sustainable provision of sanitation services. The WWTW capacity must be upgraded to accommodate current and future demand, including the addition of unconnected households under the extended project.

b) Scope Development

In summary, the scope has been confirmed as per the table hereunder:

Scope of Work – Upgrade of WWTW (1 050 kℓ Capacity)	
Scope Components	**Description**
Site	Site establishment and site clearance.
Earthworks	Bulk excavation for platform and structures. Restricted excavation for minor structures.
Inlet alterations	Partial demolition, construction of new canals, and mechanical installations.
Anaerobic Ponds	Construct new ponds and ancillaries (pipework, subsoil drainage, sumps, etc.)
Aerobic pond	Construct new pond and ancillaries (HDPE liners, pipework, subsoil drainage, etc..)
Settling pond	Construct new pond and ancillaries (pipework, subsoil drainage, sumps, etc.)
Drying beds	Construct new drying beds and ancillaries (HDPE liners, pipework, sumps, etc.)
Refurbish existing ponds	Emptying existing ponds, removing sludge, and repairing as needed.
New building (pump, chlorination, guard, office, and lab)	Construct new building and install ancillaries (plumbing, furniture, pipework, mechanical, and electrical.)

Pipelines	Install pipelines, ancillary structures, and fittings for potable water, sewer, de-sludging, aeration, chlorination, recycling, and recovery.
Access and internal roads	Upgrade the existing access road and construct internal roads.
Fencing	Demolition, refurbishment, supply and erection of perimeter fencing and gates.
Canals	Construction of required canals.
Mechanical works	Supply, installation, and commissioning of mechanical works.
Electrical works	Supply, installation, and commissioning of Electrical works.
ESKOM connection	Construct a new medium voltage overhead line and step-down transformer to connect WWTW.

c) Deliverables

As a summary of the background presented above, the main deliverables of the Upgrade of Bathurst Bulk Sewer: Wastewater Treatment Works are as follows:

- Upgrade of WWTW to handle current and future demand, with a 1 050 kℓ capacity.
- Construction of new ponds and structures.
- Installation of mechanical and electrical infrastructure.
- ESKOM connection.
- Road upgrade and construction of new internal roads.
- Refurbishment and construction of new fencing.

1.4. Temporary Works

The Contractor is responsible for the design, construction/erection, inspection, and maintenance of all Temporary Works.

No major Temporary Works is expected for the completion of the Works. Minor Temporary Works (scaffold and formwork) may be required.

1.5. Material Sources and Spoil Areas

- Backfill material will be obtained from designated excavations or commercial sources and stockpiled to the designated stockpiles.
- Bedding and padding material will be obtained from designated excavations or commercial sources and stockpiled.
- Excess material will be stockpiled to the designated stockpiles.
- All other material will be sourced from commercial sources. The Contractor shall submit samples from the sources indicated in his tender to an independent laboratory for testing to ensure compliance with the requirements of the specification.
- The Contractor will need to identify, in conjunction with the local authorities and to the approval of the Employer's Agent, suitable spoil sites.

1.6. Local Labour

A portion of the Works, as identified in the Bill of Quantities in the column named LIC, is to be done via labour intensive methods using local labour. Labour reports must be submitted monthly indicating all local labour used on the project, including for Sub-contractors, in the EPWP format.

2. PROGRAMME

2.1. General Programme

The duration of the Contract is as indicated in the Contract Data. The Contractor is to ensure that he prices accordingly in the Bill of Quantities.

The Contractor will be required to liaise with the local Ward Committee concerning the programming of the Works.

2.2. Submitted Programme

The Contractor's programme shall be in a bar chart form and shall be submitted within 28 days of the Commencement Date. In addition to the requirements of Clause 5.6.1 GCC 2015, the Contractor's programme shall show:

a) The various activities, related to a time scale, for each element of the Works, including allowance for Nominated Subcontractors, in sufficient detail to be able to assess construction progress,
b) Critical path activities and their dependencies,
c) Key dates in respect of work to be carried out by others,
d) Key dates in respect of information to be provided by the Employer's Agent and/or others,
e) Management, Site staff and labour allocated to the project for various stages.

In addition to the requirements of Clause 5.6.2 GCC 2015, the Contractor shall submit with his programme, a copy of any network diagram used in producing the programme.

If any change to the critical path occurs, the Contractor shall as soon as practicable notify the Employer's Agent in writing.

The Contractor's programme and method statement will not be accepted as the basis for claims for additional compensation without due reference to all relevant associated factors.

2.3. General Allowances

When drawing up his programme, the Contractor shall, take into consideration and make allowance for, inter alia:

a) Expected weather conditions and their effects;
b) Known physical conditions or artificial obstructions;
c) Searching for, dealing with and carrying out alterations to any existing services;
d) The accommodation and safeguarding of access and traffic;
e) The provision and implementation of the health and safety plan in terms of the Construction Regulations, 2014 of the Occupational Health and Safety Act;
f) The restrictions on the length of trench open at any one time;
g) The design, testing and approval of the concrete mixes; and
h) Allowance for response time as per the GCC2015.

2.4. Review of Progress

The Contractor shall review his progress every month, or as otherwise required by the Employer's Agent, and should progress lag behind the latest accepted programme, by more than two weeks, he shall submit a revised programme and method statement of how he proposes to make up the lost time. If, in the opinion of the Employer's Agent, such revised programme will not make up the lost time, the Employer's Agent shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable programme. Claims for additional payment to meet any costs incurred due to such reorganisation will not be accepted.

C3.2: General Specifications

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FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C3.2 - GENERAL SPECIFICATIONS

Contents

1 GENERAL 2
2 CHARACTERS OF STRATA AND MATERIALS ON SITE 2
3 ENGINEERING 2
4 CONSTRUCTION 3
5 DETAILS OF PLANTS AND SUPERVISORY STAFF 4
6 THE WORKING DAY 4
7 SITE FACILITIES AVAILABLE 5
8 SITE FACILITIES REQUIRED 5
9 ADDITIONAL REQUIREMENTS AND CONSTRAINTS 6
10 LABOUR INTENSIVE WORK 6
11 FEATURES REQUIRING SPECIAL ATTENTION 6
12 EXTENSION OF TIME RESULTING FROM ABNORMAL RAINFALL 7

NOTE

Whenever reference is made to the Contractor, it also applies to the Subcontractor.

1 GENERAL

The Standardised Specifications listed below are applicable to the contract. It shall however be noted that reference is made in certain of the specifications to other standardised specifications which may or may not be included in the list below. Where such specifications are not included, they shall however be deemed to be included in the contract documents.

South African Bureau of Standards, Standardized Specifications for Civil Engineering Construction. SABS/SANS 1200 series, specifically:

- SABS/SANS 1200 A – General
- SABS/SANS 1200 AB – Employer's Agent's Office
- SABS/SANS 1200 C – Site Clearing
- SABS/SANS 1200 D – Earthworks
- SABS/SANS 1200 DA – Earthworks (Small works)
- SABS/SANS 1200 DB – Earthworks (Pipe trenches)
- SABS/SANS 1200 DM – Earthworks (Roads, Subgrade)
- SABS/SANS 1200 G – Concrete
- SABS/SANS 1200 GA – Concrete (Small works)
- SABS/SANS 1200 H – Structural Steelwork
- SABS/SANS 1200 HA – Structural Steelwork (Sundry Items)
- SABS/SANS 1200 HC – Corrosion Protection of Structural Steelwork
- SABS/SANS 1200 L – Medium Pressure Pipelines
- SABS/SANS 1200 LB – Bedding (pipes)
- SABS/SANS 1200 LE – Stormwater Drainage

The Contractor shall have available for reference on site at all times a full set of the above specifications, together with any other to which they refer.

These specifications shall remain the property of the Contractor but shall be made available to the Employer's Agent whenever required throughout the duration of the contract.

Project specific variations to these standardized specifications are included as Scope of Work. In the event of any discrepancy with a part or parts of the standard specifications, the bill of quantities or the drawings, the project specifications described in Scope of Work shall take precedence.

2 CHARACTERS OF STRATA AND MATERIALS ON SITE

The Contractor will be held to have satisfied himself as to the subsurface conditions to be encountered and to have allowed accordingly in his tendered rates.

3 ENGINEERING

3.1 Design Services and Activity Matrix

Design Item / Level of Design	Party Responsible for Design/Supply of drawings
Up to details design and working drawings of all elements not detailed below	Employer
All Temporary works	Contractor
Undertake Scope of Works	Contractor
Record Drawings	Contractor

3.2 Drawings

3.2.1 General

The tender drawings that form part of the tender documents shall be used for tender purposes only. These drawings are bound at the back of this tender document. The drawings form an integral part of the tender and must be included in the tender to be submitted.

The Contractor will be supplied with three copies of each of the construction drawings. These drawings are issued free of charge, and the Contractor shall make any additional prints he may require at his own cost. The true positions (coordinated), invert levels and ground levels of all services shall be indicated on the drawings, for which purpose the Contractor shall receive a separate complete set of drawings from the Employer's Agent, at no cost.

As the work progresses, the Contractor shall keep full records of all amendments to and deviations from the drawings as issued to the Contractor at the start of the contract. This information must be submitted monthly by the Contractor with his payment certificate, to the Employer's Agent.

The Completion Certificate shall only be issued after the Employer's Agent has received a properly completed set of "as-built" drawings from the Contractor. No separate payment shall be made for this service as all costs related thereto shall be deemed to be included in the related items.

The levels on drawings are subject to confirmation on site, and the Contractor shall submit all levels to the Employer's Agent for conformation before he commences construction.

Only figured dimensions shall be used, and drawings shall not be scaled unless so instructed by the Employer's Agent. The Employer's Agent will supply all figured dimensions omitted from the drawings.

3.2.2 Drawing to be Provided by the Contractor

All drawings that are to be provided by the Contractor will be provided on paper and in electronic format in DXF or AutoCAD format. Drawings are to be metric. All electronic drawings will be in 1:1 scale and spatially co-ordinated.

Any information in the possession of the Contractor, which is requested by the Employer's Agent's Representative for record purposes, must be submitted to the Employer's Agent's Representative before a completion certificate will be issued.

3.2.3 Drawing to be Provided by the Employer

The Contractor is to only keep in his possession the latest revision of construction drawings. When revisions are issued to the Contractor, **previous revisions shall be handed to the Employer's Agent.** This is the responsibility of the Contractor.

4 CONSTRUCTION

4.1 Material Compliance with SABS/SANS Requirements

Where materials to be used in the works are required to comply with a SABS/SANS specification, they will be accepted as complying with the SABS/SANS specification if one of the following is satisfied.

- The display of a SABS/SANS mark on the product with a copy of the SABS/SANS certificate that allows the manufacturer to use the mark, or
- All the criteria in the relevant SABS/SANS specification are measured and confirmed on site or in an approved laboratory.

The same will apply to materials specified to comply with ISO, BS, ASTM, or other international specifications.

4.2 Existing Service

The Contractor shall so carry out all his operations as not to encroach on, or interfere with, trespass on, or damage adjoining lands, buildings, properties, road structures, pipelines,

places and things, in the vicinity of the Works and so not to interfere in any way with the smooth and continuous operation of the existing facilities.

The Contractor's attention is drawn to the fact that information regarding any existing services given on the plans or in the documents is given in good faith and without guarantee. Provision is made in the Schedule of Quantities for the location of existing services.

4.3 Site Establishment

Services Provided by the Employer

The Employer will not provide any services to the site during construction.

Facilities Provided by the Contractor

The Contractor is to provide the necessary offices, workshops, and services as required in SABS/SANS 1200A.

The Contractor shall make his own arrangements regarding the establishment of a campsite and housing for his construction personnel. The location and standard of the Contractor's camp, offices, accommodation, ablution, and other facilities shall comply with the requirements of the authorities and local communities concerned. No residential accommodation on site will be allowed. Details of the Contractor's proposals for these facilities shall be submitted to the Employer's Agent for approval prior to their erection. All regulations stipulated by the local authorities concerned must be adhered to.

4.4 Permits and Wayleaves

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

4.5 Water for the Works

The Contractor will make his own arrangements with regard to obtaining water for construction, and the cost of dewatering unless otherwise itemised in the Schedule of Quantities shall be deemed to be included in the tender price.

Under no circumstances shall water be abstracted from the existing wastewater treatment process units, pipelines, or reservoirs on site.

4.6 Survey Control and Settings

A system of benchmarks has been established on site. The coordinates and locations are indicated on the drawings.

5 DETAILS OF PLANTS AND SUPERVISORY STAFF

Within the time stipulated in the Contract Data, the Contractor shall provide the Employer's Agent with:

a) A list of plant to be used on the Contract together with the year of manufacture, power output, and registration number of such plant; and

b) A list detailing the supervision to be used by the Contractor. The list shall provide the title of the supervisors (e.g. foreman, assistant foreman, etc.) and the number of persons on Site with these titles.

The Employer's Agent reserves the right to request changes to the programme of Work, and to request variations in the plant and labour complements on Site. The Employer's Agent further has the prerogative to inspect the plant the Contractor proposes for ratification.

6 THE WORKING DAY

For the purpose of this contract, a "working day" is defined as being 9 hours in length (excluding any breaks for meals or machine servicing) on Monday to Friday, excluding public holidays. Work shall take place during daylight hours only.

7 SITE FACILITIES AVAILABLE

7.1 Water and Power Supply and Other Services

The Contractor shall make his own arrangements for obtaining water, power and other services. The Contractor must also be able to provide water required for testing the pipelines at his own cost.

7.2 Camps and Depot

The Contractor may erect his site storage depot within the boundaries of the area indicated by the Employer's Agent only after consultation with the local community.

No housing is available, and the Contractor shall make his own arrangements to house his employees and transport them to and from the Site. All arrangements for housing workmen shall be made in accordance with and subject to applicable regulations and requirements.

The Contractor will be permitted to locate structures which he may require anywhere on site provided permission is obtained through the PSC and from the relevant community. Temporary buildings and fencing are to be neat and presentable, and the surrounding areas must at all times be kept in a neat, clean and in an orderly condition.

The Contractor must not cut down or damage any trees nor make any excavations without the written permission of the Employer's Agent and will be required to restore the site to its original condition on completion of the Works.

All buildings and latrines shall be in accordance with the local authority and national health regulations and shall be kept in a clean, sanitary condition to satisfaction of the Employer's Agent.

7.3 Disposal Sites

The Contractor shall locate suitable sites, off-site, for the disposal of cleared vegetation, rubble, unsuitable material, or surplus material. The Contractor shall inform the Employer's Agent of any site he proposes to use. Site are to be approved by the Employer.

8 SITE FACILITIES REQUIRED

8.1 Employer's Agent's Office

The Contractor shall provide, maintain and service, for the exclusive use of the Employer's Agent, facilities as specified in SANS 1200 AB and a suitably sized furnished building to have site meetings. The office and meeting room is to be airconditioned. A minimum of 2 x 220V plug points are to be provided.

The term "use of the Employer's Agent" will be deemed to include, as appropriate, for the exclusive use by the Employer's Agent's staff and the Employer's Agent's Representative and his staff.

The Contractor shall provide and maintain on Site for the use of the Employer's Agent's Representative and adequate supply of coffee, tea, sugar, gas, potable water, toilet soap, towels, toilet rolls and cleaning materials.

The site office shall be placed on level ground or safety levelled. Should no power be available, the Contractor shall make provision for sufficient power to operate items listed above on a daily basis.

All windows shall be fitted with blinds and mesh burglar proofing covering the total glassed area. The office must be able to be locked securely.

The Contractor shall insure the equipment against any loss, damage or theft and shall indemnify the Employer's Agent against any claims in this regard.

8.2 Laboratory Facilities

No testing laboratory is required on-site for use by the Employer's Agent.

8.3 Sanitary Facilities

All latrines shall conform to the requirement of the Local Authority. All sanitary fees and charges due under the Local Authority or State Health Regulations for bylaws shall be paid by the Contractor. Throughout the progress of the Contract, all latrines shall be maintained

by the Contractor in a clean sanitary condition to the satisfaction of the Employer's Agent. Sanitary facilities shall be placed at least 100m away from natural water courses or as approved by the Employer's Agent.

The Contractor shall be responsible for disposal of refuse and waste generated by his staff on a daily basis at a site approved by the local authority and the Employer's Agent. The site is to be kept clean, neat, and tidy, to the Employer's Agent's satisfaction.

8.4 Nameboard

The Contractor will be required to erect two nameboards as per the specifications and details on the drawing attached to this document. The Contractor will be allowed to remove the nameboard after a final completion certificate has been submitted by the Employer's Agent.

Payment would be made on the basis of 80% when the Nameboard has been erected to the Employer's Agent's satisfaction and the remaining 20% would be paid in the final certificate.

Two nameboards would be required for this Contract. The placement of the nameboards shall be as specified by the Employer's Agent on site. The nameboards must be erected within 2 weeks of site establishment.

9 ADDITIONAL REQUIREMENTS AND CONSTRAINTS

9.1 Health and Safety Requirements

As per Clause 5(1) (a) of the Construction Regulations (2014) a Health and Safety Specification is included in this Contract. The Contractor will take the requirements of this specification into account during the tendering and execution of the works.

Furthermore, any reference to the "Machinery and Occupational Safety Act" in any specification shall be replaced with reference to the "Occupational Health and Safety Act, 1993".

9.2 Environmental Management Requirements

The Contractor will be responsible for implementing and managing an Environmental Management Plan. Refer to Particular Specification, which defines the roles and responsibilities of various members of the Contractor's staff in terms on the Environmental Management Plan.

9.3 Traffic Accommodation

Interruptions to traffic on public roads will be kept to a minimum and where interruptions are unavoidable, they will be done with the full complement of warning signs as required by the Road Traffic Sign Manual.

10 LABOUR INTENSIVE WORK

Refer to Labour Intensive Construction Specification.

11 FEATURES REQUIRING SPECIAL ATTENTION

11.1 Blasting

In the event that blasting is necessary in the construction of the Works, the Contractor shall satisfy the Employer's Agent that his proposed blasting methods and controls are such that no damage will be caused to any adjoining structures, pipelines or services.

11.2 Length of Open Trenches

The rising main and reticulation pipelines either traverse open ground or run parallel to existing gravel roads. The Contractor must ensure that all open excavations are adequately protected to prevent persons and/or animals falling into holes and/or trenches.

Except with written permission of the Employer's Agent, the length of open trench along any section of pipeline, in advance of pipe laying operations, shall at no time exceed 400m.

Special precautions and provisions must be made to maintain accesses to any public meeting place, private residences, schools, or marketplace.

11.3 Liaison with Community and Property Owners

Refer to Labour and Community Specification.

11.4 Assistance with Training

The Contractor is expected to provide the skills training of the local labour as required to ensure the Works are constructed to the required quality and specifications. The Contractor is at liberty to determine the extent of the training required and the most appropriate training methods.

Should it be found that an individual or a group, assigned for specific tasks that will require training, does not have sufficient aptitude for the requirements of the work, the Contractor must advise the Labour Officer that in his opinion training of the individual or group for the specific task will not be cost effective. The Labour Officer should attempt to recruit labour with the aptitude for the Work.

The Cost of construction skills training must be included in the tendered rates for the work and no separate payments will be made in this regard.

Also refer to the SMME, Labour and Training specifications.

12 EXTENSIONS OF TIME RESULTING FROM ABNORMAL RAINFALL

Any delays caused by rainfall shall be determined in terms of one of the three methods given below. The applicable method for a particular contract shall be specified in the Contract Documentation. The rainfall delay determined by using the specified method shall entitle the Contractor to an equivalent extension of the time for completion without the need for formal claim procedures.

Any other delays caused by exceptionally adverse weather conditions that have not already been taken into account as specified above shall be dealt with in accordance with the applicable Conditions of Contract.

The Contractor shall take cognisance of all the temperature, wind speed, moisture content and curing related limitations and/or restrictions that are applicable to some items of the Works as specified in the relevant clauses of this Standard Specification. No extensions of time will be measured or granted for any delays caused by the Contractor's compliance with these limitations and/or restrictions

Method 1(Rainfall formula)

If specified in the Contract Documentation the formula below shall be used to calculate separately the delay for each calendar month or part thereof due to rainfall. It shall be calculated each month during the period referred to in the Conditions of Contract as the time for completion of the Works (including any extension thereof that may have been granted), or until the issue date of the Taking-over Certificate, whichever is the shorter period. The delay calculated for a given month shall be used to determine the interim extension of time granted for that month. At the end of the applicable period referred to above, the aggregate of the monthly delays will be taken into account for the final determination of the total extension of time for the Contract. Such determination will not be subject to normal claim procedures

$$V = (Nw - Nn) + \frac{(Rw - Rn)}{X}$$

Where:

V = Extension of time in calendar days for the calendar month under consideration.

Nw = Actual number of days during the month on which rainfall of Y mm or more has been recorded.

Nn = Average number of days in the same month, based on historical rainfall records (as stated in the Project Data), on which rainfall of Y mm or more has been recorded.

Rw = Actual average rainfall (mm) recorded for the calendar month under consideration.

Rn = Average rainfall (mm) recorded for the calendar month, based on historical rainfall records.

X = Conversion factor for rainfall excess into calendar days, as defined in the Project Data. Otherwise can be taken as 20 if not specified.

Y = 10, unless specified otherwise in the Contract Documentation.

a) An extension of time due to adverse climatic conditions will only be considered where the conditions experienced on Site exceed normal climatic conditions applicable to the project location. Abnormal rainfall or wet conditions shall be assessed monthly or for part of a month in accordance with Method 1 prescribed in COTO Clause A1.2.3.4 and calculated using the following formula above.

b) The Contractor shall, at his own cost, provide and maintain on the Site, at a location approved by the Employer's Representative, an approved Rain gauge. The gauge shall be fenced to prevent interference, and readings shall be taken daily, recorded in a separate record book, signed by the person taking the reading, and emptied after each reading. The Employer's Representative may witness the readings if required.

c) The extent of any extension of time granted in respect of wet climatic conditions shall be determined as the algebraic sum of the "V" values for each month between the Commencement Date and the Due Completion Date of the contract, calculated in accordance with Method 1 of COTO Clause A1.2.3. provided that:

   (i) rainfall during the Contractor's Christmas shut-down period shall not be included;

   (ii) rainfall during periods where delays are due to reasons other than wet climatic conditions shall not be included;

   (iii) if algebraic sum of "V" values in negative, the time for completion shall not be reduced on account of subnormal rainfall; and

   (iv) for partial months, "V" values shall be calculated pro-rata using Nn and Rn.

d) The Employer's Representative shall, when granting any extension of time under this clause, revise the Due Completion Date to reflect the algebraic sum of all "V" values for all proceedings months, less the aggregate of Nn values for remaining unexpired months (i.e., maximum potential negative V values) if this period is negative, the Due Completion Date shall not be reduced.

Method 2 (Critical path method with consequential delays)

Where the critical path method with consequential delays is specified in the Contract Documentation for determining the extension of time resulting from rainfall, it shall be applied as follows:

A delay caused by rainfall conditions will be regarded as a delay only if all progress on an item or items of work on the critical path of the Contractor's programme has been brought to a halt for part of a day or a full day. Delays on programmed and actually planned working days only will be taken into account for the extension of time. Each day, or portion of a day so agreed will accrue as 'n' days of delay over the duration of the contract. The summary of accrued agreed 'n' delays shall be recorded at each site meeting.

The Contractor shall make provision in the programme of work for an expected delay of "N" working days caused by predictable normal rainy weather, for which the Contractor will not receive any extension of time. The value of "N" shall be given in the Contract Documentation.

Extension of time for rainfall delays which occurred during working days will be granted to the degree to which the agreed cumulative actual delays, in full or part of working days as defined above, exceed the cumulative number of "N" workings days as mentioned in the Contract Documentation, during the contract period up to the issue of the Taking-over Certificate. Extension of time for rainfall shall apply in addition to any approved contract extension of time due to other causes.

This method does not take into account any flood damage, which could cause further or concurrent delays and which should be treated separately in so far as extension of time is concerned. It also does not deal with other types of weather which may cause delays, for instance snowfalls, abnormally strong wind and extreme temperatures. All such delays shall be dealt with separately in accordance with the terms of the

Conditions of Contract.

If a delay due to wet conditions is caused by, or exacerbated by, the lack of adequate temporary drainage measures, such a delay shall not be taken into account in the calculation of any extension of time.

Any delay due to rainfall will only be recognized and granted to the extent that the delay could not be mitigated by changing work sequences. The delay shall be applied to the contract duration after any other caused and approved contract extensions of time have been applied. The total delay caused by rainfall shall not exceed the duration past the issue of the Taking-over Certificate.

Method 3 (Critical path method without consequential delays)

Where the critical path method without consequential delays is specified in the Contract Documentation for determining the extension of time resulting from rainfall, it shall be applied as follows:

Delays caused by rainfall may be considered as extension to the time for completion only if the Engineer agrees that the event (and not the consequence of the event) occurred during the working day within the contract period and caused all progress on an item or items of work on the critical path of the Contractor's programme brought to a halt. Each day, or portion of a day so agreed will accrue as 'n' days of delay over the duration of the contract. The summary of accrued agreed 'n' delays, which exclude any consequential delays as stated below, shall be recorded at each site meeting.

No limitation is placed on the quantity, severity or duration of the rainfall event as being the cause of delay. Expressly excluded from the measurement of 'n' days are consequential delays, which are taken to mean delays to critical path activities attributable to the rainfall event but occurring after (i.e. outside of and distinctly separate from) the duration of the rainfall event itself.

The Contractor shall make provision in the Contractor's programme of work for expected "N" working days caused by rainfall. This provision shall be shown as a terminal float on the Contractor's programme. The value of "N" shall be given in the Contract Documentation.

Any extension to the time for completion caused by rainfall delays will only be considered once the agreed cumulative 'n' delays during the contract period up to the issue of the Taking-over Certificate exceed "N" working days. Extension of time for rainfall shall apply in addition to any approved contract extension of time due to other causes.

This method does not take into account any flood damage, which could cause further or concurrent delays and which should be treated separately in so far as extension of time is concerned. It also does not deal with other types of weather which may cause delays, for instance snowfalls, abnormally strong wind and extreme temperatures. All such delays shall be dealt with separately in accordance with the terms of the Conditions of Contract.

The delay shall be applied to the contract duration after any other approved contract extensions of time have been applied. The total delay caused by rainfall shall not exceed the duration past the issue of the Taking-over Certificate.

Any extension of time granted under this clause does not include delays for repair or reinstatement of Works damaged by abnormal climatic conditions, which shall be applied for separately in accordance with Clauses 5.12 and 10 of the Conditions of Contract.

C3.3: Particular Specifications

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C.3.3.1: Particular specifications (Civil)

Contents

PSA GENERAL 3

PSA 1 SCOPE 3
PSA 2 INTERPRETATIONS 3
PSA 3 MATERIALS 4
PSA 4 PLANT 4
PSA 5 CONSTRUCTION 5
PSA 6 TOLERANCES 11
PSA 7 TESTING 11
PSA 8 MEASUREMENT AND PAYMENT 12

PSAB EMPLOYER'S AGENT'S OFFICE 16

PSAB 3 MATERIALS 16
PSAB 5 CONSTRUCTION 17
PSAB 8 MEASUREMENT AND PAYMENT 17

PSC SITE CLEARANCE 18

PSC 3 MATERIALS 18
PSC 5 CONSTRUCTION 18
PSC 8 MEASUREMENT AND PAYMENT 18

PSD EARTHWORKS 19

PSD 2 INTERPRETATIONS 19
PSD 3 MATERIALS 19
PSD 4 PLANT 20
PSD 5 CONSTRUCTION 21
PSD 6 TOLERANCES 24
PSD 7 TESTING 25
PSD 8 MEASUREMENT AND PAYMENT 25

PSDM EARTHWORKS (ROADS, SUBGRADE) 26

PSDM 3 MATERIALS 26
PSDM 5 CONSTRUCTION 26
PSDM 7 TESTING 28
PSDM 8 MEASUREMENT AND PAYMENT 28

PSG CONCRETE (STRUCTURAL) 28

PSG 2 INTERPRETATIONS 28
PSG 3 MATERIALS 28
PSG 4 PLANT 32
PSG 5 CONSTRUCTION 33
PSG 6 TOLERANCES 42
PSG 7 TESTS 42
PSG 8 MEASUREMENT AND PAYMENT 42

PSHC CORROSION PROTECTION OF STRUCTURAL STEEL. (SANS 1200 HC) 45

PSCH 5 CONSTRUCTION 45
PSHC 7 TESTING 45

PSL MEDIUM PRESSURE PIPELINES 45

PSL 1 SCOPE 45
PSL 3 MATERIALS 45
PSL 5 CONSTRUCTION 48
PSL 6 TOLERANCES 50
PSL 7 TESTING 50
PSL 8 MEASUREMENT AND PAYMENT 51

PSLB BEDDING (PIPES) 52

PSLB 2 INTERPRETATIONS 52
PSLB 3 MATERIALS 52
PSLB 4 PLANT 52
PXA.1 PSLB 5 CONSTRUCTION 53
PSLB 7 TESTING 53
PXA.2 PSLB 8 MEASUREMENT AND PAYMENT 53

PSLK VALVE INSTALLATIONS (SPEC LK) 54

PSLK 3 MATERIALS 54

NOTE

In certain clauses the general 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 Particular Specifications – Construction Works. It also contains some additional specifications required for this particular contract.

The number of each clause in this part of the project specifications consists of the prefix PS followed by a letter corresponding to the part of SABS/SANS 1200 being changed and a number corresponding to the number of the relevant clause in the general specifications.

The number of a new clause which does not form part of a clause in the standard specifications, and which is included herein, is also prefixed by PS followed by a letter corresponding to the part of SABS/SANS 1200 being added, followed by a new number. The new numbers follow on the last clause number used in the relevant section of the standard specifications.

PSA GENERAL

PSA 1 SCOPE

REPLACE THE CONTENTS OF SUBCLAUSE 1.1, INCLUDING THE NOTES, WITH THE FOLLOWING:

"1.1 This specification covers requirements, principles and responsibilities of a general nature which are generally applicable to civil engineering construction and building works contracts, as well as the requirements for the Contractor's establishment on the Site."

PSA 2 INTERPRETATIONS

PSA2.2 Applicable edition of standards

ADD THE FOLLOWING AT THE BEGINNING OF SUBCLAUSE 2.2:

"Unless a specific edition is specified (see the List of Applicable Specifications), ..."

PSA 2.3 Definitions

IN THE OPENING PHRASE BETWEEN THE WORDS "specification" AND "the following", INSERT THE WORDS "the definitions given in the Conditions of Contract and".

(a) General

ADD THE FOLLOWING DEFINITIONS:

" 'General Conditions' and 'Conditions of Contract': The General Conditions of Contract specified for use with this Contract, together with the Particular Conditions of Contract as applicable.

'Specified': As specified in the Standardized Specifications, the Drawings or the Project Specifications. 'Specifications' shall have the corresponding meaning."

(c) Measurement and payment

REPLACE THE DEFINITIONS FOR "Fixed charge", "Time-related charge" AND "Value-related charge" WITH THE FOLLOWING:

" 'Fixed charge': A charge that is not subject to adjustment on account of variations in the value of the Contract Price or the time allowed in the Contract for the completion of the work.

'Time-related charge': A charge, the amount of which varies in accordance with the Time for Completion of the Works, adjusted in accordance with the provisions of the Contract.

'Value-related charge': A charge, the amount of which varies pro rata with the final value of the measured work executed and valued in accordance with the provisions of the Contract."

PSA 2.4 Abbreviations

(a) Abbreviations relating to standard documents

ADD THE FOLLOWING ABBREVIATION:

"CKS: SABS Co-ordinating Specification."

ADD THE FOLLOWING TO SUBCLAUSE 2.4(b):

"MAMDD: Modified AASHTO maximum dry density".

Except for references to "the (official) SABS mark", the term "SABS" shall mean "SANS".

PSA 2.8 Items in bill of quantity

PSA 2.8.1 Principle

In the fourth line of Subclause 2.8.1, after the word "specification", add: "or in the measurement and payment clause of the standard specification, particular specification or Specification Data".

PSA 3 MATERIALS

PSA 3.1 Quality

ADD THE FOLLOWING AT THE END OF SUBCLAUSE 3.1:

"All manufactured materials supplied shall be new materials unless the contrary is specified. All materials specified to be in accordance with SABS Specifications shall bear the SABS mark, where such a mark is available for the type of product.

Where proprietary materials are specified it is to indicate the quality or type of materials or articles required, and where the terms “or other approved” or “or approved equivalent” are used in connection with proprietary materials or articles, it is to be understood that the approval shall be at the sole discretion of the Employer’s Agent."

ADD THE FOLLOWING SUBCLAUSE TO CLAUSE 3:

PSA 3.3 Ordering of materials

The quantities set out in the Bill of Quantities have been carefully determined from calculations based on data available at the time of its compilation, but are to be considered as approximate quantities only. Before ordering materials of any kind the Contractor shall be solely responsible for determining, from the drawings issued or approved by the Employer’s Agent for construction purposes, the actual quantities of materials required for the execution of the Works. No liability or responsibility whatsoever shall be attached to the Employer or the Employer’s Agent in respect of materials ordered by the Contractor except when ordered in accordance with the drawings issued or approved by the Employer’s Agent for construction purposes.”

PSA 4 PLANT

PSA 4.1 Silencing of plant

REPLACE THE CONTENTS OF SUBCLAUSE 4.1 WITH THE FOLLOWING:

"The Contractor's attention is drawn to the applicable regulations pertaining to noise and hearing conservation, framed under the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) as amended.

The Contractor shall at all times and at his own cost, be responsible for implementing all necessary steps to ensure full compliance with such regulations, including but not restricted to the provision and use of suitable and effective silencing devices for pneumatic tools and other plant which would otherwise cause a noise level in excess of that specified in the said regulations.

Where appropriate, the Contractor shall further, by means of temporary barriers, effectively isolate the source of such noise in order to comply with the said regulations."

PSA 4.2 Contractor's offices, stores and services

ADD THE FOLLOWING PARAGRAPH BEFORE THE EXISTING FIRST PARAGRAPH IN SUBCLAUSE 4.2:

"The Contractor buildings, sheds and other facilities erected or utilised on the Site for the purposes of the Contract shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. as may be required by the Contractor. The facilities shall always be kept in a neat and orderly condition.

No personnel may reside on the Site. Only night-watchmen may be on the Site after hours."

ADD THE FOLLOWING IN THE SECOND PARAGRAPH OF SUBCLAUSE 4.2:

"The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, toilets for workmen as specified, 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 suitable sanitary services shall be of the bucket or chemical type and shall be readily accessible to workers at all areas of the site.

The Contractor shall make all the necessary arrangements with the relevant local authority for the disposal of the contents of the toilets on a regular basis.

The suitable first aid services required in terms of Subclause 4.2 of SANS 1200 A shall include, inter alia, a First Aid cabinet fully equipped and maintained with at least the minimum contents as listed in the Annexure (Regulation 3) to the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), to deal with accidents and ailments which are likely to occur during the construction period.

The Contractor shall provide personal safety equipment and facilities as required by Regulation 2 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

ADD THE FOLLOWING SUBCLAUSE TO CLAUSE 4:

PSA 4.3 Restriction on the use of plant

Except for the type of plant, and to the extent permitted in terms of the Specification Data or approved by the Employer's Agent, the Contractor shall use only hand tools and equipment in the construction of the Works, or portion(s) of the Works, that are required in terms of the Specification Data to be constructed using labour intensive methods.

PSA 5 CONSTRUCTION

PSA 5.1 Survey

PSA 5.1.1 Setting out of the Works

ADD THE FOLLOWING PARAGRAPH:

"From the installed benchmarks shown on the Drawings, the Contractor must set out all the works with a Professional Land Surveyor.

The Contractor shall be required to check and verify, prior to commencement of any construction work, all benchmarks and boundary reference pegs, as shown and detailed on the Drawings. Reference and benchmark pegs disturbed and/or removed during the construction period shall be replaced by a Professional Land Surveyor and the Contractor shall bear the cost of such replacement. Payment to check and verify the reference and benchmark pegs will be made in terms of PSA 8.12"

The Contractor shall be required prior to commencement of any construction work to have all erf boundary pegs, as specified on the drawings, pegged by a registered Land Surveyor. Any erf peg disturbed and/or removed during the construction period shall be replaced by the Land Surveyor and the Contractor shall bear the cost of such replacement. The Land Surveyor shall verify all erf pegs upon completion of the works. The cost of placing the erf pegs if applicable shall be paid for under Section 1200 A: Bill of Quantities."

The Contractor shall be responsible for setting out of the pipeline routes, positions of reservoirs and other structures indicated by the Employer's Agent on the relevant drawings,

along the best available alignment and/or at the best position. The Ward Committee shall confirm that the position of any pipeline or structure is acceptable to the local residents and advice the Contractor accordingly before construction work commences.

The Contractor shall advise the Employer's Agent of any conflict between the position of any part of the Works and an existing feature.

PSA 5.1.2 Preservation and replacement of survey beacons and pegs subject to the Land Survey Act

DELETE THE SECOND SENTENCE" Before the commencement……"TO"….. apparently in their correct positions" AND REPLACE WITH THE FOLLOWING:

"Immediately on taking over the site, the Contractor, in consultation and liaison with the Employer's Agent, shall search for all pegs and the Contractor shall compile a list of pegs that are apparently in their correct position."

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 completion of the Contract, the Contractor shall expose and mark 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 the replacement of pegs that 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 replacement and certification as aforesaid shall be entirely for the Contractor's account, provided always that the Contractor shall not be held liable for the cost of replacement of pegs which:

(a) cannot reasonably be re-established in their original positions by reason of the finished dimensions of the Permanent Works;

(b) the Contractor can prove beyond reasonable doubt and to the satisfaction of the Employer's Agent, were disturbed, damaged or destroyed by others beyond its control; and

(c) were in close proximity to the work and which would unavoidably be removed, subject to the Employer's Agent's approval being given to remove such pegs."

PSA 5.1.3 Setting out of testing location

ADD NEW SUBCLAUSE 5.1.3 AS FOLLOWING:

"PSA 5.1.3 Setting out of testing locations. The Contractor shall have available on site survey equipment suitable to obtain y,x,z accuracy of 200mm to set out and record the location of each density test. GPS systems or traditional systems may be used."

PSA 5.2 Watching, barricading and lighting and traffic crossings

ADD THE FOLLOWING TO SUBCLAUSE 5.2:

"The Contractor shall comply in all aspects with the requirements of the Occupational Health and Safety Act (Act 85 of 1993), refer also PSA 5.10."

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".

PSA 5.4 Protection of overhead and underground services

REPLACE THE HEADING AND THE CONTENTS OF SUBCLAUSE 5.4 WITH THE FOLLOWING:

PSA 5.4 Location and protection of existing services

PSA 5.4.1 Location of existing services

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services which can reasonably be expected by an experienced and competent contractor to be present on, under, over or within the Site.

Without in any way limiting his liability in terms of the Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Employer's Agent, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where he intends to work. Neither the Employer nor the Employer's Agent offers any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site.

Thereafter, the Contractor shall, by the use of appropriate methodologies, carefully expose the services at such positions as are agreed to by the 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 Subclause 4.4 and 5.1.2.2 of SABS 1200 D (as amended) shall apply.

Wherever there is existing water reticulation the Contractor is to verify the position, sizes and type of pipes, or other infrastructure prior to commencing with construction in the area. The Contractor will be held responsible for maintaining access at all times. No trenches will be permitted within 2 m of telephone/electrical poles or stay.

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 when any such service is encountered or discovered on the Site.

Whilst he is in possession of the Site, the Contractor shall be liable for all loss of or damage as may occur to:

(a) known services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognizance being taken of such deviations in line and level which may reasonably be anticipated, and

(b) any other service which ought reasonably to have been a known service in accordance with the provisions of this clause, 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.

The Contractor shall also be liable for consequential damage in regard to (a) and (b), whether caused directly by the Contractor's operations or by the lack of proper protection.

No separate payment will be made to the Contractor in respect of his costs of providing, holding available on the Site and utilising the said detecting and testing equipment, nor for any costs incurred in preparing and submitting to the Employer's Agent the Drawings as aforesaid. These costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor in respect of exposing services at the positions agreed by the Employer's Agent and as described above will be made under the payment items (if any) as may be provided for in the respective sections of the specifications pertaining to the type

of work involved.

PSA 5.4.2 Protection during construction

The Contractor shall take all reasonable precautions and arrange its operations in such a manner as to prevent damage occurring to all known services during the period which the Contractor has occupation and/or possession of the Site.

Services left exposed shall be suitably protected from damage and in such a manner as will eliminate any danger arising therefrom to the public and/or workmen, all in accordance with the requirements of the prevailing legislation and related regulations.

Unless otherwise instructed by the Employer's Agent, no services shall be left exposed once their exact position has been determined. All excavations undertaken to expose underground services shall be promptly backfilled and compacted. In roadways, the requirements of subclause 5.9 of SABS 1200 DB shall be observed, while in other areas compaction shall achieve a minimum of 90% modified AASHTO density, subject also to the requirements of subclause 5.7 of SABS 1200 DB.

PSA 5.4.3 Alterations and repairs to existing services

Unless the contrary is clearly specified in the Contract or ordered by the Employer's Agent, the Contractor shall not carry out alterations to existing services. When any such alterations become necessary, the Contractor shall promptly 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.

Should damage occur to any existing services, the Contractor shall immediately inform the Employer's Agent, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs. In urgent cases, the Contractor shall take appropriate steps to minimise damage to and interruption of the service. No repairs of telecommunication cables or electric power lines and cables shall be attempted by the Contractor, unless approved by the Employer's Agent."

PSA 5.7 Safety

REPLACE THE CONTENTS OF SUBCLAUSE 5.7 WITH THE FOLLOWING:

"Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations thereunder, the Contractor shall at his own expense (except only where specific provision (if any) is made in the Contract for the reimbursement to the Contractor in respect of particular items), provide the following:

(a) Provide to its Employees on the site of the works, all safety materials, clothing and equipment necessary to ensure full compliance with the provisions of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) and associated 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;

(b) Provide, install and maintain all barricades, safety signage and other measures to ensure the safety of workmen and all persons in, on and around the site, as well as the general public;

(c) Implement on the site of the works, such procedures and systems and keep all records as may be required to ensure compliance with the requirements of the Act at all times;

(d) Implement all necessary measures so as to ensure compliance with the Act by all Subcontractors engaged by the Contractor and their employees engaged on the works; 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's 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 39 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 43 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 Clause 55.1.3 of the Conditions of Contract and for the Employer to cancel the Contract in accordance with the further provisions of the said Clause 55."

ADD THE FOLLOWING TO CLAUSE 5:

PSA 5.9 Construction regulations, 2014

The Contractor shall be required to comply with the Occupational Health and Safety Act, 1993: Construction Regulations, 2014 (the regulations) as promulgated in Government Gazette of 07 February 2014. Non-compliance with these regulations, in any way whatsoever, will be adequate reason for suspending the Works.

The proposed type of work, materials to be used and potential hazards likely to be encountered on this Contract are detailed in the Project Specifications, Bill of Quantity and Drawings, as well as in the Employers' health and safety specifications (regulation 4(1)) of the Construction Regulations 2014, which will be issued separately by the Employer.

The Contractor shall in terms of regulation 5(1) provide a comprehensive health and safety plan detailing his proposed compliance with the regulations, for approval by the Employer.

The Contractor shall at all times be responsible for full compliance with the approved plan as well as the Construction Regulations and no extension of time will be considered for delays due to non-compliance with the abovementioned plan or regulations.

A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned regulations.

PSA 5.10 Maintaining services in use

The Contractor shall take note that he shall not cut off any service in use without the prior approval of the Employer's Agent.

Failure on the part of the Contractor to comply with any of the above provisions will constitute sufficient reason for the Employer's Agent to stop the works until the situation has been remedied, or should he deem it necessary, arrange for the situation to be remedied at the Contractor's cost.

No direct payment will be made for the cost of maintaining services in use. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract."

PSA 5.11 Dealing with and accommodating traffic

The Contractor shall take note that the existing roads and tracks within the Sites shall remain operational throughout the contract period. To this end the Contractor shall provide and maintain all temporary fences, security, barriers, kerb ramps, signs, markings, flagmen, drums, lighting, personnel and all other incidentals necessary to ensure safe and easy passage of all traffic.

Temporary traffic signs etc. as well as all necessary markings shall be erected and maintained by the Contractor and the number and layout of the traffic signs shall comply with the Site Manual entitled "Safety at Roadworks in Urban Areas", as published by the Department of Transport.

Traffic signs shall have a yellow background with either a red / black border.

No direct payment will be made for the cost of dealing with and accommodating traffic. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the contract. Further, the provision of PSA 5.2 shall apply.

PSA 5.12 Site meetings

The Contractor or its authorised agent will be required to attend regular site meetings, which shall normally be held once a month on dates and at times determined by the 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 5.13 Providing access to erven and properties

Access to erven and properties along the route of trenches and roads shall be provided by the Contractor at all times. To this end suitable crossings shall be constructed where required.

Temporary crossings shall be in the form of portable bridges, temporary backfill or other approved means and shall be capable of permitting the safe passage of all vehicles and pedestrians. The Contractor shall also be responsible for maintaining crossings and for removing same when they are no longer required.

If as a result of restricted road reserve widths and the nature of the Works the construction of bypasses is not feasible, construction shall be carried out under traffic in order to provide access to the properties.

The Contractor may, with the approval of the Employer's Agent, arrange with the occupiers of the affected properties to temporarily close off a portion of a road, footpath entrance, property access road or other access, provided that the Contractor shall give due notice of the intended closure and its probable duration to the occupiers and shall as punctually as possible re-open the route at the prescribed time. Where possible roads shall be made safe and re-opened to traffic overnight. Any such closure shall be an arrangement between the Contractor and the occupiers and shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs and drums shall be provided by the Contractor to suit the specific conditions.

No direct payment will be made for the cost of providing access. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract.

PSA 5.14 Accommodation of other contractors

The Contractor shall be required to accommodate other Contractors on the Site of the Works during the Contract period. Adequate access to the site of their works shall be given the above stated Contractors at all times.

No direct payment will be made for the cost of providing adequate access and accommodating the stated Contractors on the Site of the Works, as well as the cost of any inconvenience or disruption experienced in attending to the aforementioned. Payment shall be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract."

PSA 5.15 SMME CONSTRUCTION MANAGER

The Contractor shall, in addition to the requirements of subclause 4.6 of the FIDIC Conditions of Contract for Construction 1999, guide, assist and mentor all eligible potential SMMEs intented for the Works. The Contractor shall employ on a full-time basis a construction manager on the Contract who will manage the SMMEs and report on progress with such Construction Manager must be adequately experienced with SMME work and the development thereof and will be subject to the approval of the Employer. The Construction Manager will render assistance to and mentor the SMMEs and such assistance, guidance and mentoring. The provision of an SMME Manager will deemed to be included in the time related Preliminary & General charges.

PSA 6 TOLERANCES

ADD THE FOLLOWING SUBCLAUSE TO CLAUSE 6:

PSA 6.4 Use of tolerances

No guarantee is given that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified, or when clearly not applicable, all quantities for measurement and payment shall be determined from the 'authorised' dimensions. These are specified dimensions or those shown on the Drawings or, if changed, as finally prescribed by the Employer's Agent, without any allowance for the specified tolerances. Except if otherwise specified, all measurements for determining quantities for payment will be based on the 'authorised' dimensions.

If the work is constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the calculation of quantities will be based on the 'authorised' dimensions, regardless of the actual dimensions to which the work has been constructed.

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the 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 Principles

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 CLAUSE 7.1.2.*

PSA 7.2 Approved laboratories

REPLACE THE CONTENT OF CLAUSE 7.2 WITH THE FOLLOWING:

"Unless otherwise specified in the relevant specification or elsewhere in the Scope of Work, 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; and

(d) any testing laboratory designated by the Employer's Agent."

ADD THE FOLLOWING SUBCLAUSE TO CLAUSE 7:

PSA 7.5 Employer's Agent laboratory

The Employer's Agent's acceptance control testing will be carried out by an independent commercial laboratory either on or off Site as may be necessary. Such testing will not relieve the Contractor of his obligations to carry out his own quality control testing to ensure that the materials and workmanship are within specification.

PSA 7.6 Quality control testing by Contractor

The Contractor shall carry out quality control tests on all portions of the Works as specified in the applicable specification, and shall make available all test results of quality control

testing to the Employer's Agent as soon as they become available, prior to seeking approval of the works for commencement of the next stage of construction.

PSA 7.7 Making good work disturbed by testing

On completion of the testing, the Contractor shall make good, in an acceptable manner, work disturbed by testing, whether it be due to either his own quality control testing or acceptance control testing.

PSA 7.8 Acceptance control testing

Where control testing is ordered by the Employer's Agent in addition to the required testing specified, the Contractor shall arrange for acceptance control testing to be carried out according to TMH1 by an approved commercial laboratory.

These results shall be made available to the Employer's Agent by the Contractor, within five days from date of order for all tests, except for soaked CBR's for which results shall be made available within twelve days from date of order. The Contractor shall make good the work disturbed by testing.

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 Item or section

PSA 8.1.2.1 Contents

The "tools and equipment "referred to in item b) will be regarded to include the survey equipment required under PSA 5.1.3 and the nuclear density testing device required under PSD 7.5.

REPLACE THE LAST SENTENCE OF SUBCLAUSE 8.1.2.1(b) WITH THE FOLLOWING:

"Separate items will be scheduled to cover the fixed, value-related and time-related components of the Contractor's preliminary and general costs."

REPLACE THE CONTENTS OF ITEM (c) WITH THE FOLLOWING:

"The 'duration of construction' applicable to a time-related item shall be the tendered contract period for the total works, plus as applicable, the Civil Engineering Industry Holiday (Dec / Jan) and all gazetted public holidays for the Civil Engineering Industry."

PSA 8.1.2.2 Tendered sums

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Except only where specific provision is made in the Specifications and/or the Bill of Quantities for separate compensation for any of these items, the Contractor's tendered sums under items PSA 8.3 and PSA 8.4 shall collectively cover all charges for:

- risks, costs and obligations in terms of the Conditions of Contract and of this standardized specification;
- head-office and site overheads and supervision;
- profit and financing costs;
- expenses of a general nature not specifically related to any item or items of the permanent or temporary work;
- providing such facilities on site as may be required by the Contractor for the proper performance of the Contract and for its personnel, including, but without limitation, providing offices, storage facilities, workshops, ablutions, services such as water, electricity, sewage and rubbish disposal, access roads and all other facilities required, as well as for the maintenance and removal on completion of the works of these facilities and cleaning-up of the site of the Contractor's establishment and reinstatement to not less than its original condition; and
- providing the facilities for the Employer's Agent and his staff as specified in the Contract

and their removal from the site on completion of the Contract. The facilities provided shall comply with the applicable requirements of SABS 1200 AB and PSAB and all cost deemed to be included under the tendered rates for PSA 8.3 and PSA 8.4, except where items in the Bill of Quantities are not provided for."

PSA 8.2 Payment

PSA 8.2.1 Fixed-charge and value-related items

REPLACE THE CONTENTS OF SUBCLAUSE 8.2.1 WITH THE FOLLOWING:

PSA 8.2.1.1 Fixed-charge items

"Payment of fixed charges in respect of item 8.3.1 will be made as follows:

(a) EIGHTY PER CENT (80%) of the sum tendered will be paid when the facilities have been provided and approved; and

(b) The remaining TWENTY PER CENT (20%) will be paid when the works have been completed, the facilities have been removed and the site of the Contractor's establishment has been cleared and cleaned to the satisfaction of the Employer's Agent.

No adjustment will be made to the sum tendered in respect of item 8.3.1 should the value of the works finally executed or the time for completion vary in any way from that specified in the tender.

ADD TO SUBCLAUSE 8.2.1 THE FOLLOWING:

The fixed charged items will include all associated cost to deal with the compulsory sub-contracts, other than cost already included under item 8.3.

PSA 8.2.1.2 Value-related items

Payment for the sum tendered under item 8.3.2 will be made in three separate instalments as follows:

(a) The first instalment, which is 40% of the sum, will be paid when the Contractor has fulfilled all his obligations to date under this specification, the General Conditions of Contract and the Special Conditions of Contract, and when the value of work certified for payment, excluding materials on site and payments for preliminary and general items, is equal to not less than 5% of the total value of the work listed in the Bill of Quantities.

(b) The second instalment, which is 40% of the sum, will be made when the amount certified for payment, including retention moneys but excluding this second instalment, exceeds 50% of the tender sum.

(c) The final payment, which is 20% of the sum, will be made when the works have been certified as completed and the Contractor has fulfilled all his obligations to date under this Specification, the General Conditions of Contract and the Special Conditions of Contract.

Should the value of the measured work finally completed be more or less than the tender sum, the sum tendered under item 8.3.2 will be adjusted up or down in accordance with the provisions of the Conditions of Contract, and this adjustment will be applied to the third instalment."

PSA 8.2.2 Time-related items

REPLACE THE CONTENTS OF SUBCLAUSE 8.2.2 WITH THE FOLLOWING:

"Subject to the provisions of subclauses 8.2.3 and 8.2.4, payment under item 8.4.1 (time-related item) will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered Contract period in months, provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the Works as a whole.

Should the Employer's Agent grant an extension of time for the completion of the total works, the Contractor will be entitled to an increase in the sums tendered for time-related items, which increase shall be in the same proportion to the original tendered sums, as the extension of time is to the duration of construction as defined in PSA 8.1.2.1. The Contractor shall however note that the aforementioned will not apply to extensions of time granted in terms of

PSA 8.4.1.

Payment of such increased sums will be taken to be as full compensation for all additional preliminary and general costs, either time-related costs or fixed costs that result from the circumstances pertaining to the extension of time granted."

The payment to the Contractor for Time-Related Items shall be adjusted in accordance with the following formula in the event of the Contract being extended by means of a Variation Order:

$$\textit{Sum of Tendered amounts for Time Related Items} \times \frac{\textit{Extension of Time authorised by Variation Order}}{\textit{Tender Contract period}}$$

The abovementioned adjustment of the payment for Time-Related Items shall be made in the completion Payment Certificate and shall be the only payment for additional Time-Related costs irrespective of the actual period required to complete the Contract including its authorised extensions.

In the case of fixed price contracts, the amount by which the Time-Related Items is adjusted shall not be subject to the Contract Price Adjustment formula.

In the case of contracts subject to Contract Price Adjustment the amount by which the time-related items are adjusted shall be subject to the Contract Price Adjustment formula.

PSA 8.3 Scheduled fixed-charge and value-related items

PSA 8.3.1 & Contractual requirements

8.4.3.1

ADD THE FOLLOWING:

"The sum tendered shall cover all initial costs incurred in complying with the requirements of the Conditions of Contract and include for the cost of providing and maintaining the special risks insurance stipulated in the Conditions of Contract, if applicable."

PSA 8.3.2.1 Facilities for Employer's Agent

REPLACE THE CONTENTS OF THIS CLAUSE WITH THE FOLLOWING:

"(a) One furnished offices.....Unit: Sum

(b) One nameboard.....Unit: Sum

(c) 2-way radio, charger and adaptor that operate on license frequency..... Unit: No

The facilities provided shall comply with the applicable requirements of SABS 1200 AB and PSAB."

PSA 8.3.2.2 Facilities for Contractor

All items included in the Contractor facility will be measured and priced according to subclause 8.3.2.2.

ADD THE FOLLOWINGTO SUBCLAUSE 8.3.2.2:

(k) Professional Land Surveyor

PSA 8.4 SCHEDULED TIME-CHARGE RELATED ITEMS

PSA 8.4.1 Contractual requirements.....Unit: Sum

ADD THE FOLLOWING:

"The sum shall further cover all the time-related establishment costs and be the full compensation to the Contractor for:

(i) The maintenance of his whole organisation as established for this Contract.
(ii) The maintenance of all insurances, indemnities and guarantees required in terms of the Conditions of Contract, where applicable.
(iii) Compliance with all general conditions and requirements which are not specifically measured elsewhere for payment in these Contract Documents.

Payment shall be made monthly in compliance with the method laid down in PSA 8.2.2.

The Contractor will not be paid Time-Related Preliminary and General Charges for any

special Non-Working Days, as stipulated in the Conditions of Contract, which shall be deemed to have been allowed for in his rates.

The sum shall also include, where applicable, for the cost of providing and maintaining the special risks insurance stipulated in the Conditions of Contract."

PSA 8.4.2.1 Facilities for Employer's Agent

REPLACE THE CONTENTS OF THIS CLAUSE WITH THE FOLLOWING:

"(a) One furnished office .....Unit: Sum

(b) One Contract Nameboard .....Unit: Sum

(c) Survey labourers.....Unit: Labourer Month

The facilities provided shall comply with the applicable requirements of SABS 1200 AB and PSAB.

Payment for the provision of survey labourers will be made pro-rata the period the labourers are provided."

PSA 8.4.2.2 Facilities for Contractor

All items included in the Contractor facility will be measured and priced according to subclause 8.3.2.2.

ADD THE FOLLOWINGTO SUBCLAUSE 8.3.2.2:

(k) Professional Land Surveyor.....Unit: Sum

PSA 8.4.2.3 REPLACE THE WORDS "periods stated" IN THE SECOND LINE OF THIS CLAUSE WITH THE FOLLOWING:

"duration of construction as defined in PSA 8.1.2.1".

PSA 8.5.2 Contingencies

A percentage is provided in the summary of the Schedule of Quantities to cover contingent and additional expenditure on the Works. The expenditure of the contingencies amount, in whole or in part, or not at all, shall be entirely at the discretion of the Employer's Agent.

The provision of this amount shall not in any way imply that the Contractor's tender does not include for the provision of all resources and the fulfilment of all obligations necessary to complete the Works as specified, without payment of the amount so provided.

The Employer's Agent shall, if he deems necessary, reduce the scope of work to ensure that expenditure on the Works remains within the limit of the project's budget.

PSA 8.7 Daywork

ADD THE FOLLOWING:

Provisional items for Daywork are scheduled as follows:

a) Labour at hourly rates for skilled, semi-skilled and unskilled labourers.
b) Material as a Provisional Sum with a percentage allowance on the net cost.
c) The Contractor's own plant shall be paid at hourly rates for the various types of plant. The tendered unit rates, or unit rates agreed in terms of the GCC (2015), for the Contractor's own plant used for daywork shall be deemed to cover the full cost of such plant usage, including plant operators, consumable stores, fuel, and maintenance.
d) Hired plant as a Provisional Sum with a percentage allowance on the net cost. The Contractor will be paid the actual net cost of plant hired by him for Daywork and in addition will be paid a percentage allowance on the net cost of such hire, which allowance will cover the Contractor's own overhead costs and profit.

"To ensure that the plant is achieving a reasonable output of work, the Employer's Agent's personnel will randomly monitor and measure work produced. Poor performance of any item of plant will be noted by the Employer's Agent and certain reductions in payment may be applied.

Furthermore, should the performance of a machine be poor, or persistently break down, the Employer's Agent may order that it be replaced, all at the cost of the Contractor."

PSA 8.8 Temporary works

PSA 8.8.2 Dealing with Traffic

DELETE THE ENTIRE CLAUSE AND REPLACE WITH:

"The provision of PSA 5.10 shall apply. Refer also PSA 5.2, PSA 5.3, PSA 5.7 and PSA 5.10"

PSA 8.8.4 Dealing with existing services

ADD THE FOLLOWING TO CLAUSE 8.8.4 WITH:

Careful excavation carried out by the Contractor on the instruction of the Employer's Agent to locate and expose existing services of which the exact location is not known, or where the existing service is found to be further than 2.0 m from the position indicated, will be measured by volume. The rate shall cover all costs of materials, labour and plant, including specialist detecting equipment required to locate and expose the service.

ADD THE FOLLOWING SUBCLAUSES TO CLAUSE 8.8:

PSA 8.8.7 Dealing with water

The cost involved in the control of surface water, precautions against flooding and the drainage and removal of ground water in the trenches or the protection of the road prism for the proper execution of the Works will be covered by the amount tendered for the related items (e.g. trenching, sub-base, etc.). The sum shall cover all costs with regard to the preventive measures that must be taken with regard to water and the repair of damaged portions of the Works.

PSA 8.8.8 Freehaul and overhaul

Notwithstanding any clauses in any Standardized Specification or Standard Specification Section dealing with the definition, measurement and/or payment for transport, the freehaul and overhaul is classified into two categories, namely for unsuitable material and then for backfill/bedding materials, as shown in the table below.

Material Description	Freehaul Distance	Overhaul
Unsuitable/surplus/spoil material	5 km	Distances > 5 km
Imported Backfill/bedding material	5 km	Distances > 5 km

Imported material is to be transported directly to the work area/trench where possible or to the designated stockpile areas along the pipeline; whichever distance is the shorter. Imported Backfill/bedding material required from stockpile within 5km freehaul distance will be measured and paid for in accordance with subclause 8.3.4 a) of SANS 1200 D. Imported material required outside the freehaul distance of 5km will be regarded as overhaul and will be measured and paid for in accordance with subclause 8.3.6 b) of SANS 1200 D.

Material to be spoiled outside the freehaul distance of 5km will be measured and paid for in accordance with subclause 8.3.6 b) of SANS 1200 D."

PSAB EMPLOYER'S AGENT'S OFFICE

PSAB 3 MATERIALS

PSAB 3.2 Office building(s)

REPLACE THE WORDS "as scheduled" IN PARENTHESIS IN THE FIRST LINE OF SUBCLAUSE 3.2 OF SABS 1200 AB WITH "as specified in the General specification";

REPLACE THE SECOND SENTENCE WITH THE FOLLOWING:

Two offices will be required.

One of 12m2 for the exclusive use by the Employer's Agent and the Employer's Agents Representative and one of 4 x 8m for a meeting/training room that can be used by both parties, and ceiling height of at least 2.5m. The meeting room will be equipped with a table and chairs suitable for 12 persons to be seated.

AND REPLACE SUBCLAUSE 3.2(j) OF SABS 1200 AB WITH THE FOLLOWING:

"(j) an air-conditioning unit capable of both heating in winter and cooling in summer;

ADD THE FOLLOWING TO CLAUSE 3.2:

(k) steel plan cabinet;
(l) a whiteboard, size 2,0 m² securely fitted to the wall;
(m) a rain gauge (one only);
(n) a minimum / maximum thermometer (one only);
(o) 100 litre fridge (one only); and
(p) The Contractor shall provide 2-way radios plus chargers and adaptors that operate on license frequency.
(q) The Contractor shall construct the number of carports specified in the General specification for the sole use of the Employer's Agent and his staff. Each carport shall be constructed so that the vehicle parked under it is always protected against the direct rays of the sun. The carport area shall be at least 20 m² and the floor shall be covered with a layer of crushed stone to alleviate dusty and muddy conditions. The carport(s) shall be positioned so as to provide easy and convenient access to the Employer's Agent's office."

ADD THE FOLLOWING SUBCLAUSES TO CLAUSE 4:

PSAB 4.2 Survey equipment

The Contractor shall provide on-site and make available for the exclusive use of the Employer's Agent and his staff, the survey equipment listed in General specification.

All survey equipment provided by the Contractor shall be in good condition, properly calibrated and fit for the purpose.

In addition to survey equipment provided by the Contractor for the exclusive use of the Employer's Agent and his staff, the Contractor shall make available for use by the Employer's Agent, the further survey equipment listed in the General specification, at all times when such is reasonably required by the Employer's Agent and his staff for the purposes of the Contract.

PSAB 5 CONSTRUCTION

PSAB 5.1 Nameboards

REPLACE THE CONTENT OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The Employer's Agent's nameboards shall be erected within fourteen days of the Commencement Date and shall be placed where ordered. Any damage to this board shall be repaired within seven days of a written instruction issued by the Employer's Agent.

Further to the above, the Contractor will not be allowed to erect more than two of his own name boards in the area of the Works. The position of these shall be agreed to by the Employer's Agent.

No payment will be made for the supply, erection or maintenance of the Contractor's name boards and the Employer's Agent reserves the right to order the removal of the nameboards if not properly maintained. All nameboards shall be removed within 7 days of the issue of the Final Approval Certificate."

PSAB 5.5 Survey assistants

A survey assistant will be required from time to time to assist the Employer's Agent's Representative.

ADD THE FOLLOWING NEW SUBCLAUSES TO CLAUSE 5 OF SABS 1200 AB:

PSAB 5.6 Survey equipment

All survey equipment provided by the Contractor shall be kept fully serviceable at all times by the Contractor. The Contractor shall have any defective equipment repaired or replaced at his own cost within 12 hours after notification by the Employer's Agent's staff.

Where required by the Employer's Agent, the Contractor shall, at his own cost, promptly arrange for the recalibration of survey equipment provided."

PSAB 8 MEASUREMENT AND PAYMENT

DELETE THE CONTENTS OF THIS CLAUSE AND REPLACE WITH:

"The appropriate measurement and payment clauses have been included under Clause 8 of SABS 1200 A and PSA."

PSC SITE CLEARANCE

PSC 3 MATERIALS

PSC 3.1 Disposal of material

ADD THE FOLLOWING:

"Material obtained from clearing and grubbing, including builder's rubble, and other unwanted debris, shall be disposed of.

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 2,5 m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations."

Except for the above, only the approved minimum area required for the execution of the Works including areas on which material shall be stockpiled for later reuse or on which material shall be dumped and spread, shall be cleared and grubbed. This area is to be confirmed by the Employer's Agent prior to Construction.

PSC 5.5 Re-clearing of vegetation

ADD THE FOLLOWING:

"Except if otherwise agreed, where areas have to be re-cleared on the written instruction 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 5.6 Conservation of topsoil

REPLACE THE CONTENTS OF SUBCLAUSE 5.6 OF SABS 1200 C WITH THE FOLLOWING:

Topsoil up to a depth of 150 mm, if available, shall be removed from the above specified cleared areas and stockpiled on approved sites for later reuse. Until required for spreading, the stockpiles of topsoil material shall be stabilized by watering or other approved means.

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 has been completed."

"Site clearance for pipe trenches will not be measured where such trenches lie within the carriageway of any road. "

PSC 8.2 Payment

PSC 8.2.1 Clear and grub

REPLACE THE FIRST LINE WITH THE FOLLOWING:

"The area designated by the Employer's Agent to be cleared and grubbed will be measured in square metre to the nearest square metre or, "

DELETE "(except where 8.2.9 is applicable)" IN THE SEVENTH LINE OF THIS CLAUSE,

ADD THE FOLLOWING:

"The tendered rate shall also cover the cost of loading, transporting and disposing of vegetation, builder's rubble, and other unwanted debris encountered in road reserves or along service routes at the designated spoil site described in the General specification.

DELETE THIS SUBCLAUSE:

PSC 8.2.9 Transport material and debris to unspecified sites and dump

Notwithstanding the fact that a disposal site will not be designated by the Employer's Agent, the transportation of material and debris generated by any clearing operation will not be measured for payment."

REPLACE THE FOLLOWING SUBCLAUSE:

PSC 8.2.10 Remove topsoil to nominal depth of 150mm, stockpile and maintain..... Unit: m2

The rate shall cover the cost of removing topsoil, together with such vegetation and small roots as occur the specified depth, and of stockpiling and maintaining on designated sites.

ADD THE FOLLOWING:

PSC 8.2.11 Final finishing and cleaning up of site .....Unit: Sum

The tendered sum shall include full compensation for the clearing, disposal of material, finishing, tidying and all other work required to finish and clean up the Site of the works and affected areas by removing excess earth, stones, boulders, debris and other waste material, by clearing stormwater inlets and outlets and pipe barrels, by clearing the surfacing of all dirt, mud and foreign material, and by neatly finishing off all junctions, intersections and kerbing.

All material resulting from the finishing operations shall be disposed of to a spoil site furnished by the Contractor.

The tendered rate shall make provision for the reinstatement of existing driveways to their original condition where these have been affected by the works, as these items will not be measured and paid for separately."

PSD EARTHWORKS

PSD 2 INTERPRETATIONS

PSD 2.1 Supporting specifications

REPLACE SUBCLAUSE 2.1.2 WITH THE FOLLOWING:

PSD 2.1.2 Any of the other SABS 1200 Specifications may form part of the Contract Documents."

PSD 2.3 Definitions

REPLACE THE WORD AND THE DEFINITION FOR "Borrow" WITH THE FOLLOWING:

"**Borrow material**: Material, other than material obtained from excavations required for the Works, obtained from sources such as borrow pits or the authorised widening of excavations. 'Borrow' shall have a corresponding meaning."

REPLACE THE DEFINITION FOR "Specified density" *WITH THE FOLLOWING:*

"**Specified density**: The specified dry density expressed as a percentage of modified AASHTO or PROCTOR dry density."

REPLACE THE DEFINITION FOR "Stockpile" *WITH THE FOLLOWING:*

"**Stockpile** (verb): The process of selecting and, when necessary, loading, transporting and off-loading material in a designated area for later use for a specific purpose."

ADD THE FOLLOWING DEFINITIONS:

"**Commercial Source**: A source of material provided by the Contractor, not the Employer, and including any borrow pit, provided by the Contractor.

Fill: An embankment or terrace constructed of material obtained from excavations or borrow pits. In roads it includes the earthworks up to the underside of the selected subgrade level.

Fill (material): Material used for the construction of an embankment or terrace.

Roadbed: The natural in situ material on which the fill, or in the absence of fill, the pavement layers, are constructed."

PSD 3 MATERIALS

PSD 3.1 Classification for excavation purposes

PSD 3.1.1 Method of Classifying

ADD THE FOLLOWING:

"The classification of material other than 'soft excavation' shall be agreed upon before excavation may commence.

The Contractor shall immediately inform the Employer's Agent if and when the nature of the material being excavated changes to such an extent that a new classification is warranted for further excavation. Failure on the part of the Contractor to advise the Employer's Agent in good time shall entitle the Employer's Agent to reclassify, at his discretion, such excavated material.

PSD 3.2.3 Material suitable for backfill or fill against structures

REPLACE THE CONTENTS OF THIS SUBSUBCLAUSE WITH THE FOLLOWING:

"Material used for backfill behind structures shall generally be the material excavated, subject to the following conditions:

(a) The material shall not contain an excessive number of stones retained on a 50 mm sieve;

(b) The material shall not contain large clay lumps that do not break up under the action of the compaction equipment;

(c) The liquid limit of the material shall not exceed 40, neither shall the PI exceed 18;

(d) The minimum modified AASHTO density shall be 93%."

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 SUBSUBCLAUSE:

PSD 3.3.3 Selection in borrow pits and excavations

Approval of a borrow area for a certain purpose does not necessarily mean that all the material in that area is suitable for the specified purpose. What it does mean is that the borrow area contains some suitable material. The onus shall rest on the Contractor to ensure that only material that is indeed suitable is removed and used for the specified purpose.

When the Contractor has to select excavated material for a specific purpose, the above provisions relating to borrow areas shall apply mutatis mutandis to excavations.

The Contractor shall not waste or contaminate material that has been selected for a specific purpose."

PSD 4 PLANT

PSD 4.2 Compaction plant

ADD THE FOLLOWING TO SUBSUBCLAUSE 4.2:

Where it is required that the work be carried out using labour intensive methods, the Contractor shall not use compaction plant larger than a walk-behind compactor.

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 Subsubclause 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."

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) and Construction Regulations 2014".

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) and Construction Regulations 2014."

PSD 5.1.1.3 Explosives

REPLACE THE CONTENTS OF THIS SUBSUBCLAUSE 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 other purposes where explosives are normally required, subject to the following conditions:

(a) The Employer's Agent may prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or to adjoining structures is too high. Such action by the Employer's Agent does not entitle the Contractor to additional payment for having to resort to less economical methods of construction.

(b) The Employer's Agent's prior written approval shall be obtained for each and every blasting operation. This approval may be withheld if the Contractor does not use explosives responsibly and carefully.

(c) The Contractor shall comply fully with the requirements of the Explosives Act, Act 83 of 1997 and all other legislation and regulations as may be applicable to blasting and the use of explosives.

(d) Before 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.

Should such inspections be required, the Contractor shall, together with the Employer's Agent and the insurer, examine and measure the buildings, houses or structures in the vicinity of the proposed blasting site and establish and record, together with the owner, lessee or occupier, the extent of any existing cracking or damage before the commencement of blasting operations. During the inspection, pictures or video must be taken.

(e) When there is a possibility of damage to power and telephone lines or any other services or property, the Contractor shall adapt his method of blasting and the size of the charges and shall use adequate protective measures (e.g. cover-blasting, to reduce the risk of damage.

(f) All accidents, injury to persons and animals and damage to property shall be reported to the Employer's Agent in detail and in writing 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.

(h) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good, at its own expense, any additional excavation necessitated by the shattering of rock in excess of any overbreak allowances specified in the Project Specifications or given on any drawing.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall

remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations."

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:

"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 consist of digging a 1000 x 600 x 1500mm hole where specified by the Employer's Agent.

Unless otherwise instructed or agreed by the Employer's Agent, no service shall be left exposed after its exact position has been determined and all excavations carried out for the purposes of exposing underground services shall be promptly backfilled and compacted to the following densities:

(a) In roadways : 93% Mod AASHTO density; and

(b) In all other areas : 90% Mod AASHTO density.

Where hand excavations to expose underground services have to be carried out in roadways, the Contractor shall reinstate the road layer works in accordance with the provisions of Subclause 5.9 of SABS 1200DB.

Payment in respect of the reinstatement of layer works in roadways will be made in accordance with Subclause 8.3.6.1 of SABS 1200DB (as amended).

Where a service is damaged because of the Contractor ' s negligence, the penalty payable by the Contractor shall be as specified in the project specification and he shall make good such damage or bear the cost of the repairs, as specified.

PSD 5.1.2.3 Protection of cables

REPLACE SUBSUBCLAUSE 5.1.2.3 WITH THE FOLLOWING:

PSD5.1.2.3 Protection during construction

Further to the requirements of Subclause 5.4.2 of SABS 1200A (as amended), major excavating equipment and other Plant shall not be operated dangerously close to Known Services. Where necessary, excavation in close proximity to Known Services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. No additional payment will apply to such more difficult work.

Should any service not being a Known Service be discovered or encountered during the course of the Contract, the Contractor shall, in addition to complying with the requirements of Subclause 5.4.2 of 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, where applicable and at the earliest practicable opportunity, install the permanent drainage specified or shown on the Drawings and shall at his own cost provide the temporary drainage required to protect the Works."

PSD 5.1.6 Road traffic control

DELETE THE SECOND SENTENCE OF SUBSUBCLAUSE 5.1.6.

PSD 5.2 Methods and procedures

PSD 5.2.1 Site preparation

PSD 5.2.1.2 Conservation of topsoil

ADD THE FOLLOWING TO SUBCLAUSE 5.2.1.2:

"Topsoil shall not be stockpiled higher than 2,0m. Care shall be exercised to prevent the

compaction of topsoil in any way especially by vehicles travelling over such material."

PSD 5.2.2 Excavation

PSD 5.2.2.1 Excavation for general earthworks and for structures

ADD THE FOLLOWING TO PARAGRAPH (b):

"When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. In general, payment will be made for excavating a working width of 600 mm, but the Contractor may excavate a greater working width at no additional cost to the Employer."

REPLACE THE FIRST SENTENCE OF PARAGRAPH (e) WITH THE FOLLOWING:

"Where excavations have been carried below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel compacted to 90% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density.

Where excavations for structures have been carried out in hard material, the Employer's Agent may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall retrim the excavations if necessary and, unless other remedial measures are agreed to by the Employer's Agent, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account."

Where concrete is to be cast against an excavated face, no protrusion of the excavated face will project more than 100 mm past the designated line of the excavation or be so close to the designated position of any reinforcing as to cause less than the specified concrete cover to the reinforcing to occur.

PSD 5.2.2.3 Disposal

REPLACE SUBCLAUSE 5.2.2.3 WITH THE FOLLOWING:

All surplus material will be disposed of on the stockpiles designated for the type of material.

All surplus material and all unsuitable material from excavations and clearing and grubbing operations shall be removed from the Site by the Contractor and disposed of at the site identified by the Contractor and agreed to by the Employer's Agent.

Dumping shall proceed in an orderly manner with coarse material placed at the bottom and covered with finer material, where possible. Upon completion of dumping the material shall be shaped to provide free-draining surfaces and slopes and finished off to the satisfaction of the Employer's Agent.

ADD THE FOLLOWING SUBSUBCLAUSE IN SUBSUBCLAUSE 5.2.2:

PSD 5.2.2.4 Selection and stockpiling

Approval or designation of the material in a particular borrow pit or excavation for a particular purpose does not imply that all the material in the borrow pit or excavation is suitable for the particular purpose for which the said approval or designation relates, nor that all material in the borrow pit or source should be used for the particular purpose. The Contractor shall select suitable material from that borrow pit or source, discard unsuitable material and reserve material for other purposes as necessary.

The Contractor shall organise and carry out its operations in such a manner as will prevent the contamination of suitable embankment and backfill material with unsuitable materials. Any excavated material which becomes, in the Employer's Agent's opinion, unsuitable for use in embankments or backfill as a result of contamination, shall be disposed of in a manner acceptable to the Employer's Agent and shall be replaced by the Contractor with materials acceptable to the Employer's Agent, all at the Contractor's cost.

When required, or when ordered by the Employer's Agent, material shall be stockpiled for later use. The additional costs of stockpiling material shall be paid to the Contractor in

accordance with the provisions of Subclause PSD 8.3.12."

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."

ADD THE FOLLOWING SUB CLAUSE:

PSD 5.2.3.3 The material of each area of fill shall, unless otherwise approved, be deposited in layers of thickness, before compaction, not exceeding 150 mm. The material shall be spread to form a layer that is approximately uniform thickness, and graded over the whole area of the fill site.

Each layer shall be compacted at OMC to a density of at least 93% of modified AASHTO density in the case of cohesive soil or 100% in the case of non-cohesive soil. Should the material be too wet, owing to rain or any other cause, it shall be harrowed and allowed to dry out to the correct moisture content before compaction is undertaken.

The Contractor shall ensure that stormwater will at all times be discharged uniformly over the full fill area or through specially prepared and protected drainage ditches to prevent scouring of the slopes."

PSD 5.2.4 Finishing

PSD 5.2.4.2 Topsoiling

Replace the last sentence with:

"The final thickness of the topsoil shall be as directed by the Employer's Agent or as required by the Drawings, to a nominal thickness of 100 mm after light compaction."

PSD5.2.4.3 Vegetation

ADD the FOLLOWING TO SUBCLAUSE 5.2.4.3:

"The vegetation mix to be used is described in the construction Environmental Management Plan."

PSD 5.2.5 Transport for Earthworks

REPLACE THE CONTENTS OF SUBSUBCLAUSE 5.2.5 WITH THE FOLLOWING:

"The transport of all excavated materials from works and use in the works, irrespective of the distance and source, shall be deemed to be freehaul. All haul to and from stockpiles will be freehaul, the cost of which is included in the Contractor's tendered rates and prices for the excavation of the materials. No separate compensation shall apply for the transportation of excavated materials."

ADD NEW SUBCLAUSE TO CLAUSE 5:

PSD 5.3 Recording of original ground levels

Before commencing any earthworks, the Contractor shall assist the Employer's Agent in establishing the original ground level in the area for record purposes.

PSD 6 TOLERANCES

PSD 6.1 Level Tolerances

ADD NEW ITEM c) AS FOLLOWS:

"

		Permissible deviation (PD)		
		Degree of Accuracy		
		III	II	I
		mm	mm	mm
c)	1) Specified individual layer thickness	+ 50	+50 -0	+20 -0
	2) Overall group layer thickness for multi-layer earthworks	± 50	+50 -0	+50 -0

PSD 7 TESTING

ADD THE FOLLOWING BETWEEN 7 AND 7.1:

"GENERAL. The terms of clause 7 of SABS/SANS1200 M shall apply. Judgement of quality will be done on a statistical basis for the density and the moisture content properties of the worked material"

PSD 7.2 Taking and testing of samples

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

The Contractor shall arrange with the approved independent laboratory engaged by the Contractor to carry out sufficient tests on a regular basis, as specified in SANS1200 or as required by the Employer's Agent, to determine whether the degree of compaction, and, where applicable, the quality of materials used, comply with the Specifications and shall submit the results of these tests to the Employer's Agent in a form approved by him.

ADD NEW SUBCLAUSE 7.4 TO AS FOLLOWS;

PSD 7.4 Process Control

PSD 7.4 PROCESS CONTROL. Notwithstanding clause 7.2 the testing frequency will be according to Table 1.

Table 1- Testing Frequency (for large scale open earthworks)

1	2	3	4
Test	Portion		Testing Frequency
		Volume or area to which one test is applied, max	No of tests per lot, min
Relative Compaction at OMC	(a) Ordinary fill	500m^3	3
	(b) Selected layers	500m^2	4
Indicator Tests	(a) Selected layers	2 500m^2	1
CBR/UCS	(a) In-situ founding material	5 000m^2	1
	(b) Selected layer and gravel surface	10 000m^2	1

Irrespective of the frequencies given in Table 1 the minimum Process Control for compaction and OMC testing will be that one lot of tests will be taken per day's work on a layer, within 4 hours from the work being done. "

ADD NEW CLAUSE PSD 7.5 AS FOLLOWS:

PSD 7.5 Compaction Testing

For the duration of the earthworks portion of the project the Contractor will supply and maintain a calibrated nuclear density testing device on site. The Contractor will also have available on site suitably trained staff to operate the device."

PSD 8 MEASUREMENT AND PAYMENT

PSD 8.3 Scheduled items

PSD 8.3.1 Site preparation

REPLACE SUBSUBCLAUSES 8.3.1.1 AND 8.3.1.2 WITH THE FOLLOWING:

"Where Site preparation such as clearing, grubbing, the removal of large trees or the removal and stockpiling of topsoil is required, the provisions and scheduled items of SABS 1200 C shall apply."

PSD 8.3.6 Overhaul

ADD THE FOLLOWING:

"No overhaul shall apply to material from commercial sources or to material disposed of on sites provided by the Contractor or disposed by other means employed by the Contractor."

PSD 8.3.8 Existing services

PSD 8.3.8.1 Location and expose existing services

REPLACE ITEM 8.3.8.1 WITH THE FOLLOWING:

8.3.8.1 Hand excavation for locating and exposing existing services:

(a) Locate underground electrical cables using cable indicator ..... Unit: hrs

(b) Excavate around electrical cables .....Unit: No

(c) Water, sewer and stormwater pipelines .....Unit: No

(d) Relocate exiting Telkom line ..... Unit: m

(e) Relocate existing Eskom line ..... Unit: m

(f) Locate existing reticulation services ..... Unit: m

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 excavation in roadways shall include compensation for compacting excavated or selected backfill material to 93% of modified AASHTO density. Reinstating layer works and surfacing shall be measured and paid for in terms of SABS 1200 DB.

The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water, for removing surplus excavated material from the site, for transporting all material, and for supplying adequate supervision during both excavation and backfilling operations.

PSDM EARTHWORKS (ROADS, SUBGRADE)

PSDM 3 MATERIALS

PSDM 3.2 CLASSIFICATION FOR PLACING PURPOSES

PSDM 3.2.3 Selected layer

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The following requirements shall apply in respect of the selected layer:

(a) Maximum particle size: 60% of compacted layer thickness

(b) Unstabilized selected layer

(i) Upper selected layer:

Minimum CBR at 95% of modified AASHTO density: 15

Maximum PI: 12 (the Employer's Agent has the right to alter this requirement to 3 x the grading modulus + 10).

(ii) Lower selected layer:

Minimum CBR at 93% of modified AASHTO density: 7

Maximum PI: 12 (the Employer's Agent has the right to alter this requirement to 3 x the grading modulus + 10).

PSDM 5 CONSTRUCTION

PSDM 5.2 METHODS AND PROCEDURES

PSDM 5.2.2 Cut and borrow

PSDM 5.2.2.3 Use of material

ADD THE FOLLOWING PARAGRAPH:

"(e) Commercial sources

The provisions of subclause PSD 5.2.2.5 of SABS 1200 D as amended shall apply."

PSDM 5.2.3 Treatment of the road-bed

PSDM 5.2.3.2 Removal of unsuitable ground

REPLACE THE SECOND SENTENCE OF PARAGRAPH (a) WITH THE FOLLOWING:

"The excavated spaces shall then be backfilled with approved imported material compacted to the required density."

ADD THE FOLLOWING SENTENCE TO PARAGRAPH (b):

"Unsuitable excavated material will be paid for as cut to spoil."

PSDM 5.2.3.3 Treatment of road-bed

ADD THE FOLLOWING PARAGRAPHS:

"(c)Three-pass roller compaction

Any portion of the roadbed that is shown on the Drawings or is specified or is directed by the Employer's Agent to be given three-pass roller compaction because of its inadequate natural density, shall be prepared by shaping where necessary and compacting with a roller, complying with the requirements specified below.

Compaction shall comprise three complete coverages by the wheels of the specified roller over every portion of the area that is being compacted. While it is not the intention that the Contractor should apply water to the roadbed for this type of compaction, and while no rigid moisture control will be exercised during compaction, the Contractor shall nevertheless satisfy the Employer's Agent that everything is being done to take full advantage of favourable soil moisture conditions during the rainy season, and that such compaction is as far as possible carried out when the roadbed is neither excessively dry nor excessively wet.

The Employer's Agent has the authority to decide when conditions are favourable for compaction and where such compaction is to be carried out at any particular time, and he has the right to instruct the Contractor to water the roadbed at the Contractor's expense when, in the opinion of the Employer's Agent, the Contractor failed, neglected or refused to comply with these requirements.

The rollers to be used for roller-pass compaction shall conform to the following requirements:

Grid roller: The grid roller shall have a mass of not less than 13,5 t when ballasted, shall be loaded to this mass if required, and shall be moved at a speed of not less than 12 km/h.

Vibratory roller: The vibratory roller shall be capable of exerting a combined static and dynamic force of not less than 120 kN/m width for every metre of loose-layer thickness at an operating frequency not exceeding 25 Hz and shall move at a speed not exceeding 4 km/h."

PSDM 5.2.4 Fill

PSDM 5.2.4.3 Finishing

(e) Topsoiling

REPLACE THE SECOND SENTENCE WITH THE FOLLOWING:

"The thickness of the topsoil shall be as directed by the Employer's Agent."

PSDM 5.2.5 Selected layer

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Except with regard to density, the requirements of subclause 5.2.4 shall apply. The degree of compaction shall be:

Upper selected : 95% of modified AASHTO density

Lower selected : 93% of modified AASHTO density."

PSDM 5.2.8 Transport

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The provisions of subclause PSD 5.2.5 of SABS 1200 D, as amended, shall apply."

PSDM 7 TESTING

PSDM 7.3 ROUTINE INSPECTION AND TESTING

REPLACE TABLE 2 AND THE CONTENTS OF SUBCLAUSE 7.3.2 WITH THE FOLLOWING:

PSDM 7.3.2 The dry density requirements for a particular lot of selected layer or wearing course shall be deemed to be satisfied if the average density and the results of individual tests meet the requirements specified in table 2 below. Refer to subclause PSD 7.2 for the requirements for fill.

TABLE 2 - DENSITIES

1	2	3	4	5
Layer	Specified density (% of modified AASHTO density)	Number of tests per lot	Average density, %	Minimum density for any single test, %
Lower selected layer and gravel wearing course	93	3 and 4 5 6	93,1 93,4 93,6	89,4 89,2 89,0
Upper selected layer and gravel wearing course	95	3 and 4 5 6	95,1 95,4 95,6	91,4 91,2 91,0

PSDM 8 MEASUREMENT AND PAYMENT

PSDM 8.2 Computation of quantities

DELETE THE CONTENTS OF THIS CLAUSE AND REPLACE WITH:

"The appropriate measurement and payment clauses have been included under Clause 8 of SABS 1200 D, 1200DB, PSDB and PSDB."

PSG CONCRETE (STRUCTURAL)

PSG 2 INTERPRETATIONS

PSG 2.3 Definitions

Under (a) add:

"Construction joint: a joint required on account of constraints or convenience in the method of construction and that is not a movement, contraction or expansion joint."

PSG 2.2 Designated Joints

Notwithstanding Subclause 2.4.3, "designated joints" will only be joints that are shown on the drawings.

PSG 2.4.2 Strength concrete

Grade 30MPa/40mm means strength concrete grade 30MPa with 37.5mm stone.

PSG 2.4.1 Exposure conditions

All concrete on the Works shall be as specified for severe exposure condition.

PSG 3 MATERIALS

PSG 3.2 Cement

PSG 3.2.1 Cement Specifications

REPLACE CLAUSE 3.2.1 ENTIRELY WITH THE FOLLOWING:

"Subject to the provisions of clause 3.2.2, cement will comply with the specifications of SANS

50197-1"

PSG 3.2.2 Alternative types of cement

The type of cement to be used for concrete is indicated below:

MEMBER/USE	TYPE	STRENGH CLASS
Concrete not further specified below	CEM I or II	≥32,5
Floor, road and pavements with saw cut joints or to carry traffic	CEM I or II	≥42,5

PSG 3.2.3 Storage of cement

ADD THE FOLLOWING:

"Unless approved by the Employer's Agent, cement kept in storage for longer than 8 weeks shall not be used in the Works.

Any cement that contains lumps that cannot easily be crumbled to powder between the fingers, may not be used."

PSG 3.4 Aggregates

PSG 3.4 Application specification

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

The nominal stone size specified in the concrete grade (e.g. 30 MPa/40 mm) shall mean stone conforming to the grading specified in SANS 1083 for the nearest equivalent size, i.e. 20 mm means stone that complies with SANS 1083 for 19 mm size.

PSG 3.4.3 Storage of aggregates

ADD THE FOLLOWING:

"When aggregates of different chloride content are stored on the Site, their use in the various classes of concrete shall be strictly controlled."

ADD THE FOLLOWING SUBCLAUSE:

PSG 3.4.4 Aggregates for grouting

Notwithstanding the requirements of Subclause 3.4.1, the grading of the fine aggregate (sand) and coarse aggregate (stone or pea gravel) to be used for grouting shall conform to the gradings given in Tables 1 and 2 respectively, below.

TABLE 1 - SAND	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5 4,75 1,18 0,3 0,15	100 95 - 100 45 - 65 5 - 15 0 - 5

TABLE 2 - STONE OR PEA GRAVEL	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5 4,74 2,36	100 95 - 100 0 - 5

PSG 3.4.5 Samples

At least one month before commencement of concrete work the Contractor shall supply at his own cost representative samples to the Employer's Agent of the aggregates he intends using, together with certificates from an approved laboratory indicating that the aggregates comply with the specifications. Approximately 50 kg of each sample of aggregate shall be supplied.

After approval these samples shall be taken as standard for the agreed aggregates to be used in the Works. If at any time during the course of the Contract the Employer's Agent considers that there has been any deviation from the approved standard the Contractor shall submit further tested samples of material to the Employer's Agent for approval.

PSG 3.5 Admixtures

PSG 3.5.1 Approval of admixture requirement

REPLACE THE FIRST SENTENCE THIS SUBCLAUSE WITH THE FOLLOWING:

"Chryso CW10 or similar approved admixture is to be added to the concrete mix at the time of batching for all concrete water retaining structures. The rates of application are to be as per the manufacturer's specifications.

The use of further admixtures will be subject to the approval of the Employer's Agent. The information listed in Subclause 3.5.1 shall be provided. "

ADD THE FOLLOWING NEW CLAUSE:

PSG 3.9 Curing compound

Curing compound shall be white pigmented natural resin based liquid curing compound complying with ASTM 309-74."

PSG 3.10 Precast paving slabs

The paving slabs shall comply with the requirements of SANS 541, shall be as billed and with patterned surface, or equal approved. Samples of the types which the Contractor proposes to use, shall be submitted for approval prior to construction.

PSG 3.11 Damp proof Membrane

250-micron thickness damp proof membrane complying with SANS 952, Type D.shall be used wherever shown on the drawing or specified by the Employer's Agent.

ADD THE FOLLOWING NEW CLAUSE:

PSG 3.12 Materials for building work

PSG 3.12.1 Cement

The requirements stipulated for subclause 3.2.1 and PSG 3.2.1 shall apply.

PSG 3.12.2 Sand

Sand for mortar shall comply with SABS 1090.

PSG 3.12.3 Bricks

Brickwork shall be built in stretcher bond. The walls shall be built to the dimensions shown on the drawings or ordered. All bricks shall be well soaked in water immediately before being laid and the previous course of bricks shall be well wetted before the laying of the following course.

Walls shall be carried up regularly so that no brickwork is more than 1m higher than adjoining brickwork.

All bricks shall comply with SABS 227 and shall be NFX burnt clay masonry units free of stones, cracks and other defects. The bricks shall be obtained from an approved manufacturer and samples of the bricks shall be submitted to the Employer's Agent for approval.

PSG 3.12.4 Mortar

Mortar shall comprise of the cement, lime and sand mixed in the proportions given below:

Cement:	50 kg
Lime:	0 – 40L
Sand:	130L (measured loose and damp)"

PSG 3.13 Classification of no-fines concrete

No-fines concrete shall be type NF19, the prefix denoting the size of the aggregate, namely 19mm.

Each size of aggregate shall be a single size aggregate graded in accordance with SABS 1083.

The volume of aggregate per 50kg of cement shall be 0,3m³."

ADD THE FOLLOWING NEW CLAUSE:

PSG 3.14 Materials for movement joints

PSG 3.14.1 General

The various jointing materials, the manufacturers of the materials and the methods of application shall be as approved by the Employer's Agent. Materials shall be stored and protected to avoid damage, degradation, distortion or contamination.

The joint materials shall be resistant to ultraviolet light and to biological degradation.

PSG 3.14.2 Waterstops

Waterstops shall be of approved manufacture and of the pattern and the material and widths billed and specified and shown on the drawings. They shall comply with the national standards, and have the appropriate physical properties as set out below:

	PVC	Rubber
Tensile strength (@ 25°C)	12,2 MPa	20,7 MPa
Elongation at break (@ 25°C)	250%	500%
Hardness BS degrees (IRHD @ 25°C)		60 to 650
Softness (BS)		28 to 520

All intersections between waterstops shall be prepared by mitring and welding/vulcanising intersection pieces in the factory in accordance with the manufacturer's instructions and to approval of the Employer's Agent. Only straight lengths of waterstop may be field welded using the appropriate jigs and tools.

Where required, waterstops shall have eyelets so that they may be tied securely to the adjacent reinforcement. "Rearguard"-type waterstops shall have flanges or cleats that grip effectively.

PSG 3.14.3 Fillers

Closed cell expanded polyethylene fillers shall comply with the following:

Property	Unit	Value Test Method
Density	kg/m³ 110	DIN 53420
Compression Stress at compression strains of 10% 25% 50%	 kPa 175 kPa 210 kPa 340	 DIN 53577 DIN 53577 DIN 53577
Compression set after 24 hours Recovery	% 14	
Tensile Strength	kPa 680	DIN 53571
Elongation at Break	% 49	DIN 53571
Max. water absorption after 24 hours by volume	% 0,1	ASTM C-177

Fillers shall be pre-cut to suit the application with a tear-out strip for forming the specified recess for the sealant. If so required, the filler shall be glued into position with an approved epoxy glue.

PSG 3.14.4 Bondbreakers, primers and sealants

The bond breaker (if specified) shall be self-adhesive PVC tape (or equal, approved material) with a width the same as the joint recess into which it is to be applied.

The primer, if required for the sealant, shall be fully compatible with the sealing compound that is to be used.

The elastomeric sealant shall be either a two-component polysulphide liquid polymer base complying with the requirements of SANS 110 or a polyethylene based polyurethane "pouring grade" for horizontal or near horizontal joints or "gun grade" for vertical/overhead joints and joints steeper than 1 in 10 to the horizontal. All elastomeric sealants shall comply with BS 4254 Type A1 and shall have a movement tolerance of 25%.

PSG 4 PLANT

PSG 4.1 General

ADD THE FOLLOWING SUB-CLAUSE:

PSG 4.1.1 Minimum Plant

The Contractor shall have the following minimum Plant available and in sound working order:

(a) Two concrete mixers, where required.
(b) Two weigh-batchers to supply the mixers.
(c) Four concrete vibrators, at least one of which 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 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 commencement of every major concrete-placing operation.

If the Plant used for placing concrete for the structure is electrically or mechanically powered, the Contractor shall also provide some other approved, non-electrically-powered standby means for placing concrete at an adequate rate in the event of a power or mechanical failure of the main Plant.

When the Contractor elects to place a crane inside the walls of the structure during the construction period, he shall communicate with the Employer's Agent in good time to ensure that the design and layout of the panels that form the roof slab and floor allow for such positioning of the crane. When sections of the roof and floor have to be redesigned to accommodate the crane, the redesign cost shall be borne by the Contractor."

PSG 4.3 & 4.4 Mixing plant and vibrators

REPLACE THE CONTENTS OF THESE SUBCLAUSES WITH THE FOLLOWING:

"Stand-by mixers and vibrators of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular mixers or vibrators or failure of the power supply."

PSG 4.5 Formwork

PSG 4.5.1 Design

ADD THE FOLLOWING:

"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 the methods he proposes to use to the Employer's Agent for approval. The Employer's Agent has the authority to order alterations to the design or the sizes of any part of the formwork or scaffolding. The Contractor shall check the safety and suitability of all such alterations. The fact that the Employer's Agent has approved or altered any part of the formwork of scaffolding shall not be construed as relieving the Contractor of his responsibility with regard to the strength and stability of the formwork or scaffolding."

PSG 4.5.2 Finish

ADD THE FOLLOWING:

If no formwork finish is indicated on the drawings then the concrete finishes shall be as follows:

CRITERIA	FINISH
Exposed walls	Smooth
Surfaces that will be buried	Rough

PSG 4.5.3 Ties

ADD THE FOLLOWING:

"No plugs, bolts, ties or clamps of any description used to hold the formwork will be allowed to project into or through the concrete unless expressly approved by the Employer's Agent.

The use of sleeves for formwork ties through the walls of water-retaining structures will not be permitted. Ties, when cast in, shall have some form of positive anchorage to prevent any rotation when loosening formwork.

Only approved tie-rods consisting of solid rods (that remain embedded in the concrete) and with removable ends shall be used to hold the formwork of the walls. The removable tie-rod ends shall facilitate removal without damage to the concrete, and no permanently embedded parts of such tie-rods shall have less than 50 mm of cover to the finished concrete surface.

The cavities left in the concrete when the tie-rod end cones are removed shall be soundly caulked with a cement mortar to which an approved shrinkage-reducing agent has been added, and shall be neatly finished to a smooth surface uniform with that of the surrounding concrete.

The cost of supplying special tie-rods as well as the filling of cavities left by the tie-rod cones shall be included in the rates tendered for formwork under the appropriate pay items.

On no account shall formwork be secured to reinforcing bars."

ADD THE FOLLOWING TO SUBCLAUSE 4.5:

PSG 4.5.4 Formwork: chamfers and fillets

All exposed external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered, but the top edge of a slab that is to receive an applied finish shall not be chamfered.

Internal corners in concrete work need not have fillets unless such fillets have been specified on the drawings or ordered by the Employer's Agent.

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

IN SUBCLAUSE 5.1.3(A) REPLACE THE words "bar or stirrup" *TO READ*: "bar, secondary reinforcement, tie, stirrup, tying-wire knots or wire ends".

ADD TO SUBCLAUSE 5.1.3: "Tying wire may not encroach on the specified minimum cover by more than a single strand thickness."

ADD THE FOLLOWING SUBCLAUS:

PSG 5.1.6 Spacers

Spacers of approved design include approved plastic or other proprietary spacers, or purpose made precast mortar blocks.

Where mortar blocks are used they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed. The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m³ and which are free from honeycombing. The mortar blocks shall be cured in water for at least 7 days. Blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Employer's Agent, will be rejected and shall be removed from the Site.

PSG 5.2 Formwork

PSG 5.2.1 Classification of finishes

(c) Special

ADD THE FOLLOWING:

"This finish is obtained by first giving the surface a smooth finish with the joints between formwork panels forming an approved regular pattern suitable for the appearance of the structure. All projections shall then be removed, irregularities repaired and the surface rubbed or otherwise treated until it is smooth with an even texture, appearance and colour.

If the finish of exposed surfaces does not comply with the requirements for uniformity of the texture and appearance, the Contractor shall, when instructed to do so by the Employer's Agent, rub down the exposed surfaces of the entire structure or any part thereof as specified below, entirely at his own cost. All repairs must be completed before the rubbing commences.

The surface shall be saturated with water for at least one hour. The initial rubbing of the face shall be carried out with a medium coarse carborundum stone together with a small amount of mortar of the same cement/sand ratio as the concrete being repaired. Rubbing shall continue until all form marks, projections and irregularities have been removed and a uniform surface has been obtained. The paste produced by the rubbing shall be kept in place. The final rubbing shall be carried out with a fine carborundum stone and water. This rubbing shall continue until the entire surface has a smooth, even texture and is uniform in colour. The surface shall subsequently be washed with a brush to remove surplus paste and powder."

PSG 5.2.2 Preparation of formwork

ADD THE FOLLOWING:

"Construction joints shall be positioned as shown on the Drawings."

PSG 5.2.5 Removal of formwork

ADD THE FOLLOWING NEW SUB-CLAUSE:

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 and slabs."

PSG 5.3 Holes, chases and fixing blocks

ADD THE FOLLOWING:

"Cover blocks for reinforcing and fixtures may be placed into the concrete provided that neither the strength nor any other desirable characteristic (such as the appearance) of the concrete section is affected or impaired in the opinion of the Employer's Agent."

PSG 5.5 Concrete

PSG 5.5.1.1 General

REPLACE THE CONTENT FOR THIS SUBCLAUSE:

The concrete mix design for strength concrete must be prepared in an approved laboratory and the results of actual test mixes must be submitted for approval together with 7-day and 28-day strength test results. Special attention is drawn to the fact that the concrete mix must provide a very dense and impervious concrete.

No concrete shall be cast until the mix designs have been approved by the Employer's Agent. The Employer's Agent may call for revised mix de signs at any stage during the Contract.

The relevant requirements of SPEC RC shall apply to all reinforced concrete water-retaining structures.

PSG 5.5.1 <u>Quality</u>

PSG 5.5.1.5 Durability

The exposure conditions of the reservoir concrete are classified as "severe".

PSG 5.5.1.6 Prescribed mix concrete

Notwithstanding the requirements of Subclause 5.5.1.6, samples of aggregates will not be made available by the Employer's Agent. The Contractor shall supply aggregates from commercial sources located by him, complying with the requirements of Subclause 3.4.1, for the production of prescribed mix concrete.

Unless otherwise directed by the Employer's Agent in writing, prescribed mix concrete shall

be mixed in the following proportions:

Grade	By mass			By volume		
	Cement	Sand	Stone	Cement	Sand+	Stone
30	1	2.2	2.9	1 sk$	0,08 m³	0,09 m³
25	1	2.5	3.2	1 sk$	0,09 m³	0,11 m³
20	1	2.9	3.6	1 sk	0,11 m³	0,13 m³
15	1	3.6	4.2	1 sk	0,14 m³	0,15 m³
10	1	4.5	5.0	1 sk	0,17 m³	0,17 m³

+ Assuming 5% moisture in sand

$ sk = 50 kg sack

PSG 5.5.1.7 Strength concrete

ADD THE FOLLOWING:

"The concrete mixes shall be designed by the Portland Cement Institute or a similar approved laboratory.

The minimum ordinary Portland cement content for strength concrete with a 28 day characteristic compressive strength of 25MPa and higher shall be 325kg/m³. The maximum ordinary Portland cement content shall be 400kg/m³ in reinforced concrete and 500kg/m³ in prestressed concrete.

The maximum water: cement ration shall be 0,55 for ordinary Portland cement."

PSG 5.5.2 Batching

Notwithstanding the requirements of this subclause, the method of batching shall be subject to approval. If volume batching is allowed, only full standard 50kg bags of cement may be used to make up a batch.

PSG 5.5.3 Mixing

PSG 5.5.3.2 Ready-mixed concrete

ADD THE FOLLOWING:

" The use of ready-mixed concrete will only be allowed if its test cubes on site is successful. The mix shall be produced from the proposed ready-mix facility and transported to the site by the proposed transporters."

PSG 5.5.5 Placing

ADD THE FOLLOWING:

"Concreting of the wall between horizontal construction joints shall be carried out in both directions from a point on the wall in order to close the gap with fresh concrete.

Structural concrete shall not be cast directly against the side of any excavation without the use of formwork unless prior approval has been obtained in writing from the Employer's Agent.

Concrete used in pipe trenches for encasement may be cast directly against the side of the excavation. Concrete for thrust/anchor blocks shall be cast directly against the side of the excavation."

PSG 5.5.6 Compaction

DELETE "or (if approved)…. by spading, rodding or forking" in the first sentence of subclause 5.5.6.3.

PSG 5.5.7 Construction joints

ADD THE FOLLOWING:

"Construction joints shall be limited to the minimum.

Horizontal construction joints are permitted in the structure walls in positions indicated on the Drawings or approved by the Employer's Agent. Vertical construction joints in the walls are subject to the written approval of the Employer's Agent and the cost of all such vertical or

horizontal construction joints will be deemed to be included in the rates for cast-in-situ concrete.

The construction joints in water-retaining structures shall be made strictly in accordance with the details shown on the Drawings. The joints between screeds and concrete floors shall be regarded as construction joints and the surface of the floor shall be prepared as described for construction joints.

Should the Contractor's method of construction necessitate the placing of a construction or other joint in a position not shown on the Drawings, such method of construction and position of the joint shall be approved by the Employer's Agent in writing. The cost of such joint shall be included in the tendered rates and shall include scabbling or the concrete where steel reinforcement is continuous.

The wall shall be cast in lifts of a height that permits each lift to be poured without interruption in one continuous operation during normal working hours.

It is the Contractor's responsibility to ensure that construction 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.

For construction joints at kickers all additional costs for concrete, preparation, etc. will be deemed to be included in the rates tendered for concrete in walls or sides and kicker joints or construction joints will not be measured separately."

PSG 5.5.8 Curing and protection

ADD THE FOLLOWING:

"The curing methods of retaining for formwork in place, covering with a waterproof membrane and use of a curing compound of the type specified in PSG 3.9 are strongly recommended. Concrete will not be paid for unless properly cured and proof of curing is continuously visible on site."

ADD THE FOLLOWING SUBCLAUSES:

PSG 5.5.8.1 Horizontal surfaces

Horizontal and near horizontal surfaces shall be treated in accordance with Subclause 5.5.8.

Other surfaces of the concrete shall be treated with a curing compound complying with PSG5-5.3.

PSG 5.5.8.2 Formed surfaces

In order to improve the effectiveness of the curing treatment, the specified minimum time for the removal of the formwork shall be four days.

PSG 5.5.8.3 Acceptance Criteria

Tests from a ready-mix plant of ready mixed concrete provided will not be acceptable for acceptance testing. All samples will be taken on-site, as close to the point of use as is practical.

PSG 5.5.8.4 Curing compound

Before any membrane curing compound is used, each batch shall be tested on a trial surface to ensure that it forms a satisfactory membrane, and any compound which is unsatisfactory in the opinion of the Employer's Agent, shall be rejected. Curing membranes will be disallowed if permanent discolouration of the concrete takes place. Surfaces where curing membranes are used shall be treated in such a manner that the final concrete texture and colour blends in with the rest of the concrete work. Furthermore, the Employer's Agent shall, at his discretion, require the Contractor immediately to adopt an effective alternative means of curing any area of the structure to which a membrane has been applied which, in the opinion of the Employer's Agent, is unsatisfactory. The curing compound used shall be to the approval of the Employer's Agent. Wax based curing compounds will not be permitted.

The curing compound shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, when the concrete has taken its initial set. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing

compound has been applied and the application rate shall be as approved by the Employer's Agent and rigidly applied by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape.

PSG 5.5.9.2 Hot weather conditions

No placing of concrete shall take place if the ambient temperature exceeds 32°C, or is likely to rise to above 32°C during the casting period or within eight hours after casting is completed.

PSG 5.5.10 Concrete surfaces

All unformed concrete surfaces shall, except where otherwise ordered, be given a steel float finish.

ADD THE FOLLOWING NEW SUB-CLAUSE:

PSG 5.5.10.4 Where the surfaces of the concrete are to be additionally hardened or protected the positions of such surfaces and the method to be used will be shown on the Drawings and will be scheduled. Materials or products with a ferrous content will not be allowed."

PSG 5.5.13 Grouting to Machine and Structural Bedplates

Replace Clause 5.5.13 with the following

"PSG 5.5.13.1 Materials

a) Water. Water for grout shall comply with the requirements given in Subclause 3.3 of SABS/SANS 1200G.

b) Aggregates. Notwithstanding the requirements of Subclause 3.4.1 of SABS/SANS 1200 G, the grading of fine aggregate (sand) and coarse aggregate (stone or pea gravel) shall conform to the gradings given in Tables 1 and 2, respectively, below.

c) Cement. Cement shall be ordinary portland cement.

d) Admixtures. Admixtures shall comply with the requirements of Subclause 3.5 of SABS/SANS 1200 G and shall have a proven record of satisfactory performance under conditions encountered in the Republic of South Africa.

e) Proprietary grouting materials. Unless otherwise approved by the Employer's Agent, proprietary grouting materials shall be obtained ready mixed in sealed pockets as supplied by the manufacturers.

TABLE 1 - SAND

1	2
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5	100
4,75	95-100
1,18	45-65
0,3 (300 µm)	5-15
0,15 (150 µm)	0-5

TABLE 2 – STONE OR PEA GRAVEL

1	2
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5	100
4,75	95-100
2,36	0-5

PSG 5.5.13.2 Preparation and procedures

a) Before a machine or structural bedplate is placed on the concrete the following steps shall be carried out:

1) All defective concrete, laitance, dirt, oil, grease, and loose material shall be removed from the concrete foundation by bush-hammering, chipping, or other means until sound clean concrete is obtained. The surface of the foundation shall be scrabbled, but shall not be so rough as to interfere with proper placing of the grout. All foundation bolt sleeves shall be cut out, or cut off flush if the sleeves cannot be removed. The top of the foundation shall be re-shaped if necessary.

2) The underside of each steel base, particularly in the bearing areas, shall be cleaned and any burrs and ragged edges removed before the base is placed in its final location.

3) All holding-down bolt sleeves shall be thoroughly cleaned of any materials that may prevent the grout from flowing freely to the bottom of the bolt sockets.

b) The base shall be properly aligned and levelled and shall be maintained in that position during grouting.

c) After the machine or structural bedplate has been placed the following precautions shall be observed:

1) Shimming shall be kept to a minimum. Steel plates shall be used for packing and shall be ground to the required thickness, where necessary.

2) Before grouting is started all loose dirt, oil, grease, and other foreign matter on the surface of the foundation, the undersides of bedplates, and in the bolt holes shall be removed by means of oil free compressed air or other approved means. The surface of the foundation slab shall be thoroughly saturated with clean water, and all free water shall be removed from the surface and the boltholes just before the grout is placed.

3) Grouting shall not be carried out until the alignment of all units to be grouted has been checked and approved by the Employer's Agent.

4) Special care shall be taken with grouting in hot or cold weather to ensure proper setting and gain of strength and, in the case of proprietary grouting materials, by having ice or hot water available, as the case may be, in accordance with the instructions of the manufacturer.

Enclosures shall be provided for the grout such that, until it has set, its temperature will be in the range 15 - 27ºC.

Shields to protect the grout from the sun and from hot winds shall be provided by the Subcontractor when so ordered.

PSG 5.5.13.3 Formwork

Formwork for grouting shall comply with the applicable requirements of Subclause 5.2 of SABS/SANS 1200 G. Forms shall be caulked where necessary. Adequate clearance between forms and bedplates shall be provided to enable the grout to be worked into place.

PSG 5.5.13.4 Mixing (all free-flowing grouts except epoxy grouts)

The grout shall be mixed to a homogeneous uniform mixture and delivered ready for placing at a temperature between 15ºC and 25ºC.

The materials and water shall be mixed in a mortar mixer for at least 3 min or, in the case of small jobs only, shall be thoroughly mixed by hand, the entire mass being turned over enough times to ensure even distribution of its components.

The mixing shall be done as close as possible to the place(s) where the grout is placed.

No more grout shall be mixed at any one time than can be placed in a period of 20 min. After the grout has been mixed it shall not be re-tempered by the addition of water.

PSG 5.5.13.5 Grouting (all free-flowing grouts except epoxy grouts)

The grout shall be placed quickly and continuously to avoid the undesirable effects of over-working. (These effects are segregation, bleeding, and breaking-down of initial set). The method of placement shall be subject to approval. The means of placing the grout shall be such that the grout will completely fill the space to be grouted, will be thoroughly compacted, will be free of air pockets, and will have evenly distributed contact over an area in excess of 80% or, in the case of expanding grout, 95% of the bearing area of the item to be supported.

Where practicable, grout shall be placed from one side only and where this is not practicable, care shall be taken to ensure that any entrapped air is released.

After the grout has taken its initial set,

a) the forms shall be removed;

b) excess grout shall be so cut away as to leave a smooth and neatly finished job;

c) except where the grout is intended to provide resistance to side thrust, all edges shall be trimmed at 45º to the vertical, from the bottom edge of the bedplate; and

d) all excess grout on or about the bedplates shall be removed.

Damage to paintwork, if any, shall be repaired within 24 hours.

Packing plates, shims, and other leveling devices shall remain in position.

PSG 5.5.13.6 Dry-packed grout (standard dry sand and cement grout)

Dry-packed grout shall have a minimum compressive strength at 28 d of 20 MPa. The quantity of water added after placing shall be kept to a minimum consistent with placing conditions, and the cement, sand and, where applicable, pea gravel proportions by mass shall be as follows:

a) Where the clearance between bedplate and foundation is 25 mm or less: 1 part of Portland cement, and 2 parts of sand; and

b) Where the clearance exceeds 25 mm: 1 part of Portland cement, 1 part of sand, and 1 part of pea gravel.

Dry-packed grout shall be rammed by means of tamping rods against formwork placed along three sides of the bedplate.

PSG 5.5.13.7 Non-shrink grout with metallic aggregate

The manufacturer's instructions shall be observed when non-shrink grout with metallic aggregate is used.

Where the clearance between the bedplate and the foundation is less than 50 mm a sand-based mix shall be used. Where the clearance exceeds 50 mm the Employer's Agent may order a mix with a base of sand plus pea gravel to be used.

PSG 5.5.13.8 Expanding grout with powdered aluminium additive

The manufacturer's instructions shall be observed when an expanding grout with powdered aluminium additive is used.

Where the clearance between the bedplate and the foundation is less than 25 mm, a sand-based mix shall be used.

Where the clearance exceeds 25 mm the Employer's Agent may order mix with a base of sand plus pea gravel to be used.

Each batch shall be mixed for at least 6 min after the powdered aluminium has been added. Where a ready-mixed grout is used, the powdered aluminium shall be added at the placing site and the batch mixed as specified in PSG 5.5.13.4. Grout shall be placed within 45 min after the addition of the powdered aluminium.

The Contractor shall not use powdered aluminium additive when the ambient temperature is below 5ºC.

PSG 5.5.13.9 Epoxy grout (epoxy mortar type only)

The manufacturer's instructions shall be observed when an epoxy grout is used.

PSG 5.5.13.10 Testing

The Contractor shall, where so ordered, carry out a site test for each grouting procedure and each grouting gang to be used. The tests shall be carried out on a dummy bedplate similar in configuration to that, which is to be grouted, but not exceeding 1 m^2 in area unless otherwise ordered. When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80% with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95%. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Employer's Agent.

The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and subject them to compression tests to determine whether the specified strength has been achieved. Test procedures shall comply with the relevant requirements of Subclauses 7.2.1-7.2.3 of SABS/SANS 1200 G."

PSG 5.5.14 Defects

ADD THE FOLLOWING TO SUBCLAUSES 5.5.14:

All defects shall be repaired as soon as possible after the formwork has been removed and the Employer's Agent has inspected the concrete. A statement of the method to be used for each repair shall be submitted to the Employer's Agent for his approval before any work is carried out. The Employer's Agent may prohibit the further placing of concrete in the particular area concerned until he is satisfied that the repair has been satisfactorily executed.

ADD NEW SUBCLAUSES TO CLAUSE 5.5.14:

PSG 5.5.14.3 Prevention and repair of plastic shrinkage cracks

The Contractor shall take whatever measures are necessary to prevent plastic shrinkage cracking in the concrete. Particularly on dry windy days or hot sunny days the Contractor shall make provision for fine spraying of the concrete surface with water within one hour of casting or covering of the concrete with black plastic sheeting. It may be necessary to change the aggregates or the concrete mix proportions.

ADD THE FOLLOWING NEW SUB-CLAUSES:

PSG 5.5.16 Soilcrete

Where soilcrete is specified for filling under floor slabs, the soilcrete shall comply with the requirements of subclause PSDB 3.5 (c) of section 1200 DB as amended and shall be placed as specified in the subclause."

PSG 5.5.17 Brickwork

Brickwork shall be built in stretcher bond to the dimensions shown on the drawings. All bricks shall be well soaked in water immediately before being laid and the previous course of bricks shall be well wetted before the laying of the following course."

PSG 5.5.18 Plasterwork

Plasterwork shall consist of a single coat, comprising one application of a 1:6 cement: sand mixture with a wood float finish. The thickness of the plaster shall be between 13 and 20 mm. All plaster shall be finished smooth, shall be plumb and corners shall be rounded and square."

PSG 5.5.19 No-fines concrete

PSG 5.5.19.1 Batching and mixing

Cement shall be measured by mass or full bags of 50kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The quantity of water added shall be just sufficient to form a smooth grout that will adhere to and completely coat each and every particle of aggregate and that is just wet enough to ensure that at points of contact of the aggregate the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 ℓ of water per 50kg of cement.

Mixing shall be carried out in an approved batch-type mechanical mixer, but small quantities may be hand mixed.

PSG 5.5.19.2 Placing

No-fines concrete shall be placed in accordance with the procedure approved by the Employer's Agent. It shall be placed in its final position within 15 minutes of having been mixed.

The concrete shall be worked sufficiently to ensure that it will completely fill the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping or ramming shall be avoided and under no circumstances shall the concrete be vibrated.

PSG 5.5.19.3 Protection

All no-fines concrete shall be protected from the elements and loss of moisture. Protection

against loss of moisture shall be accomplished by one or more of the following methods:

(a) Retaining formwork in place

(b) Covering exposed surfaces with sacking or other approved material kept continuously wet

(c) Covering exposed surfaces with plastic sheeting

No-fines concrete placed during cold weather shall be adequately protected against frost for at least 3 days."

ADD NEW SUBCLAUSES AS FOLLOWS:

PSG 5.6 Holding Down Bolts for Equipment

The treatment-plant/pump Contractor will supply all holding-down bolts for all items of plant and penstocks together with all dimensions and other details necessary for the construction of the pedestals and holding-down bolt pockets, or the fixing of the bolts. The Contractor shall either form pockets or cast in the bolts, as ordered. The items of plant will be aligned and levelled on site by the plant Contractor (by means of metal blocks and shims under the base at the anchor studs and also midway between studs in the case of heavy equipment) and, after the Employer's Agent is satisfied with the alignment and the level of each unit, the Contractor shall grout up the units solidly by filling the voids inside and under the baseplate with an approved non-shrink grout."

PSG 5.7 Casting pipes and specials in concrete

Where the pipe or special is supplied by others the Contractor shall provide a box-out in the wall and cast the unit in at a later stage. When constructing such box-outs reinforcement shall not be cut but shall run through the opening. Reinforcement shall be cut and/or bent out at a later stage to suit the item being cast in. After installation of the item the remaining reinforcement shall be bent back in position.

Where entry holes for pipes/specials have been provided in the walls, the Contractor shall be responsible for the concreting in of such pipes/specials regardless of whether or not these have been supplied by himself.

Before commencing the positioning in holes of any pipes/specials the Contractor shall:

a) remove all formwork and boxing remaining in the holes;

b) make any alterations required to the position and shape of the holes and cut reinforcement to suit the item, as directed by the Employer's Agent; and

c) thoroughly scabble the sides of the holes so as to obtain a satisfactory bond surface for the new concrete and treat the surface as specified in Subclause 5.5.7.3.

Immediately prior to concreting being carried out by the placing of mortar and concrete around the pipes, the surface of the existing concrete shall be saturated with water. All surplus water shall be removed and the surface covered with a layer, approximately 12 mm thick, of mortar made of the same mix as the concrete in which the pipes/specials are to be placed.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. The concrete shall be carefully worked around the puddle flange, if any, and the pipe barrel or body of the special, and shall be vibrated in layers so as to obviate a falling away from pipe/special surfaces of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass.

PSG 5.8 Fixings for items supplied under this Contract

Holding down bolts or other fixings required for the installation of items supplied under this Contract shall be provided by the Contractor. These fixings shall be cast in or grouted into pockets or installed by other means as approved by the Employer's Agent.

Where anchor bolts are used which are installed into holes drilled into concrete or masonry these shall be of a type approved by the Employer's Agent. All such bolts used shall be manufactured from stainless steel or a metal with a resistance to corrosion equal to that of grade 304 stainless steel. No GMS in close proximity to stainless steel will be permitted.

Anchor bolts shall have minimum pull-out forces and minimum ultimate lateral loads at least

equal to those specified below:

Specified Anchor Size	Minimum Pull-out Force (kN)	Minimum Ultimate Lateral Load (kN)
M6	10,35	7,60
M8	13,70	11,15
M10	19,44	15,95
M12	31,85	26,90
M16	50,45	45,80
M20	60,50	71,20

PSG 6 TOLERANCES

PSG 6.2 Permissible deviations

ADD THE FOLLOWING:

Degree of Accuracy II shall apply except that abrupt changes in a continuous surface shall not be more than 3 mm.

PSG 7 TESTS

PSG 7.1 FACILITIES AND FREQUENCY OF SAMPLING

PSG 7.1.1 Facilities

ADD THE FOLLOWING:

"The Contractor shall provide sufficient storage capacity for the concrete cubes and shall arrange to have them tested 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 7.1.2 Frequency of sampling

REPLACE CALUSE 7.1.2.2

At least 2 sets of samples shall be taken from each days casting and from at least every 35m^3 of concrete of each grade placed. Each specific section poured is required to have a minimum of 2 samples taken even if the grade of concrete is the same. E.G. if columns and walls are casted on the same day, each is required to have a minimum of 2 samples taken.

Notwithstanding the requirements of this subclause, the Contractor shall take note that he is responsible for taking an adequate number of tests to ensure that the concrete being used complies with the specification. The Employer's Agent will only carry out such control testing as he requires.

PSG 7.2.4 Early strength testing of concrete in wall panels

Two samples of the concrete used in the construction of the wall panels shall be tested prior to lifting of the panels.

Where lifting frames are not used the lifting of the panels will not be allowed unless an average strength of 25 MPa has been achieved.

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."

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.1 Measurement and rates

PSG 8.1.1 Formwork

Notwithstanding the method of measuring and paying for formwork specified in Subclauses 8.1.1, 8.1.2.1and 8.1.2.2,formwork will be measured per square metre.

This item in the bill will cover the cost of kickers, supply, delivery, placing, removal of formwork including all operations involved in this work.

PSG 8.3.1 Reinforcement

REPLACE THE CONTENTS OF THIS CLAUSE 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 authorised by the Employer's Agent.

Clips, ties, separators, stools and other steel used for positioning reinforcement will not be measured, unless these are 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 8.3.2 Mesh

REPLACE THE CONTENTS OF THIS CLAUSE WITH THE FOLLOWING:

The unit of measurement for welded mesh shall be square meter of fabric reinforcement in place, and the quantity shall be calculated from the net area covered by the mesh, excluding overlaps.

The tendered rate shall include full compensation for the supply, delivery, cutting, bending, welding, placing and fixing of the mesh, including all tying wire, stools, supports and waste."

PSG 8.4 Concrete

PSG 8.4.2 Blinding layer

REPLACE THE CONTENTS OF THIS CLAUSE WITH THE FOLLOWING:

The unit of measurement for blinding layer shall be square meter, and the quantity shall be calculated from the dimension given on the drawings.

The tendered rate shall include full compensation for the supply, delivery, cutting, bending, welding, placing and fixing of the mesh, including all tying wire, stools, supports and waste."

PSG 8.4.3 Strength concrete grade

The rates for concrete shall also cover:

- The cost of the preparation of design mixes by an approved laboratory and submission for approval by the Employer's Agent (see PSG5-5-1-1);
- The cost of non-designated joints (see PSG5-5-7-2);
- Screeded finish of unformed surface as specified in PSG5-5-10-2;
- Chamfers and fillets (No additional payment will be made for chamfers and fillets up to 40 mm wide);
- Holding down bolts, the rate shall cover the cost of supplying and installing the bolts including all things necessary to ensure that the bolts are effectively and rigidly held in position during casting, complete with sleeved pockets, all as detailed on the drawings;
- The supply and floating in of grout under the plates to ensure solid and complete filling of the gap; and
- The rate shall cover the cost of compacting the area, application of weed-killer, supplying, laying and bedding the slabs, grouting the joints and filling any gaps, all as specified.

PSG 8.4.4 Unformed surface finishes

The rates for unformed surface finishes shall cover the cost of providing the respective surface finish as specified in PSG5-5-10.

The rate shall cover the cost of the supply and floating in of grout under the plates to ensure solid and complete filling of the gap.

The rate shall cover the cost of compacting the area, application of weed-killer, supplying, laying and bedding the slabs, grouting the joints and filling any gaps, all as specified.

PSG 8.4.5 Aggregates.....Unit:m^3

ADD THE FOLLOWING:

The rate shall cover the cost of supplying, laying and tools and labour involve for ths work.

PSG 8.4.7 Additives

This item is measured per cubic meter.

The rate shall cover the cost of supplying and tools and labour involve for ths work.

PSG 8.5 Joints Unit: m

Only designated joints as shown on the drawings will be measured for payment according to the length of each type of joint constructed (see PSG5-5-7). The rate shall cover the cost of all materials, labour and plant required to construct each type of joint specified on the drawings, including the cost of all shuttering, treatment of the joint as specified in Subclause 5.5.7.3, the provision of chamfers as specified where concrete is exposed, as well as testing and repairing where necessary.

Non-designated joints will not be measured for payment.

PSG 8.9 Water tightness tests

The water tightness test of water retaining structures will be paid by a lump sum separately for each structure.

The sum shall cover the cost of all labour, equipment and materials to carry out the tests, as specified hereafter, to rectify faults and to achieve a test result to the satisfaction of the Employer's Agent.

Water shall be provided free of charge for one filling of the structure. The sum shall include for all water required over and above that required for one filling of the water retaining structure.

Test

The structure shall be cleaned and initially filled with the specified water at a uniform rate that does not exceed 2m in height every 24hours. Structures shall not be backfilled unless specified.

When first filled, the water level shall be maintained by the addition of further water for a stabilizing period of 7 days while absorption and autogenic healing takes place. After the stabilizing period, the level of the water surface shall be recorded at 24 hour intervals for a test period of 7 days. During this 7 day test period, the total permissible drop in water level shall not exceed 1/500 of the average water depth of the full tank or 10mm, whichever is less.

Notwithstanding the satisfactory completion of the test, any evidence of seepage of water to the outside faces of the structure or intensified flow of the underfloor drainage system shall be assessed against the requirements of the specification. Any necessary remedial treatment of the concrete to the cracks of joints shall, where applicable, be carried out from the internal water face. When a remedial water lining is applied to inhibit leakage at a crack it shall have adequate flexibility and have no reaction with the stored water.

Where the structure fails the to satisfy the 7 day test then, after completion of the remedial work, it shall be refilled and a further 7 day test undertaken in accordance with this clause.

PSG 8.10 Disinfection of potable water retaining structures

Water retaining structures shall be disinfected in the same manner as potable water pipelines. The Employer's Agent is to confirm the availability of water for disinfection. The disinfection shall take place before testing of the structure commences. The disinfection shall take place in the following manner if there is adequate water available,

A) The structure shall be flushed out with clean water until all sediment and foreign matter is removed.

B) The structure shall be filled with a solution of calcium hypochlorite at 0.15g/l at the adding rate of not more than 2m per 24hours and allowed to stand for 24 hours.

C) The reservoir shall be emptied and sprayed internally with clean water and the walls

broomed down to remove the solution from the walls.

In the case of water unavailability for disinfection, the reservoir will be sprayed internally with a high-pressure cleaner and the walls, columns and floor scrubbed with the calcium hypochlorite solution by means of stiff brooms. After completion of this step C applies again.

PSHC CORROSION PROTECTION OF STRUCTURAL STEEL. (SANS 1200 HC)

PSCH 5 CONSTRUCTION

PSHC 5.3 Dressing and repairs during fabrication

All sharp edges will be ground to a smooth radius of at least 1 mm.

PSHC 7 TESTING

PSHC 7.2 Inspection by the Employer's Agent

The Employer's Agent will be afforded the opportunity to inspect steel works before it is hot dip galvanized.

PSL MEDIUM PRESSURE PIPELINES

PSL 1 SCOPE

Add to sub-clause 1.1 "Drawings numbered L1, L2 and L3 are withdrawn and replaced by the Standard Detail drawings as depicted in the Employer's Agent's drawings.

PSL 3 MATERIALS

PSL 3.3 CI pipes fittings and specials

ADD: "All cast iron fittings to be lined with cement mortar or coated with Rilsan or Fusion-Bonded Epoxy (FBE)".

PSL 3.4 Steel pipes, fittings and specials

PSL 3.4.1 General

ADD TO THIS SUBCLAUSE THE FOLLOWING:

Steel pipes shall be manufactured as specified in BS 534. Steel plate to BS 4360 Grade 43A is acceptable. The manufacturer of the pipes shall submit to the Employer's Agent the steel maker's certificates covering all steel used as required in Clause 3.4 of SANS 719.

The steel pipes shall be manufactured exclusively at the works of such manufacturers as may be approved by the Employer's Agent and at only one works unless otherwise agreed by the Employer's Agent in writing.

PSL 3.4.4 Fittings and Specials

ADD TO CLAUSE 3.4.4 THE FOLLOWING:

"All fasteners used for stainless steel specials will be of the same grade of stainless steel as the specials."

PSL 3.7.1 Other types of pipes

REPLACE 3.7.1 WITH THE FOLLOWING:

1. uPVC pipe shall comply with ISO 4422 (SANS 966 Part I) specifications
2. mPVC pipe shall have a working stress not exceeding 17.5MPa for pipes 110mm diameter and larger and not exceeding 12.5MPa for pipes smaller than 110mm diameter and shall comply with the requirements of SANS 966 Part II.
3. HDPE pipe shall comply with ISO 4427 (SANS 533) specifications.
4. The minimum working pressure for plastic pipes shall be 9 Bar.

PSL 3.7.1.1 *ADD*: "Potable Water and Return Effluent mPVC pipes which are laid across roads for future reticulation are to be comply with the following;

1. All pipes to be installed in the same directions for tie-ing up with future reticulation to ensure extension of the pipe network (plain ended and socket ends tie up with other

pipe crossings and or reticulations – keep plain ended and socket ends going in the same direction);

2. Pipes under roads **not to** be cut and full length pipes to be installed. For example 3 full pipe lengths of 6 metres = 18 metres even though the drawings may request pipes to extend 1 m beyond kerbs etc., therefore ensuring that male and socket ends are retained for future extensions (**Socket end not to be cut)**;

3. Pipe ends to be closed with two layers of 0.5-micron polyethylene sheeting at least 500 mm wrapped from the pipe end and taped to ensure tight fit around the pipe barrel; and

4. Trenches to be backfilled with granular material as specified for bedding as per SABS1200 LB to at least 300 mm above pipe barrel.

PSL. 3.7.1.2 Hydrants shall be of the underground screw down type with an overall maximum height of 320 mm and rising spindle. The hydrant shall be opened by rotating the spindle in an anti-clockwise direction. The outlet connection shall be of the London Round Thread type. The hydrant must conform to SABS 1128: Part 1-1977.

PSL 3.7.1.3 Provide an anchor block to the Fire hydrant T-piece as specified on the drawings.

PSL 3.7.3 FC Pipes and Specials

ADD THE FOLLOWING:

FC pipes are not approved for this project.

PSL 3.8 Jointing materials

PSL 3.8.3 Flanges and Accessories

REPLACE SUB-CLAUSE 3.8.3 WITH THE FOLLOWING:

" Flanges shall comply with SANS 1123 and have a minimum working pressure of 1 600 kPa, except where otherwise indicated. Holes shall be drilled to Table 1600/3 of SANS 1123.

Any item of pipework or special or valve of which the flanges are incorrectly drilled, will be rejected. The reaming of bolt-holes to oversized dimensions to enable a particular item to fit will not be allowed.

All flanges shall be provided complete with bolts, nuts, washers and rubber O-rings or fibre insertions, as appropriate. Rubber O-rings dimensioned in accordance with DIN 2514 specification shall be supplied to suit suitably machined flanges. Compressed asbestos fibre insertions shall be not less than 1,5 mm thick and shall comply with BS 2815 Grade B."

PSL 3.8.4 Loose Flanges

With regard to sub-clause 3.8.4 the following standard shall apply:

"Bolts and nuts shall comply with requirements of SABS 135."

PSL 3.9 Corrosion protection

PSL 3.9.1 <u>CI pipes</u>

Notwithstanding the provisions of this subclause, all CI pipes, fittings, specials, valves, meters and hydrants shall be coated internally and externally using "Rillsan". The coating shall be 250 – 300 microns thick and shall be applied by an approved applicator. Fusion bonded epoxy (FBE) coating applied internally and externally to SABS 1217 or DIN 30677 will also be accepted.

PSL 3.9.2 <u>Steel pipes</u>

Notwithstanding the provisions of this sub-clause, all steel pipes and specials to be installed shall be heavy duty hot dipped galvanized complying with the requirements of SABS ISO 1461 and shall **<u>not</u>** be passivated. Further machining, cutting or welding after hot dip galvanizing will not be allowed.

After the galvanizing process, all steel pipes and specials shall be cleaned, scrubbed and washed down firstly with a suitable solvent and then with clean water. Immediately thereafter, the pipes and specials shall be internally and externally FBE coated or

equivalent approved as scheduled below, all in accordance with the manufacturer's instructions.

Coat	Product	DFT (µm)		
		Min	Nominal	Max
1	Holding Primer Sigmacover or approved equivalent	45	50	75
2	Sigma TCN 300 (Brown) or approved equivalent	125	150	175
3	Sigma TCN 300 (Black) or approved equivalent	125	150	175
Total DFT		295	350	425

All coats shall be in contrasting colours and no DFT reading may be less than nor more than the minimum and maximum values specified. The overall average DFT shall not be less than the nominal DFT specified.

Application shall be by airless or conventional pressure pot spray systems and thinners shall be used strictly in accordance with the manufacturer's instructions. All critical areas like edges and welds shall be given an extra stripe coat.

Note:

The drilling patterns for flanges shall be SABS 1123 Table 1600/3 and all pipes, specials and fittings shall be supplied complete with all necessary stainless steel bolts, washers and nuts as well as appropriate insertion pieces applicable to diameter and material.

PSL 3.9.2.2 Fusion bonded epoxy

REPLACE (b4) WITH THE FOLLOWING:

Fusion bonded epoxy (FBE) coating shall comply with the provisions of SANS 1217 as for a Type 2 powder coating which shall apply mutatis mutandis to the coating of fittings.

Such coating may only be done in a shop with a known or proven proficiency in such type of work.

The entire surface to be coated must be free of dust and moisture and must comply with the provisions of Subclause 4.1.1 of SANS 1217. The total dry film thickness shall be at least 400 micrometres (+ 50 micrometres).

The sealing area of the flanges shall be treated to a dry film thickness of 150 micrometres (+ 25 micrometres) (i.e. masked off before the second coat is applied).

The painting shall be such that all trimmings are covered by paint for a distance of at least 5 mm to discourage bi-metal corrosion.

No field repairs of damaged paint areas will be allowed.

PSL 3.9.3 Protection against Electrolytic Corrosion

ADD THE FOLLOWING:

All buried flexible couplings or flanges incorporating mild steel components shall be wrapped in the following manner.

The joint shall be cleaned and primed in accordance with the manufacturer's instructions, packed with petrolatum paste (Denso S105 or equal approved) and wrapped with petrolatum tape, care being taken to eliminate all voids to achieve a smooth profile.

Thereafter the joint shall be wrapped with medium-duty PVC backed adhesive tape providing a 50% overlap to 100mm beyond the petrolatum tape.

PSL 3.9.6 Corrosive Soil

ADD TO SUB-CLAUSE 3.9.6:

"The soil within the Municipal area is classified as corrosive. All metal flanged joints, saddles, bolts and nuts shall be protected by means of Denso paste and then wrapped to give a covering of at least three layers of Denso- impregnated tape or other means of inhibiting corrosion approved by the Employer's Agent or the Employer's Agent's Representative".

PSL 3.10 Valves

DELETE THE CONTENTS OF THIS SUB-CLAUSE AND REPLACE BY:

PSL 3.10.1 Gate valves

Gate valves shall comply with SANS 664 to the pressure rating as specified, shall carry the SANS mark, clockwise closing, with non-rising spindle, and shall be drop-tight when tested in accordance with BS 5163. The direction of closing must be shown clearly on the valve. The design of the stuffing box shall be such that the O-rings can be replaced while the valve is in service without having to remove the valve dome.

Gate valves shall be fitted with cap-tops and shall be either flanged or spigotted as billed. Gate valves shall be supplied with couplings and all materials necessary for complete installation.

Gate valve type: In line valve – RSV.

Scour valve – wedge gate/waterworks pattern.

PSL 3.10.2 Air valves

Vent-O-Mat Series RBX Double-Orifice (or equal, approved), suitable for a working pressure of 2 500 kPa and 4 000 kPa, shall be used.

PSL 3.10.3 Flow switch

SERIES V4 Flotect® Flow Switches or equivalent approved by the Employer's Agent, suitable for a working pressure up to 69 bar.

PSL 3.10.4 Pressure Switch

SERIES DA/DS or equivalent approved by the Employer's Agent.

PSL 3.10.5 Non return valve

Cast iron flanged swing check valve with fitting up to PN16. Testing shall conform to BS 6755

PSL 3.10.6 Strainer

Model 70F or equivalent approved by the Employer's Agent. The valve should comply with the following specification:

- Stainless steel basket/ screen
- Steel cover
- should be coated Fusion Bonded Epoxy, RAL 5005(blue)

PSL 3.10.7 Flow meter

Standard & BFM Series/ ANSI FLANGED 150/300 class -DIN PN16 or approved equivalent by the Employer's Agent. The installation for this valve should comply with the specification.

PSL 3.10.9 Pressure gauge

316 Stainless Steel Bourdon Tube Pressure Gauge is recommended for corrosive environments and corrosive and corrosive Liquid media. Suitable for pressure up to 20 bar.

PSL 3.11.5 Manhole covers and frames

The requirements of the subclause shall apply, except that the type of cover and frame to be used shall be as detailed as called for on the Drawings.

PSL 3.11.6 Surface Boxes

All surface boxes shall be as specified and detailed on the Drawings.

PSL 5 CONSTRUCTION

PSL 5.1 Laying

PSL 5.1.1 General

ADD TO SUB-CLAUSE 5.1.1:

"The centre line of the pipeline shall normally be 2,5m from the road reserve boundary inside the road reserve. The pipeline is to be laid continuously and leaving gaps for fittings will not be allowed.

For mPVC pipelines, the pipe shall be laid to within 2,0m of the connection point. For HDPE pipelines the Contractor is to lay at least 300mm past the connection point.

PSL 5.1.3 Keeping pipelines clean

ADD TO SUB-CLAUSE 5.1.3:

Unless otherwise directed by the Employer's Agent, the Contractor shall, when filling the pipelines with water for the first time, use suitable pipe pigs driven by a flush of water to aid the cleaning of all sections of the pipeline(s). If necessary, the pig shall be passed through a section more than once. If necessary, the Contractor shall install special temporary fittings in the pipeline for the insertion and recovery of the pigs. Such temporary fittings shall be removed after the pipeline has been cleaned to the satisfaction of the Employer's Agent. The Contractor shall satisfy the Employer's Agent that every pig inserted into the pipeline is recovered after use.

PSL 5.1.4 Depths and Cover

Unless otherwise shown on the drawings or instructed by the Employer's Agent, cover to pipes shall be as follows:

<u>During Construction:</u>

Where construction traffic is liable to cross over pipes, they shall be laid so that there is not less than 0,75m of cover over the pipe. Road crossings shall be constructed after the construction of the road layers has reached the stage where 0,75m cover is available.

<u>Pipes beneath Verges and Open Spaces:</u>

The tops of pipes beneath verges shall be not less than 1,0m and not more than 1,25m below the final verge level.

<u>Supply Connection:</u>

The tops of pipes shall not be less than 450mm and not more than 600mm below the final road surface.

<u>Pipes beneath existing roadways:</u>

The tops of pipes beneath a road shall not be less than 1m and not more than 1,25m below the road level.

<u>General</u>

Generally, cover to pipe shall be 0.6m, except where shallow pipe is encased in concrete or where pipe is laid deeper to avoid excessive air-locks.

PSL 5.2 Jointing method

PSL 5.2.2 Flanged (Steel Pipelines)

ADD TO SUBCLAUSE 5.2.2:

All insertion gaskets shall cover the full face of the flange.

ADD TO CLAUSE 5.2:

PSL 5.2.5 Joints for fittings

All plain ended valves and specials shall be jointed into pipelines using fittings as shown on the drawing or specified by the Employer's Agent.

PSL 5.3 Setting of valves, specials and fittings

ADD TO CLAUSE 5.3:

"The hydrant shall be bolted to the tee such that the outlet is in line with the pipeline. Valves shall be positioned opposite the erf splay peg at intersections.

Upon completion of the Works all gate valves in the reticulation (other than scour valves) shall, unless otherwise instructed by the Employer's Agent, be left in the "open" position by

the Subcontractor."

PSL 5.6 Valves and hydrant chambers

Valve chambers shall be constructed in accordance with the details shown on the drawings.

PSL 5.10 Disinfection of pipelines

Notwithstanding the requirements of Subclause 5.10, the Contractor shall disinfect the pipelines before testing and before connecting into the reservoirs or the reticulation.

ADD THE FOLLOWING NEW CLAUSES:

PSL 5.11 Markers for valves

After backfilling of trenches and final levelling of the site the pipeline routes shall be accurately located using the pipeline markers. Pipeline markers shall be constructed using pre-cast concrete lintols as per drawing details. Markers shall be 750 mm high and properly secured 750 mm deep into the ground. The pipeline markers shall be placed 300 mm to the right of the line in the direction of flow and at each change of direction and within sight distance from one to the next.

Markers for valves are to be supplied and placed by the Contractor."

PSL 5.12 Flexible connections at structures

In order to avoid damage to pipes due to differential movement where the pipes enter chambers or other structures, all rigid pipes built, cast or grouted into such structures shall be provided with flexible connections to the type details shown on Drawing LD-2 of SANS 1200 LD.

PSL 6 TOLERANCES

PSL 6.2 Control points

ADD : "Valves shall be located as indicated on the plan layout opposite the boundary peg of the erf, and to within a longitudinal tolerance of 100mm."

PSL 6.3 Alignment (plan and level)

ADD TO LAST SENTENCE: ", provided this does not result in a reversal of the grade of the pipeline."

PSL 7 TESTING

PSL 7.3.3 Permissible Leakage Rates

ADD: "See standard drawings PSL 5/1 and PSL 5/2 for tables of permissible leakage rates for uPVC, mPVC, AC and HDPE pipes. When testing pipe system made up of different types of pipes, the arithmetical sum of the respective calculated leakage rates for the various pipe types, diameters and lengths shall be taken as the maximum allowable leakage. Alternatively, the Contractor may request that each section be tested separately in which case the additional tests, witnessing and connecting fees shall be at his expense."

ADD THE FOLLOWING NEW CLAUSES:

PSL 7.3.4 Witnessing of a Successful Leakage Test by an Official of The Water Division

The Contractor shall take note that the Employer's Agent's Representative is required to witnesses a successful leakage test of the whole new reticulation being put forward for acceptance.

PSL 7.3.5 Removal of Test Equipment

Upon the successful completion of the leakage test the new pipe system will be deemed to be Clients property and the Contractor shall not carry out any work on the pipes apart from the disconnection of his pump (but not his flange and pipe system from the hydrant tee), the completion of the backfilling to the pipeline and construction of the hydrant and valve chambers. The completion of backfill at the connection points and the surface restoration/reinstatement shall be carried out by the Contractor.

PSL 7.3.6 Testing of pipes laid under roads for future reticulation

The Potable Water and Return Effluent pipes that are required to be laid across the roads

for future reticulation are to be air tested.

PSL 7.5 Defects liability period

Should leaks or defects develop during the Defects Liability Period they shall be rectified by the Contractor. This will include the cost of re-testing and subsequent sterilization. During the Defects Liability Period the municipality may carry out further pressure tests on the whole or part of the new reticulation and any necessary remedial work shall be carried out at the Contractor's expense."

PSL 7.5 Restriction on length of open trench

The restrictions pertaining to the maximum allowable length of open trench as contained in SDDB5.11 may result in certain lengths of the pipeline being backfilled before they can be tested as specified in Clause 7. The pipeline may be tested in short sections provided the method of such testing is approved by the Employer's Agent.

PSL 8 MEASUREMENT AND PAYMENT

PSL 8.1 General

REPLACE THE SECOND SENTENCE OF THIS CLAUSE WITH THE FOLLOWING:

"No payment will be made for depths of excavation in excess of those specified unless ordered in writing by the Employer's Agent."

PSL 8.2.1 Supply, Lay and Bed Pipes Complete with Couplings

ADD: "The rate tendered shall further cover the cost of the work provided for under 8.2.4, for the supply and installation of all galvanised/stainless steel bolts, nuts, washers, insertion pieces, for corrosion protection as specified, and with respect to testing, for the supply and installation of all equipment, fittings and specials required, as well as the cost of water drawn and the disposal of the sterilisation solution. The measured quantity of pipe length will not, except for the payment of materials on site, be measured for payment until the length under consideration has been accepted in terms of subclause 7.3, PSL 7.3.1 and PSL 7.3.3.

PSL 8.2.2 Extra-over 8.2.1 for the supplying, laying, and bedding of specials complete with couplings

Subclause 8.2.1 and PSL 8.2.1 shall apply.

PSL 8.2.10 Temporary valves etc

DELETE THIS CLAUSE:

Provision has been made under PSL 8.2.1 for the measurement and payment of work included under this Sub-Clause.

REPLACE THE HEADING AND CONTENTS OF SUBCLAUSE 8.2.13 WITH THE FOLLOWING:

PSL 8.2.13 Chambers

a) Valve Chambers, etc. .....Unit: No

Valve chambers, etc., will be measured as complete units for which separate items will be scheduled for each type of chamber of overall depth not exceeding 1,5m from soffit of roof to floor level complete as detailed on the Drawings.

The tendered rate shall cover all materials, plant and labour necessary for the complete construction of the chambers, including ladders, doors, manhole covers and frames, handrails, the lifting davit as well as the compaction of the bottom of the chamber excavation to 90% of modified AASHTO maximum density as well as for building in of the pipes through the wall, for frames and concrete pedestals, as and when required.

b) Extra over for chambers of depth exceeding 1,5m..... Unit: No

Additional depths of chambers in excess of 1,5m will be measured in increments of 0,5m depth for each type of chamber.

The rate tendered shall cover the cost of the complete construction of each extra 0,5m additional depth as well as for additional step irons, brickwork and uPVC pipe as required."

PSL 8.2.15 Special Wrapping in Corrosive Soil

Delete this subclause. Provision has been made under PSL 8.2.1 for the measurement and payment of work included under this Sub-Clause.

ADD THE FOLLOWING NEW CLAUSES:

PSL 8.2.16 Supply and install markers

The rate shall include for the supply and installation of the hydrant markers in the verge as ordered. This is covered under PSL8.2.1.

PSL 8.2.17 Connection to Existing Mains

Under PSL8.2.1. It shall cover the cost of isolating the main, cutting into the main to accommodate the connecting fittings, dewatering the excavation, taking steps to prevent the ingress of ground, stones and other material into the main, as well as for any required liaison with others and for making good any damage to the existing main.

The excavation to expose the main, the supply, laying, bedding coupling up and testing of valves and specials used in the connection, as well as the provision of bedding, will be measured for payment under the appropriate items provided for this in the schedule."

PSLB BEDDING (PIPES)

PSLB 2 INTERPRETATIONS

PSLB 2.3 Definitions

Flexible pipe

ADD THE FOLLOWING:

"mPVC and HDPE pipes shall be classified as flexible pipes."

PSLB 3 MATERIALS

PSLB 3.1 Selected granular material

REPLACE SUB-CLAUSE 3.1 WITH THE FOLLOWING:

"Selected granular material shall be an aggregate, sand or granular material, all of a non-cohesive nature, the grading analysis of which shows 100 % passing a 13,2 mm sieve and not more than 5% passing a 0,075 mm sieve and has a compatibility factor not exceeding 0,4.

In the case of flexible pipes, the selected granular material shall consist of sand."

PSLB 3.4 Selection

PSLB 3.4.1 Suitable material available from trench excavation

ADD THE FOLLOWING:

Suitable selected bedding material will be generally available from trench excavations along the route. Additional material may be obtained from the stockpiles of granular material that were made during bulk earthworks operations.

ADD THE FOLLOWING NEW CLAUSE:

PSLB 3.5 Bedding in waterlogged conditions

Where ordered by the Employer's Agent a bedding cradle of the specified thickness, comprising of 6,7 mm concrete stone complying with SABS 1083, shall be used in waterlogged conditions."

PSLB 3.6 Crushed Stone Bedding

Where the conditions on the trench bottom are so wet that the use of selected granular material is not practical, use will be made of 19mm single sized crushed stone material from commercial sources. The use of such stone will be entirely at the Employer's Agent's discretion."

PSLB 4 PLANT

PSLB 4.1.1 Placing and compacting

ADD THE FOLLOWING:

Except that the Contractor may use a tractor with trailer or a truck as the case may be to haul bedding material, where it is required that the work is to be carried out using labour intensive methods, the Subcontractor shall use only hand tools such as shovels, wheelbarrows and hand tampers in the placing and compaction of bedding.

The bedding and fill material on each side of the pipe must be well compacted to 90% MOD AASHTO over the full depth of the bedding layers. The bedding cradle and fill directly above the pipe must not be compacted until the depth of cover to pipe is 200mm for all pipe sizes.

PXA.1 PSLB 5 CONSTRUCTION

PSLB 5.1 General

PSLB 5.1.1.2 Bottom

ADD THE FOLLOWING:

"Where expansive clay is encountered in the trench bottom, the selected fill blanket shall comprise selected granular material."

PSLB 5.1.2 Details of bedding

ADD THE FOLLOWING PARAGRAPHS:

"The dimension 'X' for flexible and rigid pipes as indicated on drawing LB-1 will be 100 mm unless otherwise indicated on the Drawing. The dimension 'X' will be measured from the invert of the pipe.

Notwithstanding the provisions of this subclause, and except for Class A bedding, pipes shall be bedded and protected in accordance with the details shown on the drawings, which shall supersede, as applicable, drawings LB 1 through to LB 5."

PSLB 5.2 Placing and compacting of rigid pipes

Notwithstanding the provisions of this subclause, the bedding for rigid pipes shall be constructed to the dimensions shown on the drawings and using the bedding material specified.

PSLB 5.2.1 Class A Bedding

ADD THE FOLLOWING TO SUBCLAUSE 5.2.1(c)

“or a period of 5 days has elapsed after the placing of the concrete in that section, whichever occurs first.”

PSLB 5.3 Placing and compacting of flexible pipes

Notwithstanding the provisions of this subclause, the bedding for flexible pipes shall be constructed to the dimensions shown on the drawings and using the bedding material specified.

PSLB 7 TESTING

PSLB 7.2 Compaction

Where compaction is carried out using labour intensive methods, the required compaction shall be 90% of MAMDD for all materials.

The method implemented for testing of the bedding compaction shall be the sand replacement test method.

PXA.2 PSLB 8 MEASUREMENT AND PAYMENT

PSLB 8.1 Principles

PSLB 8.1.3 Volume of bedding materials

Notwithstanding the provisions of this subclause, the volume of bedding will be computed from the dimensions shown on the drawings.

REPLACE THE LAST SENTENCE WITH THE FOLLOWING:

"No allowance will be made for bulking of material, or any additional volume of bedding material required due to overbreak or any other cause.

Further, the volume of bedding displaced by the pipeline will not be measured for payment."

PSLB 8.1.5 Disposal of displaced material

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"Material displaced by the pipeline and by imported material from sources other than trench excavation, shall be disposed of at an approved site furnished by the Employer. No haulage is payable for such material."

PSLB 8.1.6 Free haul

REPLACE THE CONTENT OF THIS SUBCLAUSE WITH THE FOLLOWING:

The freehaul specified in SANS 1200 D sub-clause 5.2.5.1 shall be the entire length of the pipelines under construction and shall be applicable to selected fill material and selected granular material obtained from the excavations.

PSLB 8.2 Scheduled items

REPLACE THE TITLES WITH THE FOLLOWING:

PSLB 8.2.1 Provision of bedding and padding from trench excavation

PSLB 8.2.2 Supply only of bedding and padding by importation

REPLACE THE UNIT OF THE FOLLOWING CLAUSE:

PSLB 8.2.2.1 From other necessary excavation Unit: m^3.km

PSLK VALVE INSTALLATIONS (SPEC LK)

PSLK 3 MATERIALS

PSLK 3.1 Gate valves

The gate valves shall comply with the following, as applicable:

a) for working pressures up to 1,0 MPa and of diameter up to but not exceeding 300 mm gate valves shall be of cast iron and shall comply with the relevant requirements of SANS 664.

b) the outlet connection shall be flanged, spigot plain ended or socketed as billed.

c) the spindles shall be non-rising.

d) the spindles shall be fitted with cap tops unless otherwise billed.

e) the direction of closing shall be clockwise.

f) the valve design shall be such that the valve may be opened or closed against the maximum working differential pressure with an effort not exceeding 250 N on the handwheel or valve key in the case of valves up to 300 mm in diameter. In order to achieve this, gate valves shall be fitted with either plain or ball thrust bearing, spur gearing and close-machined channel guides and shoes as required.

PSLK 3.2 Pressure reducing valves

Pressure reducing valves shall comply with Subclauses 4.1.7 and 4.1.10 of SPEC LK, and shall be installed where shown on the drawings or ordered by the Employer's Agent.

ADDITIONAL CLAUSES

Clause numbers refer, where applicable, to either the Conditions of Contract or to the Technical Specifications but the absence of a clause reference shall not exonerate the Contractor from relating a measured item to the relative clause in either the Conditions of Contract or the Technical Specification.

PSXA FENCING AND GATES

PSXA 3 MATERIALS

PSXA.3.1 Fence Panels

- 1.8m high and 3 m width fence panels
- Panel mesh aperture size (76x25mm)
- Panels to be reinforced with a deep 4 x 50mm V-formation horizontal recess bends
- Wire diameter of 3mm
- Panels, posts and wires to be PVC Coated
- Fencing to have anti-climb and anti-cut design

PSXA.3.2 Fence Posts

- Square Tube Posts to be 2.4m high (76x76x1.6mm)
- The panels are fixed onto the front or back of the posts by means of fixators and security bolts. The welded square tubular posts have inserts to fix the panels with the fixators and covered with a plastic cap.
- Posts are corrosion treated and powder coated or hot dipped galvanized and powder coated on request.
- Posts to be installed on 450 x 450 x 500mm deep footings or to the manufacture's specification
- Razor spikes to be fitted on top of panels.

PSXA.3.3 Gate

- Dimensions: 1800mm high x 5600 mm wide
- Gates shall be installed at the locations shown on the relevant drawing.
- Gates shall be mounted to swing as indicated.
- Latches shall be installed as required.

PSXA 5 CONSTRUCTION

- All material to be install to manufacturer's specifications.
- Install all fencing and gates in accordance with the drawings, specifications, instructions, and as specified lines and grades indicated.
- Line posts shall be spaced at intervals of 3.00 m.
- Terminal posts shall be set at abrupt changes in vertical and horizontal alignment.
- The fence site must be set out before construction takes place
- All corners and changes in the fence direction must be marked out.
- Posts shall be approximately centred in their footings.
- Concrete shall be allowed to cure prior to installing any additional components to the posts.

PSXA 7 TESTING

All testing shall be done in accordance with the applicable SANS 1200 and/or the manufacturers specifications.

PSXA 8 MEASUREMENT AND PAYMENT

PSXA.8.1 Fencing Panels

Panels will be priced per square meter. The rate shall be all inclusive of supplying, installing testing and finishing.

PSXA.8.2 Fencing Posts

Posts will be priced per No. The rate shall be inclusive of supplying, installing, testing and finishing.

PSXA.8.3 Concrete Footings

Concrete will be priced as specified in SANS 1200G and PSG

PSXA.8.4 Gate

The gates will be priced per gate. The rate shall be all inclusive of supply, installation, testing and finishing.

PSXB HDPE SWEEP BENDS

PSXB 2 INTERPRETATIONS

Seamless Long Radius HDPE Sweep Bend Specifications:

ASTM F714:	Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter
ASTM 3350:	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
ASTM 3350:	Standard Specification for Polyethylene Plastic Pipe Based on Controlled Outside Diameter
AWWA C901:	Polyethylene Pressure Pipe and Tubing, 13mm (½ Inch). Through 76mm (3 Inches) for Water Service
AWWA C906:	Polyethylene Pressure Pipe and Fitting, 100mm (4 Inches) Through 1.65m (65 Inches), for Water Distribution and Transmission
NSF:	National Sanitation Foundation Standard 14 (Plastic Piping Components and Related Material) and Standard 61(Drinking Water System Components-Health Effects)

PSXB 3 MATERIALS

PSXB.3.1 General Sweep Bend Specifications

Manufactured in one continuous piece from HDPE pressure pipe

Outside diameter of the spigot ends shall meet the requirements of ASTM F714. Spigot lengths will be suitable for butt fusion welding, electrofusion, or mechanical connection (with connectors specifically designed for that purpose).

The bends will be shipped to site loose or palletized. No strapping or other foreign material will be placed inside the bend.

Only ARC BENDS™ bends as manufactured by Pipestar International Inc. will be considered approved. All others must submit technical data and samples to be considered for approval.

PSXB.3.2 Freedom from Defects

Fittings shall be examined for defects by visual inspection in the first instance, or by any other inspection method if required

Fittings shall be smooth and clean with no grooves or blisters or other visible defects on the surface

There shall be no cavities, voids or inclusions in the fitting body

Defective fittings cannot be repaired and re-supplied unless specifically authorized by the client in writing.

PSXB.3.3 Marking

All fittings shall be clearly marked with at least the following information:

- ✓ Manufacturers name or Trademark.
- ✓ Identification of the material type.
- ✓ Pressure class as nominated by the manufacturer based on this guideline.
- ✓ Nominal size and SDR of the pipe for which the fitting is intended.
- ✓ Code for traceability of the manufacturing date or batch.

PSXB 6 TOLERANCE

General Sweep Bend specification

Centre line radius of curvature generally 3 x Diameter (HDPE Industry Nomenclature 6D).

Meets Pipestar published dimensional schedule. Dimensional tolerance +/- 3/4"(+/- 20mm).

The bend manufacturing process will produce a single piece bend at the angle specified by the engineer, with an angular tolerance + or - 2° without any reversion.

PSXC SUBSOIL DRAINAGE

PSXC 2 SCOPE

This section covers the supply, installation, testing, and commissioning of sub-soil drainage systems. It includes trench excavation, bedding, laying of perforated HDPE pipes, placement of filter material, geotextile wrapping, backfilling, connections to outlets, and protection of the works.

The purpose of the system is to lower groundwater levels, drain infiltrating water, and stabilise underlying layers.

PSXC 3 INTERPRETATIONS

PSXC.3.1 Supporting Specifications

This specification shall be read in conjunction with:

- Project Drawings
- General Specifications (e.g., SANS 1200 / COTO)
- Manufacturer's Technical Data Sheets
- Applicable SANS standards

PSXC.3.2 Application

This specification applies to all locations where sub-soil drainage is indicated or directed by the Engineer.

PSXC.3.3 Definition and Abbreviations

HDPE:	High-Density Polyethylene
I.D:	Internal Diameter
Geopipe:	HDPE perforated sub-soil drainage pipe
Filter Material:	Stone or geotextile preventing clogging
Infiltration Index:	litres of water entering pipe per metre per second under a specific head

PSXC 4 MATERIALS

PSXC.4.1 Sub-soil Drainage Pipe (Geopipe)

Drainage pipe must be installed per the manufacturer's instructions and shall meet the following requirements:

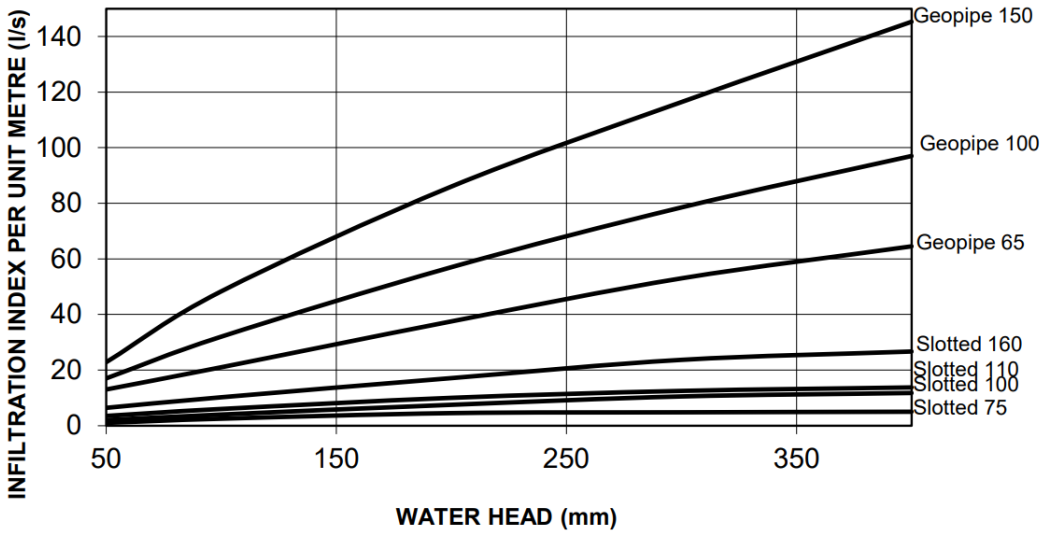
Pipes for subsoil drainage shall have an internal diameter of [65/100/150] mm (specify diameter). The pipe shall be manufactured from High Density Polyethylene (HDPE) with a solid 5.0mm wall thickness. It shall be extruded into an open lattice wall structure, with 70% of the diameter consisting of open area and a 30% solid area along the invert. Perforations in the open structure of the pipe shall be greater than 3 mm but less than 12mm.

PSXC.4.2 Infiltration Performance Required

The water infiltration capacity of the pipe under a 200mm static head shall not be less than specified:

- For 65mm I.D. pipe = 30 litres per metre per second (l/m/s).
- For 100mm I.D. pipe = 50 litres per metre per second (l/m/s).
- For 150mm I.D. pipe = 80 litres per metre per second (l/m/s).

INFILTRATION INDEX OF DRAINAGE PIPES



To minimise the risk of mineral and / or biochemical clogging of the pervious infiltration zone, the drainage voids in the open structure of the pipe shall have no dimension consistently smaller than 3 mm, and to minimise the risk of small aggregate entering the pipe, no dimension consistently larger than 12 mm.

PSXC.4.3 Filter Material

- Clean stone aggregates (13.2 mm or 19 mm), free from fines and organic matter.
- Must comply with COLTO grading for drainage layer material.
- No soil contamination shall be permitted.

PSXC.4.4 Geotextile Filter Fabric

- Non-woven, needle-punched geotextile complying with SANS 10320, Class A/B.
- Must fully enclose the pipe and filter layer.

PSXC.4.5 Fittings

- Bends, tees, connectors of the same material as the pipe.
- End caps where required.

PSXC 5 PLANT

The Contractor shall provide suitable plant and equipment, including but not limited to Trench excavators, Plate compactors/rollers, Pipe laying tools, equipment levels for slope control, Plant for transporting filter material, Pumps for dewatering where necessary and etc.

All plant must be maintained in good working condition.

PSXC 6 CONSTRUCTION

PSXC.6.1 Excavation

- Excavate trenches to the dimensions and alignment shown on the drawings.
- Trench bottom to be smooth, uniform, and free of soft spots.
- Dewater trenches if required.

PSXC.6.2 Bedding

- 100 mm layer of drainage stone or coarse sand.
- Properly shaped to provide uniform support.

PSXC.6.3 Pipe Laying

- Pipes shall be laid to a minimum gradient of 1% unless otherwise shown.
- Joints must be tight-fitting and aligned.
- Perforations typically to face downwards, unless manufacturer specifies otherwise.

PSXC.6.4 Filter Encasement

- Pipe shall be surrounded with approved filter aggregate to at least 150 mm above crown.
- Geotextile shall fully wrap the filter before backfilling.
- Overlap geotextile by ≥300 mm.

PSXC.6.5 Backfilling

- Backfill with approved material in layers not exceeding 150 mm.
- Compact to specifications without damaging pipe.

PSXC.6.6 Outlets & Connections

- Connect drain lines to catchpits, stormwater manholes, or open channels as indicated.
- Provide rodent screens at outlets.

PSXC.6.7 Protection

- No heavy machinery allowed directly above pipe trench unless required cover is achieved

PSXC 7 TOLERANCES

- Pipe gradient: ±5mm over 10m.
- Horizontal alignment: within 50mm.
- Compaction: as per project specification (Min 93–95% Mod AASHTO).

PSXC 8 TESTING AND COMMISSIONING

PSXC.8.1 Visual Inspection

- All pipes, joints, filter layers, and geo-fabric wrapping must be inspected prior to backfilling.

PSXC.8.2 Flow/Flush Testing

The Contractor shall flush the system to confirm continuous discharge at outlets.

PSXC.8.3 As-Built Records

Submit drawings showing pipe positions, levels, and outlet details.

PSXC 9 MEASUREMENT AND PAYMENTS

Payment shall be per linear meter of completed and accepted sub-soil drainage, including:

- Excavation and backfill
- Bedding
- Geopipe
- Filter material
- Geotextile
- Trench compaction
- Connections
- Testing and commissioning

No separate payment for dewatering unless stated elsewhere.

PSXD BUILDING WORKS

PSXD 2 SCOPE AND GENERAL

This section covers all labour, materials and workmanship required for building works, including:

- Masonry and concrete work
- Plastering and finishes
- Doors, windows, roofing
- Waterproofing
- Electrical installations (LV only)
- Plumbing, sanitary fittings and drainage
- Painting
- Fixtures, fittings and sundry building items

All work shall comply with this specification, the BoQ, the Drawings, the OHS Act, and the applicable SANS standards.

PSXD 3 APPLICABLE STANDARDS

In addition to the standards listed previously (SANS 2001 series for masonry, plaster, roofing, etc.) the following Standards shall apply:

PSXD.3.1 Electrical

The SANS 10400 series (all relevant parts) together with the OHS Act and the Electrical Machinery Regulations must be applied to ensure that all building works meet the required safety, health, structural, and electrical compliance standards.

SANS 10142-1:	Wiring of Premises (Low Voltage)
SANS 1973:	Plugs and socket-outlets
SANS 60598:	Luminaires
SANS 763:	Distribution boards
SANS 164:	Plugs and socket systems

PSXD.3.2 Plumbing & Sanitation

SANS 10252-1:	Water supply installations
SANS 10254:	Hot water systems (geysers)
SANS 10252 :	Drainage system
SANS 10400-P :	Drainage
SANS 10400-W:	Fire requirements
SANS 1056:	WC pans and flushing systems
SANS 50465:	Basins, taps, mixers
SANS 198:	µPVC pipes and fittings for drainage
SANS 966:	PVC-M/Class pipes (water supply)
SANS 1023:	Traps and waste fittings

PSXD 4 MATERIALS

PSXD.4.1 Electrical Materials

All materials shall be new, SABS-approved, and comply with SANS 10142-1.

- Distribution Boards (DBs): Steel, flush or surface mount, with DIN rail breakers to SANS 60947.

- Circuit breakers: Type B unless otherwise specified.
- Cabling: Cu conductors, SANS 1507.
- Conduits: SANS 950 (PVC heavy duty), or galvanised steel in plant rooms.
- Socket outlets: SANS 164-1 or SANS 164-2 (as per drawings).
- Light switches: SANS 60669.
- Luminaires: LED type, minimum IP65 for WWTW environments.
- Earth leakage devices: To SANS 61008/61009.
- Earthing and bonding: Copper earth spikes, stranded copper earth conductors.

PSXD.4.2 Plumbing Materials

All plumbing materials must bear an SABS mark.

Pipes & fittings

- Cold water: uPVC to SANS 966-1, Class 12 min.
- Hot water: Copper to SANS 460 or PEX system (if approved).
- Drainage: PVC-U to SANS 198, Class 34 min.
- Traps: Bottle or P-traps to SANS 1023.

PSXD.4.3 Sanitary fittings

- WC pans and cisterns to SANS 1056
- Wash hand basin to SANS 497/50465
- Shower base/tile shower with waterproofing
- Taps/mixers to SANS 50908 / 10279
- Geyser to SANS 10254, minimum 150 L unless specified

PSXD 5 CONSTRUCTION

PSXD.5.1 Electrical Installation

All electrical work shall be performed by a registered electrician and installed per SANS 10142-1.

PSXD.5.1.1 Distribution Boards

- Supply, mount, wire and commission DBs as shown.
- Label all circuits clearly with engraved labels.
- Provide single-line diagram inside DB.

PSXD.5.1.2 Conduits & Cabling

- All wiring shall be concealed in walls or ceilings unless otherwise shown.
- PVC conduits to be chased into walls before plastering.
- All conduits must be continuous with draw wire.
- Minimum conductor sizes per SANS 10142-1.

PSXD.5.1.3 Socket Outlets

- Height above FFL: 300 mm (unless shown otherwise).
- Weatherproof sockets (IP55/IP65) in wet areas, plant rooms, exterior walls.

PSXD.5.1.4 Lighting Installation

- Luminaires to be mounted firmly; IP65 for WWTW-related rooms.
- Switching: 1-way or 2-way as indicated.

- Emergency lights or UPS circuits where required.

PSXD.5.1.5 Earthing & Bonding

- Earth electrodes installed and tested.
- Equipotential bonding in bathrooms and wet areas.
- Bond all metallic plumbing components.

PSXD.5.2 Plumbing Installation

PSXD.5.2.1 Water Supply

- Pipework installed to SANS 10252-1.
- All pipework pressure tested to 1.5 × working pressure, min 1000 kPa.
- Isolation valves installed at entry point and each sanitary fitting branch.

PSXD.5.2.2 Hot Water Systems

- Geyser installation must comply with SANS 10254.
- Drip tray with 50 mm outlet to outside.
- Vacuum breakers and pressure control valve installed.

PSXD.5.2.3 Drainage Installation

- To comply with SANS 10252-2 and SANS 10400-P.
- Minimum falls:
  - Ø110 mm: 1:60
  - Ø75 mm: 1:40
  - Ø50 mm: 1:30
- Access points to be provided at bends and junctions.
- All joints solvent-welded unless rubber-sealed push-in types are specified.

PSXD.5.3 Sanitary Fittings

All fittings installed level, securely anchored, sealed and tested:

- WC pan, cistern and seat
- Basin with mixer tap
- Showerhead, mixer, and floor drain
- Bottle trap or P-trap
- Mirror, towel rail, toilet paper holder if applicable
- Silicone seal all junctions

PSXD 7 TESTING, COMMISSIONING & QUALITY CONTROL

PSXD.7.1 Testing & CoC

Full insulation resistance, polarity and earth-leakage testing required.

Contractor shall issue a Certificate of Compliance (CoC) on completion.

PSXD.7.2 Electrical

- Test all circuits per SANS 10142-1.
- Provide test sheet results.
- Provide a valid CoC before practical completion.

PSXD.7.3 Plumbing

- Submit pressure test results.

- All leaks must be repaired and retested.
- Showers and drainage must be tested by flooding for 10–15 minutes.

PSXD.7.4 Testing

- Water supply: Hydrostatic pressure test
- Drainage: Full water test or air test to SANS requirements
- Geyser: Commissioning test by qualified plumber

PSXD.7.5 Building Finishes

- All finishes must be even, smooth and match approved samples.

PSXD 8 MEASUREMENT & PAYMENT

Payment shall be in accordance with the BoQ. Rates shall include all:

- Materials, labour, supervision
- Cutting, jointing, chasing, patching, making good
- Fixings, supports, brackets
- Scaffolding and access
- Testing & commissioning
- Compliance with SANS, CoC (electrical), and SANS 10254 commissioning (geysers)

PSXE BUILDING WORKS

PSXE 2 SCOPE AND GENERAL

This section covers the provision of all labour, materials, equipment and workmanship necessary for the construction and completion of minor building works associated with the Works, including but not limited to:

- Brickwork and blockwork
- Plastering
- Roofing
- Windows and doors
- Internal and external finishes
- Painting
- Minor joinery and fixtures
- Waterproofing where required

All work shall comply with this specification, the drawings, the BoQ, and SANS 10400 (Building Regulations) and relevant SANS 2001 workmanship specifications.

PSXE 3 APPLICABLE STANDARDS

Unless otherwise stated, materials and workmanship shall comply with the following standards:

- SANS 2001-CM1: Masonry walling
- SANS 2001-CP1: Cement plaster
- SANS 2001-CG1: Installation of glazing systems
- SANS 2001-CE1: Carpentry and joinery
- SANS 10096: The design & construction of timber buildings.
- SANS 10163: Structural timber design.
- SANS 2001-CC1: Concrete (for lintels, aprons, small structural elements)

- SANS 10400: National Building Regulations (Parts A–T)
- SANS 613: Timber doors
- SANS 545: Burnt clay masonry units
- SANS 1215: Concrete masonry units

PSXE 4 MATERIALS

PSXE.4.1 Masonry Units

- Clay face bricks: complying with SANS 227, Class FBS minimum.
- Clay stock bricks: SANS 227, Class NFP.
- Concrete blocks: SANS 1215, 7 MPa minimum for non-load-bearing, 10 MPa for load-bearing.
- Mortar: 1:5 (CEM II 32.5R: sand), unless noted otherwise.

PSXE.4.2 Sand

Sand for mortar and plaster shall comply with SANS 1090.

PSXE.4.3 Cement

Cement shall comply with SANS 50197-1. No cement older than 90 days may be used on site.

PSXE.4.4 Reinforcement

Light reinforcement, brickforce, and mesh shall comply with SANS 1024.

PSXE.4.5 Timber

Structural timber shall comply with SANS 1783-2, treated to H2 or H3 as required.

Doors, Frames, Windows

- Timber doors to SANS 613.
- Steel door frames to SANS 1586.
- glazing to SANS 10137.
- Hardware to have corrosion resistance appropriate for a wastewater environment (stainless steel preferred).

PSXE.4.6 Plaster

Plaster sand shall be clean, well-graded and comply with SANS 1090. Plaster thickness: 12–15 mm internal, 15–20 mm external.

PSXE.4.7 Paint & Coatings

All paint shall comply with relevant SABS/SANS standards. Primer, undercoat and finishing system to follow manufacturer recommendations.

PSXE.4.8 Waterproofing

Waterproofing products shall comply with SANS 10400 and be applied by approved applicators.

PSXE 5 CONSTRUCTION

Setting Out

The Contractor shall set out all building work accurately based on the drawings. Any discrepancies must be reported immediately to the Engineer.

Protection of Works

All openings, frames, finishes, and newly completed works shall be protected from damage throughout construction. Any damage shall be made good at the Contractor's cost.

PSXE.5.1 Masonry Walling

Workmanship shall comply with SANS 2001-CM1.

- Joints 10 mm thick, tooled or raked where exposed.
- No broken bricks shall be used.
- Brickforce shall be placed every second course, or as shown.
- DPC (SANS 298) to be installed under all wall plates, sills, and as shown on drawings.
- All masonry shall be plumb, level and true.

PSXE.5.2 Lintels

Precast concrete lintels shall comply with SANS 1504. Minimum bearing: 150 mm.

PSXE.5.3 Plastering

To comply with SANS 2001-CP1.

- Internal plaster: 12–15 mm, steel-trowelled smooth.
- External plaster: 15–20 mm, wood-float finish.
- Surfaces to be moist-cured for at least 3 days.
- Galvanised corner beads shall be used on all exposed corners.

PSXE.5.4 Roofing

Roof construction shall conform to:

- SANS 10400-L (roofs)
- SANS 2001-CT1 (Structural Co or SANS 2001-CS1 (steel)
- Coverings according to drawings (IBR, corrugated, tiles)

Flashings, barge boards, gutters, fascia boards, and downpipes shall be included.

PSXE.5.5 Doors and Windows

Installation shall be plumb, square and securely anchored.

- Frames to be built in during brickwork, not grouted afterward.
- All frames shall be protected from plaster contamination.
- Glazing thickness to suit opening size and wind loads as per SANS 10400-N.

PSXE.5.6 Painting

All painting shall comply with relevant SANS standards and manufacturer's specifications. Preparation:

- All surfaces shall be cleaned, primed, repaired and dried before painting.
- Minimum 3-coat system (primer, undercoat, 2 coats finish) unless specified otherwise.
- High-corrosion environments (WWTW blower room / MCC room): epoxy or polyurethane systems.

PSXE.5.7 Waterproofing

To be installed per SANS 10400 together with SANS 10021 areas:

- Roof valleys
- Parapets
- Wet rooms
- Pipe penetrations
- Floor/wall junctions in ablution areas

PSXE.5.8 Fixtures & Ironmongery

The Contractor shall provide all fixings, anchors, adhesives, screws and sundry items necessary to complete the installation of fittings.

Stainless steel (grade 304 or 316) shall be used in all humid or corrosive areas.

PSXE 7 TESTING & QUALITY CONTROL

PSXE.7.1 Masonry

- Masonry walls shall be inspected for plumbness, level, flatness and joint uniformity.
- Sample panel may be requested by the Engineer.

PSXE.7.2 Waterproofing

- All waterproofed areas must undergo a flood test (24 hours) where applicable.

PSXE.7.3 Paint

- No coat shall be applied until the previous coat has dried fully.
- Colour and finish shall match approved samples.

PSXE.7.4 Doors & Windows

All doors shall swing freely without binding.

- All windows shall open and close smoothly with proper seals.

PSXE 8 MEASUREMENT & PAYMENT

Payment shall be in accordance with the items listed in the Bill of Quantities (BoQ) and paid per the relevant items measured.

Unless separately specified, rates shall include:

- Labour, materials, equipment
- Setting out
- Protection of works
- Nails, screws, fixings, adhesives
- Waste, offcuts and making good
- Scaffolding and access
- Compliance with SANS and municipal regulations

PSXF INSULATION OF HOT AND COLD-WATER PIPES

PSXF 2 SCOPE AND GENERAL

PSXF.2.1 Scope

This specification covers the insulation (lagging) requirements for all hot and cold-water service pipes associated with geysers, sinks, basins, baths, showers, external taps, and any other domestic or building water installation components.

Requirements are based on SANS 10252-1: Water Supply Installations, SANS 204: Energy Efficiency in Buildings, and SANS 10400-XA: Energy Usage in Buildings.

PSXF.2.2 General Requirements

All hot-water service pipes, including those connected to geysers, must be insulated for their full length, regardless of location.

Exposed cold-water pipes shall be insulated where required to prevent condensation, thermal gain, or freezing.

Insulation shall be continuous, unbroken, and fitted tightly around pipes, bends, tees, valves, and fittings.

Insulation shall be suitable for external conditions where used outdoors (UV-resistant and weatherproof).

PSXF 3 INTERPRETATIONS

The installation shall comply with the latest editions of the following South African National Standards:

SANS 10252-1: Water Supply and Drainage for Buildings (Part 1: Water Supply Installations).

SANS 204:2011: Energy Efficiency in Buildings.

SANS 10400-XA: Energy Usage in Buildings (mandatory building regulations).

SANS 151: Electric Storage Water Heaters (for geysers).

SANS 10254: Installation, Maintenance, Replacement of Domestic Hot Water Systems.

PSXF 4 MATERIAL

PSXF.4.1 Insulation material shall:

- Comply with SANS 10252-1 heat-loss criteria.
- Be closed-cell elastomeric foam, mineral wool with vapour barrier, polyethylene foam, or equivalent approved.
- Have a water vapour permeability suitable for preventing condensation.
- Be Class 1 fire rated or compliant with fire-safety requirements applicable to the building class.

PSXF.4.2 Finish Options:

- PVC cladding (indoor or external).
- Aluminium foil laminate.
- UV-resistant outdoor sheathing for exposed areas.

PSXF.4.3 Minimum Thermal Resistance

Pipe insulation shall meet the minimum R-values in accordance with SANS 204:

Pipe Internal Diameter	Minimum R-value
≤ 80 mm	$R \geq 1.00\ m^2 \cdot K/W$
> 80 mm	$R \geq 1.50\ m^2 \cdot K/W$

PSXF.4.4 Hot Water Piping (per SANS 10252-1 & 10400-XA)

- All hot water service pipes within the building, in roof spaces, within service ducts, or outside shall be fully insulated.
- Pipes connected to solar geysers or heat pumps shall have insulation resistant to temperatures ≥ 120°C.

PSXF.4.5 Avoidance of Heat Loss

Insulation shall be selected to:

- Reduce heat loss from hot water pipes.
- Improve system energy efficiency in compliance with XA-requirements.
- Prevent overheating in enclosed spaces.

PSXF 5 CONSTRUCTION

PSXF.5.1 Installation Requirements

- Pipe insulation shall be installed by a competent plumbing contractor.
- All joints shall be tightly butted and sealed with matching vapour-seal tape.

- Pipe brackets and supports shall not compress the insulation; saddles or oversized supports shall be used.
- At valves, fittings, unions, and couplings, insulation shall be neatly cut and re-sealed without thermal bridging.
- No insulation shall be left with gaps, tears, or exposed surfaces.
- Exposed external insulation must be weatherproofed with UV-resistant covering.

PSXF.5.2 Cold Water Piping

Cold water pipes shall be insulated where:

- Pipes run externally and may be exposed to freezing temperatures.
- Condensation may form, such as in roof spaces, ducts, or humid areas.
- Required by the engineer to prevent heat gain or protect system performance.

Insulation shall include vapour-barrier protection.

PSXF 6 TOLERANCE

The following tolerances shall apply to the installation of pipe insulation:

PSXF.6.1 Insulation Thickness Tolerances

- The installed insulation thickness shall not vary by more than:
  - ±3 mm for insulation up to 25 mm nominal thickness.
  - ±5 mm for insulation thicker than 25 mm.
- Localised deviations exceeding these limits shall be removed and replaced.

PSXF.6.2 Coverage Tolerances

- Insulation coverage on all straight pipe runs shall be 100% continuous with zero tolerance for gaps.
- At fittings (bends, tees, valves, unions, couplings), insulation shall extend to within ±2 mm of adjoining sections.

PSXF.6.3 Alignment Tolerances

- Insulated pipe runs shall remain well-aligned with the pipe centreline, with a maximum allowable misalignment of ±5 mm over any 1 m length.
- No part of the insulation may be compressed beyond 10% of the nominal thickness at supports or brackets.

PSXF.6.4 Vapour-Seal Integrity Tolerances

- Vapour-barrier tape overlaps shall be a minimum of 25 mm; tolerance +5 mm / –0 mm.
- No openings greater than 1 mm are permitted in the vapour-barrier surface for cold-water pipes.

PSXF.6.5 Joint Tolerances

- Longitudinal and circumferential joints shall be tightly butted with a maximum gap of:
  - 1 mm for hot-water piping
  - 0 mm for cold-water piping (vapour barrier requirement)
- All joints must be sealed. Unsealed joints are not permitted.

PSXF.6.6 Cladding/Sheathing Tolerances

- External weatherproof cladding shall be installed with a tolerance of ±3 mm in fit.
- Overlaps for PVC or aluminium sheathing shall be minimum 20 mm with a tolerance of +5 mm / –0 mm.

PSXF.6.7 R-Value Compliance Tolerance

- Installed insulation must comply fully with SANS 204 minimum R-values.
- No negative tolerance is permitted on thermal performance.
- Any insulation with a calculated installed R-value below specified minimums shall be replaced.

PSXF 7 TESTING AND QUALITY ASSURANCE

- Contractor shall provide product data sheets confirming R-values.
- Engineer may request samples for inspection prior to installation.
- No pipework shall be concealed until insulation is inspected and approved.
- All defective or damaged insulation shall be replaced at the contractor's cost.

PSXF 8 MEASUREMENT AND PAYMENT

Payment shall include supply, installation, fixing, sealing, and finishing of insulation to all specified pipes, including fittings and accessories, complete in all respects.

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C3.3.2: Particular specifications (Mechanical)

Contents

PSXMA MECHANICAL SCREEN 4

PSXMA 1 SCOPE 4

PSXMA 3 MATERIALS 4

PSXMA 3.1 Equipment Required 4

PSXMA 5 CONSTRUCTION (INSTALLATION) 5

PSXMB HAND SCREENS 5

PSXMB 1 SCOPE 5

PSXMB 3 MATERIALS 5

PSXMB 3.1 Equipment Required 5

PSXMB 5 CONSTRUCTION (INSTALLATION) 5

PSXMC SCREENING CONVEYOR/ WASHER 6

PSXMC 1 SCOPE 6

PSXMC 3 MATERIALS 6

PSXMC 3.1 Equipment required 6

PSXMC 5 CONSTRUCTION (INSTALLATION) 7

PSXMD SCREENINGS COMPACTOR 7

PSXMD 1 SCOPE 7

PSXMD 3 MATERIALS 7

PSXMD 3.1 Equipment required 8

PSXMD 5 CONSTRUCTION (INSTALLATION) 9

PSXME DEGRITTING SPIRAL TROUGH 9

PSXME 1 SCOPE 9

PSXME 3 MATERIALS 9

PSXME 3.1 Equipment required 9

PSXME 5 INSTALLATION 10
PSXMF PISTA TRAP PADDLER 10
PSXMF 1 SCOPE 10
PSXMF 3 MATERIALS 10
PSXMF 3.1 Equipment required 11
PSXMF 5 CONSTRUCTION (INSTALLATION) 11
PSXMG VERTICAL SHAFT MIXERS 11
PSXMG 1 SCOPE 11
PSXMG 3 MATERIALS 11
PSXMG 3.1 Equipment required 12
PSXMG 5 CONSTRUCTION (INSTALLATION) 13
PSXMG 7 TESTING AND COMMISSIONING 13
PSXMH VERTICAL SHAFT AERATORS 13
PSXMH 1 SCOPE 13
PSXMH 3 MATERIALS 13
PSXMH 3.1 Equipment required 14
PSXMH 5 INSTALATION 15
PSXMH 7 TESTING AND COMMISIONING 15
PSXMI INTERNAL RECYCLE PUMPS 17
PSXMI 1 SCOPE 17
PSXMI 3 MATERIALS 17
PSXMI 3.1 Equipment required 17
PSXMI 5 CONSTRUCTION (INSTALLATION) 18
PSXMJ SECONDARY SETTLING TANKS 18
PSXMJ 1 SCOPE 18
PSXMK CHLORINE DOSING EQUIPMENT 20
PSXMK 1 SCOPE 20
PSXMK 3 MATERIALS 20
PSXMK 3.1 Equipment required 21
PSXMK 3.2 Ancillary equipment required 21
PSXMK 4 PLANT 21
PSXMK 8 MEASUREMENT AND PAYMENT 22
PSXML PUMPS 22
PSXML 1 SCOPE 22
PSXML 2 INTERPRETATIONS 22
PSXML 2.1 Abbreviations 22
PSXML 2.2 Standards 22
PSXML 3 MATERIALS AND MANUFACTURE 23

PSXML 3.1 General 23
PSXML 3.2 MANUFACTURE 24
PSXML 4 PLANT 30
PSXML 5 CONSTRUCTION (INSTALLATION) 30
PSXML 5.1 Installation of pump sets 30
PSXML 6 TOLERANCES 31
PSXML 7 TESTING AND COMMISSIONING 31
PSXML 8 MEASUREMENT AND PAYMENTS 39
PSXMM PENSTOCKS, WIERS, ADJUSTABLE WEIRS, HANDSTOPS AND STOPLOGS 39
PSXMM 1 SCOPE 39
PSXMM 3 MATERIALS, DESIGN AND MANUFACTURE 39
PSXMM 3.1 Material 39
PSXMM 3.2 Manufacture 39
PSXMM 3.3 Design 41
PSXMN ARCHIMEDEAN SCREW PUMPS 41
PSXMN 1 SCOPE 41
PSXMN 3 MATERIALS, MANUFACTURE AND DESIGN 41
PSXMO MANUFACTURE AND SUPPLY OF VALVES 43
PSXMO 1 SCOPE 43
PSXMO 2 INTERPRETATION 43
PSXMO 3 MATERIALS 44
PSXMO 3.1 Material 44
PSXMO 3.2 Manufacture 44
PSXMO 5 CONSTRUCTION (INSTALLATION) 47
PSXMO 6 TOLERANCES 47
PSXMO 7 TESTING AND INSPECTION 47
PSXMO 7.1 TESTING 47
PSXMO 7.2 Inspection 47
PSXMO 8 MEASUREMENT AND PAYMENT 47
PSXMP MANUFACTURE, SUPPLY AND TESTING OF STEEL PIPES 48
PSXMP 1 SCOPE 48
PSXMP 2 INTERPTRETATION 48
PSXMP 2.2 STANDARDS 48
PSXMP 3 MATERIALS 49
PSXMP 5 CONSTRUCTION (INSTALLATION) 50
PSXMP 6 TOLERANCE 58
PSXMP 7 TESTING AND INSPECTION AT MANUFACTURER'S WORKS AND AT SITE 58
PSXMQ QUALITY ASSURANCE REQUIREMENTS 60

PSXMA MECHANICAL SCREEN

PSXMA 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defects Liability period of one mechanical screen.

PSXMA 3 MATERIALS

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovation.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMA 3.1 Equipment Required

Mechanical Screen

The purpose of the mechanical screen is to remove all suspended solids, ≥ 6mm Ø from the new incoming sewage.

The screen will have to operate automatically, controlled via the instrumentation and switch gear as specified in the electrical specifications!

The screen field must be adequately sized to accommodate the specified flows. Sufficient raking must be provided to keep the screen field clean and clear of any material in the sewage water. The screen must also be capable to handling the discharge of night soil tankers.

Gearboxes

Gearboxes shall be designed specifically for use with mechanical screening and shall be capable of withstanding all loads that could result due to the application of the mechanical screen. All gears shall be cut, hardened, and ground. Semi-hardened and subsequently machined gears will not be acceptable. The gearbox shall be provided with a removable cover in the housing to facilitate the changing of gears.

This shall be accomplished without disturbing the motor alignment or draining the lubricating oil.

The casing and support stand shall be manufactured from close-grained cast-iron and so designed that the housing assures complete protection against moisture entering of all working parts and life-long alignment of shafts, bearings and seals.

Lubrication of upper gears and bearings shall be either by splash type lubrication or through feed lines from an oil pump driven directly by one of the gear shafts and fitted with and external pressure gauge. The oil will then flow downwards to lubricate the final reduction gearing and bearings. The lubricating oil shall be retained in the housing by means of a dry well which shall encircle the output shaft to avoid complete drainage of oil in the box in the event of an oil seal failure. The lower output shaft bearing situated in the dry well shall be grease-lubricated with the grease-nipple located in a readily accessible position.

Gearboxes shall be designed for continuous operation 24 hours per day. Mechanical power ratings (AGMA) shall be not less than 2 x installed power, and the efficiency not less than 96% when the aerator is running at peak power consumption.

Worm gears will not be considered.

The aerator shaft shall be coupled to the output shaft by means of a rigid coupling. This type of coupling shall be designed to drive by friction between the coupling faces in order to avoid the necessity to place the bolts in shear for the required coupling capacity.

Tenderers shall submit a detailed description and a clearly labelled cross sectional drawing of the mechanical screen with their tenders as well as all other details of the screen, motor, couplings, bearings. **Failure to submit the above information will render the tender incomplete and such liable to rejection.**

PSXMA 5 CONSTRUCTION (INSTALLATION)

The Mechanical screen shall be mounted in such a way as to facilitate ease of maintenance.

PSXMB HAND SCREENS

PSXMB 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defects Liability period of two manual raked screens.

PSXMB 3 MATERIALS

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in these documents comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials considering the latest technical innovation.

All components shall have a surface finish in relation to their importance, their position, and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMB 3.1 Equipment Required

Two hand raked screens must be supplied, one for a standby at the inlet works and one for screening all flows bypassed before entering the emergency clean.

The purpose of the screenings is to remove and prevent all suspended solids ≥15mm Ø to pass through with the main sewage flow.

All material caught by the screen bars must be manually raked with a specialized rake, specially manufactured to fit the screen bars and of an adequate length to easily rake from the bottom to the top of the screen field.

All material raked from the screen field must be discharged into a perforated plate, of adequate size to allow the screenings to dry before removed, either to the screening conveyor or the waste bin.

Care should be taken, that bars next to the channel wall either provide spacing as specified or smaller.

PSXMB 5 CONSTRUCTION (INSTALLATION)

The hand raked screens shall be mounted in such a way as to facilitate ease of maintenance.

PSXMC SCREENING CONVEYOR/ WASHER

PSXMC 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defects Liability period of a screening's conveyor/washer.

PSXMC 3 MATERIALS

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in these documents comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovation.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMC 3.1 Equipment required

Screenings conveyor/washer

The conveyor/washer receives the screenings as discharged from the mechanical screen. Even screenings from the manual Standby-hand screen can be discharged into the conveyor, compactor.

The mechanical means of conveyance must not only convey the screenings into the screenings compactor but must break up, wash and press the organic material. This will enable wash water spray (± 5 bar) to back wash the majority organic material to the head of the mechanical screen channel. A sufficient screen/perforated plate must prevent all screenings to return to the main sewage flow.

Sufficient number of return pipes, with screen/perforated plate covering the return pipe openings must be provided to eliminate any flooding of the conveyor/washer.

Manual as well as automatic provisions must be made to clean the return pipe screen/perforated plate openings.

The wash water booster pumps will supply adequate volume at ± 5 bar water to wash the screenings during the conveyance action. More than one wash water supply point might be necessary, with sufficient spray equipment and valve control must be provided to adjust spray volume according to practical operating requirements.

After maximum wash water has been returned to the main sewage flow, the washed screenings are discharged into the screening compactors.

Gearboxes

Gearboxes shall be designed specifically for use with typical conveyance of sewage water screenings and shall be capable of withstanding all loads that could result due to the operating conditions. All gears shall be cut, hardened and ground. Semi-hardened and subsequently machined gears will not be acceptable. The gearbox shall be provided with a removable cover in the housing to facilitate the changing of gears.

This shall be accomplished without disturbing the motor alignment or draining the lubricating oil.

The casing and support stand shall be manufactured from close-grained cast-iron and so designed that the housing assures complete protection against moisture entering of all working parts and life-long alignment of shafts, bearings and seals.

Lubrication of upper gears and bearings shall be either by splash type lubrication or through feed lines from an oil pump driven directly by one of the gear shafts and fitted with and external pressure gauge. The oil will then flow downwards to lubricate the final reduction gearing and bearings. The lubricating oil shall be retained in the housing by means of a dry well which shall encircle the output shaft to avoid complete drainage of oil in the box in the event of an oil seal failure. The lower output shaft bearing situated in the dry well shall be grease-lubricated with the grease-nipple located in a readily accessible position.

Gearboxes shall be designed for continuous operation 24 hours per day. Mechanical power ratings (AGMA) shall be not less than 2 x installed power, and the efficiency not less than 96% when the aerator is running at peak power consumption.

Worm gears will not be considered.

Shafts and bearings

The gearbox output shaft shall be designed so that it is of sufficient size and rigidity to positively guarantee complete isolation of gearing from the conveyor shaft loads and thrust conditions.

All bearings shall be designed for a life of at least 100000 hours at a B10 rating. Proof of such rating shall accompany the tender. 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 compiled with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than one (where the “permissible” loads are the manufacturer’s figures for 5000 hours at a B10 rating) Tenderers shall indicate what these forces are and how they are accommodated.

The output shaft shall be fitted with a standard mechanical seal closely positioned to the lower bearing, reducing shaft run out and deflection to a minimum. The seal shall be balanced and sleeve mounted.

Tenderers shall submit a detailed description and a clearly labelled cross sectional drawing of the aerators with their tenders as well as all other details of the aerator, motor, couplings, bearings. **Failure to submit the above information will render the tender incomplete and such liable to rejection.**

PSXMC 5 CONSTRUCTION (INSTALLATION)

The conveyor shall be mounted in such a way as to facilitate ease of maintenance.

PSXMD SCREENINGS COMPACTOR

PSXMD 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defect Liability Period of a screening compactor.

PSXMD 3 MATERIALS

Construction materials shall be either steel protected against corrosion as specified or else inert corrosion proof materials.

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steel and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer/Manufacturer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMD 3.1 Equipment required

Screenings compactor

The main function of the compactor will be to de-water the washed screenings and compact it, to an acceptable dry and clean condition.

The washed screenings from the conveyor/washer must be discharged into the compactor, where the de-watering and compaction takes place.

The water must be returned to the main sewage flow, ahead of the mechanical screen.

The dry and compacted screenings from the compactor must be discharged into the waste bin.

Gearboxes

Gearboxes shall be selected for continuous operation with a power service factor of not less than 2,0 based on installed power.

Worm gear will not be considered.

All gears and pinions shall be hardened and ground after cutting.

Gearboxes shall be of a type specifically designed to accommodate all loads caused by operating conditions. Bending of the shaft shall not damage the driving gears of the bearings.

Shafts and Bearings

All bearings shall be designed for a life of 100 000 hours at a B10 rating. Proof of such rating shall accompany the tender. In addition, the bearings on the output shaft shall be capable of withstanding the resultant forces caused by the combination of redial and axial loads (imposed by the stirrer) acting simultaneously, and shall be selected such that the following condition is complied with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than 1 (where the “permissible” loads are the manufacturer’s figures for 5 000 hours at a B10 rating). Tenderers shall indicate what these forces are and how they are accommodated.

The gearbox casting shall be designed to prevent moisture from entering. A dry well for the output shaft lower bearing shall be provided to avoid complete drainage of oil in the box in the event of an oil seal failure. The gearbox casting shall be made of close-grained cast iron.

Installed motor sizes shall make allowance for gearbox efficiencies and a 10 % margin on motor power.

Where belt drives are used in the drive train, allowance shall be made for the additional power loss when calculating the minimum size of motor required.

The Tenderer shall supply all relevant information for the proper adjudication of the units, giving information regarding the impeller size and shape, the blade pitch, the top speed, the pattern of flow in the basin, shaft length and diameter as well as construction taking into full account the specified medium, the ambient temperature, the height above sea level, tank geometry and the water depth in the tank.

PSXMD 5 CONSTRUCTION (INSTALLATION)

The compactor shall be mounted in such a way as to facilitate ease of maintenance.

PSXME DEGRITTING SPIRAL TROUGH

PSXME 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defect Liability Period a de-gritting spiral trough.

PSXME 3 MATERIALS

Construction materials shall be either steel protected against corrosion as specified or else inert corrosion proof materials.

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steel and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer/Manufacturer shall indicate in his tender the proposed materials for each component of the assembly.

PSXME 3.1 Equipment required

De-gritting Spiral Trough

The main sewage flow, after being fine screened, flows through a pista trap.

All settled grit at the bottom of the pista trap must be spirated upwards, to be discharged into the waste bin.

The de-gritting spiral trough will allow for maximizing grit to be removed from the pista trap.

The trough will be positioned in the civil channel and must be grouted in, by the Civil Contractor, under supervision of the Mechanical Contractor.

Gearboxes

Gearboxes shall be selected for continuous operation with a power service factor of not less than 2,0 based on installed power.

Worm gear will not be considered.

All gears and pinions shall be hardened and ground after cutting.

Gearboxes shall be of a type specifically designed to accommodate all loads caused by the operation of the de-gritting spiral trough. Bending of the shaft shall not damage the driving gears or the bearings.

Shafts and Bearings

All bearings shall be designed for a life of 100 000 hours at a B10 rating. Proof of such rating shall accompany the tender. In addition, the bearings on the output shaft shall be capable of withstanding the resultant forces caused by the combination of redial and axial loads (imposed by the stirrer) acting simultaneously, and shall be selected such that the following condition is complied with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than 1 (where the "permissible" loads are the manufacturer's figures for 5 000 hours at a B10 rating). Tenderers shall indicate what these forces are and how they are accommodated.

The gearbox casting shall be designed to prevent moisture from entering. A dry well for the output shaft lower bearing shall be provided to avoid complete drainage of oil in the box in the event of an oil seal failure. The gearbox casting shall be made of close-grained cast iron.

Installed motor sizes shall make allowance for gearbox efficiencies and a 10 % margin on motor power.

Where belt drives are used in the drive train, allowance shall be made for the additional power loss when calculating the minimum size of motor required.

The Tenderer shall supply all relevant information for the proper adjudication of the units, giving information regarding the de-gritting spiral.

PSXME 5 INSTALLATION

The de-gritter shall be mounted in such a way as to facilitate ease of maintenance.

PSXMF PISTA TRAP PADDLER

PSXMF 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defect Liability Period of one pista trap paddler.

PSXMF 3 MATERIALS

Construction materials shall be either steel protected against corrosion as specified or else inert corrosion proof materials.

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steel and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer/Manufacturer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMF 3.1 Equipment required

Pista Trap Paddler

The pista trap paddler must establish an optimal flow velocity through the pista trap, to ensure maximum grit settling and minimum organic settling.

Gearboxes

Gearboxes shall be selected for continuous operation with a power service factor of not less than 2,0 based on installed power.

Worm gear will not be considered.

All gears and pinions shall be hardened and ground after cutting.

Gearboxes shall be of a type specifically designed to accommodate all loads caused by operating conditions. Bending of the shaft shall not damage the driving gears or the bearings.

Shafts and Bearings

All bearings shall be designed for a life of 100 000 hours at a B10 rating. Proof of such rating shall accompany the tender. In addition, the bearings on the output shaft shall be capable of withstanding the resultant forces caused by the combination of redial and axial loads (imposed by the stirrer) acting simultaneously, and shall be selected such that the following condition is complied with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than 1 (where the “permissible” loads are the manufacturer’s figures for 5 000 hours at a B10 rating). Tenderers shall indicate what these forces are and how they are accommodated.

The gearbox casting shall be designed to prevent moisture from entering. A dry well for the output shaft lower bearing shall be provided to avoid complete drainage of oil in the box in the event of an oil seal failure. The gearbox casting shall be made of close-grained cast iron.

Installed motor sizes shall make allowance for gearbox efficiencies and a 10 % margin on motor power.

Where belt drives are used in the drive train, allowance shall be made for the additional power loss when calculating the minimum size of motor required.

The Tenderer shall supply all relevant information for the proper adjudication of the units, giving information regarding the paddler.

PSXMF 5 CONSTRUCTION (INSTALLATION)

The paddler shall be mounted in such a way as to facilitate ease of maintenance.

PSXMG VERTICAL SHAFT MIXERS

PSXMG 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defect Liability Period of mechanical vertical shaft mixers.

PSXMG 3 MATERIALS

Construction materials shall be either steel protected against corrosion as specified or else inert corrosion proof materials.

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steel and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

All “stirrer(s)” to be replaced with “Mixer(s)”

The Tenderer/Manufacturer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMG 3.1 Equipment required

Mixers

Vertical shaft mechanical mixers are required to mix the contents of the anaerobic and anoxic sections of the reactor. The mixers are required to keep the organic solids, with a concentration which could vary between 2 000 and 10 000 mg/ in suspension as homogeneously as possible.

The introduction of oxygen through surface agitation shall be minimized while gently mixing the contents of the tanks. Should any baffles or other appurtenances be required, tendered prices shall make provision, therefore. The horizontal zones of maximum turbulence should preferably be as close to the floor of the tank as possible.

The impeller shall be selected such that good pumping action is obtained without any vortex action and Tenderers shall state what pumping action is expected from this equipment at all speeds.

No visible sludge build-up in any section of the tank will be allowed.

Six random samples will be taken in a specific tank, and the individual samples shall have a solid content within 20 % of the mean of the six samples.

The following Vertical mixer to be supplied, installed, commissioned and tested.

Gearboxes

Gearboxes shall be selected for continuous operation with a power service factor of not less than 2,0 based on installed power. Tenderers shall provide a catalogue of the make of gearbox offered and provide calculations to indicate how the selection of gearbox was made.

Worm gear will not be considered.

All gears and pinions shall be hardened and ground after cutting.

Gearboxes shall be of a type specifically designed to accommodate bending caused by long overhang of the shaft of the stirrer. Bending of the shaft shall not damage the driving gears of the bearings.

Shafts and Bearings

All bearings shall be designed for a life of 100 000 hours at a B10 rating. Proof of such rating shall accompany the tender. In addition, the bearings on the output shaft shall be capable of withstanding the resultant forces caused by the combination of redial and axial loads (imposed by the stirrer) acting simultaneously, and shall be selected such that the following condition is complied with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than 1 (where the “permissible” loads are the manufacturer’s figures for 5 000 hours at a B10 rating). Tenderers shall indicate what these forces are and how they are accommodated.

The gearbox casting shall be designed to prevent moisture from entering. A dry well for the output shaft lower bearing shall be provided to avoid complete drainage of oil in the box in the event of an oil seal failure. The gearbox casting shall be made of close-grained cast iron.

Installed motor sizes shall make allowance for gearbox efficiencies and a 10 % margin on motor power. Impellers shall be selected to operate preferably in the range of 20 – 25 rpm with a top speed not exceeding 2 m/s, if not, adequate motivation to accompany tender document.

Where belt drives are used in the drive train, allowance shall be made for the additional power loss when calculating the minimum size of motor required.

The Tenderer shall supply all relevant information for the proper adjudication of the units, giving information regarding the impeller size and shape, the blade pitch, the top speed, the pattern of flow in the basin, shaft length and diameter as well as construction taking into full account the specified medium, the ambient temperature, the height above sea level, tank geometry and the water depth in the tank.

PSXMG 5 CONSTRUCTION (INSTALLATION)

The mixers shall be mounted in such a way as to facilitate ease of maintenance. The tenderer shall indicate in his tender how maintenance on the stirrer blade and bearings can be carried out without lowering the water level in the tank.

PSXMG 7 TESTING AND COMMISSIONING

On completion of installation, the stirrers shall be thoroughly tested at minimum and maximum water level for speed of rotation, energy input, resistance to bending of shaft and overall efficient operation of the complete mechanical and electrical system. The Contractor shall provide free of charge for testing purposes a kW meter to measure the energy absorbed by each mixer.

If the mixers are unable to satisfy the abovementioned criteria, the Contractor shall alter the mixers or add more mixers to satisfy the criteria at his own expense.

PSXMH VERTICAL SHAFT AERATORS

PSXMH 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defects Liability period of vertical shaft mechanical aerators.

PSXMH 3 MATERIALS

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovation.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMH 3.1 Equipment required

Aerators

Vertical shaft aerators shall be designed not only to act as surface aerators but also as an efficient circulator capable of drawing mixed liquor from the base of a cell and distributing it over the surface ensuring continuous and complete mixing.

The aerator shall be capable of operating efficiently at various depths of flow through the aeration tank and the Tenderer shall submit full details of the variation in oxygen input of the aerators offered over the full range of immersion depths for which the particular aerators were designed to operate. At maximum stated immersion depth, the motors shall draw 100% of the rated power.

Due to the variation in expected oxygen demand the aerators shall be required to operate over immersion depths that vary by at least 200mm.

The aerators must be installed on the platforms as shown on the drawings. Any additions or modifications required shall be stated in the tender.

Preference will be given to aerators having a good pumping action when operating at a low rotational velocity. The tip speed of the aerator blades shall not exceed 5 m/s and any offers exceeding this, must be accompanied with sufficient motivation.

After assembly of the finished aerator cone, shaft and mounting flange, but before being dispatched to Site, the assembled unit shall be dynamically balanced at twice the maximum operating speed of rotation and in addition shall be tested for centricity and correct angular attachment of cone and flange to shaft. These tests shall be done in the presence of the Engineer or his Representative, and at least two-week notice shall be given to the Engineer prior to the tests. Should any offer deviate from this requirement, full details of tests to be performed shall be submitted with the tender.

Gearboxes

Gearboxes shall be designed specifically for use with vertical shaft aerators and shall be capable of withstanding bending moments, thrusts and other tensions that could result due to the long shaft between the aerator and the gearbox. All gears shall be cut, hardened and ground. Semi-hardened and subsequently machined gears will not be acceptable. The gearbox shall be provided with a removable cover in the housing to facilitate the changing of gears.

This shall be accomplished without disturbing the motor alignment or draining the lubricating oil.

The casing and support stand shall be manufactured from close-grained cast-iron and so designed that the housing assures complete protection against moisture entering of all working parts and life-long alignment of shafts, bearings and seals.

Lubrication of upper gears and bearings shall be either by splash type lubrication or through feed lines from an oil pump driven directly by one of the gear shafts and fitted with and external pressure gauge. The oil will then flow downwards to lubricate the final reduction gearing and bearings. The lubricating oil shall be retained in the housing by means of a dry well which shall encircle the output shaft to avoid complete drainage of oil in the box in the event of an oil seal failure. The lower output shaft bearing situated in the dry well shall be grease-lubricated with the grease-nipple located in a readily accessible position.

Gearboxes shall be designed for continuous operation 24 hours per day. Mechanical power ratings (AGMA) shall be not less than 2 x installed power, and the efficiency not less than 96% when the aerator is running at peak power consumption.

Worm gears will not be considered. Gearboxes shall be provided with jacking bolts of grade 3.4 Stainless Steel allowing at least 100 mm adjustment up and down.

Shafts and Bearings

The aerator and gearbox, output shafts shall be manufactured from Stainless Steel or other similar metal, resistant to the corrosivity of sewage. The gearbox output shaft shall be

designed so that it is of sufficient size and rigidity to positively guarantee complete isolation of gearing from the aerator shaft loads and thrust conditions.

All bearings shall be designed for a life of at least 100 000 hours at a B10 rating. Proof of such rating shall accompany the tender. 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 compiled with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than one (where the "permissible" loads are the manufacturer's figures for 5 000 hours at a B10 rating) Tenderers shall indicate what these forces are and how they are accommodated.

The output shaft shall be fitted with a standard mechanical seal closely positioned to the lower bearing, reducing shaft run out and deflection to a minimum. The seal shall be balanced and sleeve mounted.

The aerator shaft shall be coupled to the output shaft by means of a rigid coupling. This type of coupling shall be designed to drive by friction between the coupling faces in order to avoid the necessity to place the bolts in shear for the required coupling capacity.

Tenderers shall submit a detailed description and a clearly labelled cross sectional drawing of the aerators with their tenders as well as all other details of the aerator, motor, couplings, bearings, a catalogue of the make of gearbox and how the gearbox selection was made. Failure to submit the above information will render the tender incomplete and such liable to rejection.

PSXMH 5 INSTALATION

The aerators shall be mounted in such a way as to facilitate ease of maintenance. The Tenderer shall indicate in his tender how maintenance on the aerator blade and bearings can be carried out without lowering the water level in the tank.

PSXMH 7 TESTING AND COMMISIONING

Tenderers shall provide proof or sufficient evidence of oxygenation capacities and oxygenation efficiencies (for instance by submitting a report on performance by some recognized testing organization) and must state clearly how aerator performance was assessed. Failure to submit this information will lead to the rejection of the tender on the grounds of incompleteness.

Oxygenation efficiency where called for in the Technical Schedules shall be expressed as kilograms oxygenation capacity per kilowatt-hour i.e., as the mass of oxygen measured in kilograms which the aerator can introduce over a period into a body of completely de-oxygenated water divided by the power input to the motor over the same period, measured in kilowatt-hours at Standard Conditions of 760 mm Hg and 20°C.

In situ oxygenation efficiency tests may be conducted once the plant is operating effectively and Tenderers shall price the Provisional Item in the Schedule of Quantities for conducting such tests.

The tests shall utilise the steady state method as follows:

In the aeration of activated sludge mixed liquor, at a temperature of T (˚C), the following relationship holds:

The test shall utilise the steady state method as follows:

Mass Balance Equation

In the aeration of activated sludge mixed liquor, at a temperature of T (˚C), the following relationship holds:

$$\frac{dC}{dt} = K(T)[C_s(T) - C] - r$$

Where:

dC/dt: Rate of change of Oxygen concentration (mg/l.hr)

K(T): Oxygen transfer coefficient in mixed liquor at T˚C (hr-1)

Cs(T): Saturation concentration of oxygen in mixed liquor at T˚C and ambient barometric pressure(mg/l)

C: Measured Oxygen concentration in the mixed liquor (mg/l)

r: Oxygen uptake rate of mixed liquor (mg/l/hr)

Steady-State Assumption

Under normal operating conditions, a state of equilibrium (steady state) is assumed, where the concentration of oxygen does not change over time. This means:

$$\frac{dC}{dt} = 0$$

This simplifies the mass balance equation to:

$$r = K(T)[C_s(T) - C]$$

This relationship allows for the calculation of the oxygen transfer coefficient, K(T):

$$k(T) = \frac{r}{(C_s(T) - C)}$$

Saturation Concentration Calculation

$$C_s = \frac{468 - 2.65S}{31.6 + T} \times \frac{(P - P_\omega)}{(760 - P_\omega)}$$

Where:

S: Dissolved solids in mixed liquor (part per 1 000)

T: Temperature of mixed liquor (˚C)

P: Barometric pressure (mm Hg)

Pw: Saturation vapour pressure of water at T˚C (mm Hg)

Temperature Correction

In equation (1), r and C are determined and Cs(T) is obtained from Equation (2), the value of K(T) can be calculated. Its value at 20˚C is obtained using the following relationship:

$$K(T) = K(T) * 1.02^{(T-20)}$$

The corrected coefficient, K(20), is therefore:

$$K(20) = K(T) * 1.02^{(20-T)}$$

Oxygenation Capacity (OC) Calculation

From the value of K(20), the in-situ oxygenation capacity of the aeration system in a particular basin is calculated as:

$$OC = k(20) \cdot C_5(20) \cdot V \times 10^{-3} \text{ (kg/hr)}$$

Where:

$C_s(20)$: The standard saturation concentration of oxygen in mixed liquor containing 1 000 mg/l of dissolved solids, at 20˚C and 760 mm pressure, which is given as 9.02 mg/l.

V: Volume of mixed liquor in the basin (m^3).

The actual test procedure shall be proposed by the Contractor and must meet with approval from the Engineer before it is implemented.

Nevertheless, the following points shall be incorporated in the test procedure:

The Contractor shall provide four dissolved oxygen meters of approved make, all standardized and calibrated in accordance with the instructions supplied by the manufacturer.

The Contractor shall provide all equipment required for conducting the oxygen uptake rate tests.

The positions of the D.O. probes shall be to the satisfaction of the Engineer.

The Contractor shall provide all equipment required to assess the power consumption of the aerators during the steady state oxygenation capacity test.

At least three consecutive tests shall be conducted.

The Contractor shall provide all test equipment required for assessing the constants to enable the in-situ oxygenation efficiencies to be related to Standard Conditions.

Should doubts exist regarding the efficiency of the aerators after installation, the SABS will be instructed to carry out the necessary efficiency tests at the cost of the Contractor. If the oxygenation capacity at the aerators should prove to be less than specified, the Contractor shall, entirely at his own cost, improve the oxygenation capacity to the capacity specified. If these improvements result in larger aerators with greater electricity demand, the Employer will recover once-only from the Contractor, a sum of money which shall be determined by the cost of the additional electricity required by the aerators and will be calculated as a capitalized sum, taking into account the present cost of electricity, inflation, price rises, interest rates for state loans and redemption of the loan.

PSXMI INTERNAL RECYCLE PUMPS

PSXMI 1 SCOPE

This section of the specification includes the manufacture, delivery, transport, handling, protection, storage, installation, successful commissioning and upholding during the Defect Liability Period of one R-recycle and three A-recycle pumps.

PSXMI 3 MATERIALS

Construction materials shall be either steel protected against corrosion as specified or else inert corrosion proof materials.

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South African or other internationally recognized standard specification.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steel and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer/Manufacturer shall indicate in his tender the proposed materials for each component of the assembly.

PSXMI 3.1 Equipment required

Recycle Pumps

The tenderer shall provide full details of the of the equipment offered with the Tender and shall provide full characteristic curves of the pump including Quantity/Head, NPSH and efficiency. The power, speed and type of motor shall also be given. The rating of the motor shall be at least 15% higher than the maximum power absorbed by the pump shaft.

Four axial flow pumps complete with electrical motors drive unit, propeller and main trips are required, capable of handling raw screened and de-gritted sewage. The axial flow pump

shall be installed in a chamber from where mixed liquor can be drawn from the anoxic and aerobic tank. The axial flow pumps shall each be able to deliver ……against a total head of ……. m.

The pumps shall be completed with propeller and draught tube. A detail of the chamber is shown on drawing…… The draught tube shall be cast into the concrete slab.

The electrical motor shall be mounted on top, and a suitable size steel drive shall drive the propeller.

Shafts and Bearings

All bearings shall be designed for a life of 100 000 hours at a B10 rating. Proof of such rating shall accompany the tender. In addition, the bearings on the output shaft shall be capable of withstanding the resultant forces caused by the combination of redial and axial loads (imposed by the stirrer) acting simultaneously, and shall be selected such that the following condition is complied with:

$$\frac{actual\ radial\ load}{permissible\ radial\ load} + \frac{actual\ axial\ load}{permissible\ axial\ load}$$

is equal or less than 1 (where the "permissible" loads are the manufacturer's figures for 5 000 hours at a B10 rating). Tenderers shall indicate what these forces are and how they are accommodated.

Installed motor sizes shall make allowance for gearbox efficiencies and a 10% margin on motor power.

Where belt drives are used in the drive train, allowance shall be made for the additional power loss when calculating the minimum size of motor required.

The Tenderer shall supply all relevant information for the proper adjudication of the units, giving information regarding the recycle pumps.

PSXMI 5 CONSTRUCTION (INSTALLATION)

The mixers shall be mounted in such a way as to facilitate ease of maintenance.

PSXMJ SECONDARY SETTLING TANKS

PSXMJ 1 SCOPE

This Section of the Contract covers the supply, delivery, transport, handling, storage, erection, installation, commissioning, testing, adjustments, handing over in complete working order and upholding during the Maintenance Period of plant for the clarifiers.

TANK SHAPE

The clarifier will be built in concrete and will have an internal diameter of 17m Ø and maximum water depth of approximately 5,1m. The floor of the tank will have a slope towards the centre of the tank. The sludge will be scraped towards a central sludge collection hopper from where it will be withdrawn.

The effluent launder will be built in concrete on the outer tank wall.

The flow into the tank will be by an inlet pipe passing under the tank floor turning upwards at the centre to discharge and disperse the sewage water within a stilling box inducing even radial flow into the body of the tank.

INLET/OUTLET AND DISPERSION ARRANGEMENTS

The inlet pipe under the floor and inside the inlet structure of the clarifier will be supplied and installed by the Civil Contractor and does not form part of the Mechanical Contract. Similarly, the sludge draw-off pipe under the floor of the tank will be supplied and installed by the Civil Engineering Contractor.

The typical puddle pipe assembly will be supplied by the Mechanical Contractor, to be installed by the Civil Contractor.

Two 75mm inside diameter continuous conduit pipe (PVC) with no sharp bends, complete with cable draw wire and fixed at each end of the conduit and orientated to suite the site electrical layout will be supplied and installed by the Civil Engineering Contractor.

The concrete centre column encases the inlet pipe at its lower end. The incoming flow leaves the concrete centre column through vertical slots arranged below water level and is deflected by a stilling box to be provided by the Mechanical Contractor, and which shall be fabricated from 304 stainless steel. The Mechanical Contractor shall detail in his tender the dimensions and location of the stilling box, and the Engineer must approve the final arrangements.

ACCESS BRIDGE AND WALKWAY

The rotating half bridge shall be supported by a pivot bearing assembly to mount the bridge on the central support and by drive and support wheels supported at the other end. It shall incorporate an access walkway not less than 750 mm in width between internal faces and designed to support a uniformity distributed live load of 2,5 KN/m^2. Galvanized hand railing, adequately supported, and a 100 mm x 3 mm thick kicker plate made of Hot Dipped Galvanized steel shall be provided on both sides of the walkway. The walkway flooring shall be open-grid Hot Dipped Galvanized steel, and shall be capable of supporting the above loading with a maximum deflection of 2, 5 mm. The deflection of the bridge shall not exceed 1/325 of the span in accordance with the established structural practice.

A loading notice shall be fixed to the bridge in accordance with Safety Acts.

A ladder with the necessary handrails shall be rigidly fixed to the outer end of the bridge to provide access thereto, if necessary.

END CARRIAGE AND DRIVE UNIT

The outer end of the bridge shall be carried by two polyurethane tired wheels, one drive wheel and one trailing wheel running on the peripheral wall.

No special track will be provided, and the Mechanical Contractor must give tolerances of the finished concrete wall.

The drive wheel shall be driven by a flanged mounted weatherproof electric motor directly coupled to an oil filled reduction gearbox. Full details of the wheel axle support and its fixing must be given in the Tender document.

A deflector must be incorporated in front of the leading and trailing wheels to deflect any foreign objects and prevent accidents. A thermal overload device or shear pins shall be incorporated in the drive unit to stop the bridge immediately should it become jammed.

The travel speed (end carriage) must be such that effective sludge scraping takes place.

CENTRE PIVOT

The bridge shall be supported at the centre of the tank by means of a totally enclosed weatherproof pivot bearing assembly, designed to carry the bridge with super imposed loading. An arrangement must be incorporated in the pivot assembly to allow small vertical movements of the bridge at the outer end without imposing undue twisting of the bearing assembly. The assembly must be provided with grease nipples to allow easy lubrication. A weatherproof slip ring assembly must be provided, generously rated for the electrical power required to drive the bridge. All electrical connections and covers at the centre pivot shall be protected from the ingress of moisture.

SCRAPER AND SLUDGE REMOVAL EQUIPMENT

The scraper mechanism shall scrape the entire floor area and shall be arranged in an echelon formation.

The scrapers shall be fitted to an underwater support system suspended from the overhead rotating bridge. The scraper mechanism and bridge shall form one rigid unit but there shall

be some adjustment in the level of the floor scrapers. Supporting arms from the bridge shall be of Grade 304 Stainless Steel angle iron sections. All bolts and nuts shall be in grade 304 stainless steel.

The scraper blades shall be manufactured of Grade 304 Stainless Steel, of 150 mm minimum overall depth, fitted with abrasion resistant rubber or other approved material wearing edges. Sufficient vertical adjustment shall be allowed for ease of installation.

In the case where scrapers are specified in an echelon formation, the structural members suspending the scrapers from the bridge shall be sufficiently sturdy to keep the scrapers in their relevant positions without the metal back plates coming into contact with the floor.

Sludge is conveyed by the scrapers along a sloping floor to a central well. A sludge draw-off pipe extends from the central well under the tank to an external chamber, the flow.

SCUM REMOVAL

The scum baffle shall consist of Grade 304 stainless steel plates. Horizontally adjustable Grade 304 stainless steel brackets will support the scum baffle to the outer concrete wall.

Scum removal is required in each tank and consists of Grade 304 stainless steel scum skimmer, to skim the entire water surface area within the scum baffle and a scum receiving hopper of similar material. The apparatus shall be of a design suitable for continuous operation activated by the movement of the bridge past it and shall withdraw from the tank sufficient liquid to ensure an efficient flushing of the scum through the scum pipe. During the remainder of the bridges cycle the outlet shall shut tight so as to prevent leakage.

OVERFLOW WEIR

A v-notch overflow weir made of 3 mm thick grade 304 stainless steel plate must be provided and installed by the Mechanical Contractor on the outside of the overflow launder. The weir will be adjusted to ensure an even effluent discharge around the whole circumference of the tank, without leakage through joints. No leakage either between concrete and/or weir sections shall be allowed. Tenderers shall allow in their prices for sealing and levelling of the plates.

SCREED TO TANK FLOOR

The Main Contract for the Civil Work contains a clause stating that granolithic concrete screed should be laid to the required levels by use of the scraper mechanism, used in strict accordance with the instructions and under supervision of the Mechanical Contractor.

The Civil Engineering Contractor will be required to supply and fix mild steel templates for screeding purposes to the scrapers.

CORROSION PROTECTION

Corrosion protection must be carried out strictly in accordance with the specification.

STARTING AND STOPPING THE BRIDGE

There is to be no automatic control of the rotating bridges. The bridge shall include the sliprings, motor and emergency stop as specified in the Particular Specification of the Electrical specification.

PSXMK CHLORINE DOSING EQUIPMENT

PSXMK 1 SCOPE

This section of the Specification includes the supply, delivery, installation, commissioning and uphold during the Defect Liability Period of chlorination equipment.

PSXMK 3 MATERIALS

The chlorinator equipment and all associated chlorine dosing pipe work and accessories that may come in contact with chlorine gas or solution shall be constructed of materials resistant to corrosion from the effects of chlorine.

PSXMK 3.1 Equipment required

A vacuum operated chlorinator system containing two vacuum regulators suitable for fitting onto 1 kg containers are required. The chlorinator system shall operate in the change-over configuration.

The vacuum shall be created by an ejector in the chlorine dosing system. The ejector will be driven by a clear water supply. Provide booster pump to ensure adequate clear water pressure. The pressure required in the clear water supply system to the

ejector shall be stated in the tender. Each chlorinator shall be provided with the necessary drainage and ventilation pipes.

Each system to be supplied and installed under this Contract and must include the following:

a) regulators, rate valves, ejectors, in line strainers, etc.

b) The complete gas piping includes valves and fittings to the ejectors and the u-PVC piping to the diffuser.

c) The diffuser should be designed to match the equipment accepted and shall be readily removable.

d) complete clear water piping from the distribution pipe including valves and fittings to the chlorine room.

PSXMK 3.2 Ancillary equipment required

The following ancillary equipment will be required:

a) The complete electrical installation, cables, etc. as per electrical specification.

b) One electrical driven extractor fan with a capacity of 1 000 rpm.

c) A sturdy weatherproof cupboard, 750 x 750 x 300 deep with a 50 mm minimum roof over-hang and with two glass doors in front must be mounted on the wall just outside the chlorine room. A hardwood-framed fibre glass covered construction is required. The Tenderer submits details of his offer with his tender. This cupboard will be used to house a resuscitator and two gas masks, completely self-contained with oxygen cylinders, etc. “Siebe Gorman” ref. 01457708 or equal. Design of the cupboard must be approved by the Engineer before manufacturing.

d) One chlorine detector with alarm unit.

e) One lifting beam with hooks suitable to fit the containers with a chain block.

f) The changeover device between the containers shall be provided with potential-free contact for monitoring purposes.

Chlorine Container Weighing System

To determine the chlorine available in a container, two separate scales with a capacity from 0 to 2 000 kg with a large dial each indicating in intervals of 2 kg maximum must be provided. The accuracy of the scale must be within 0,25% of scale deflection. The tare weight of the container must be back balanced to give a nett reading of the weight of liquid chlorine available in the container. The platform of the scale must have four trunnions mounted thereon for easy positioning of the chlorine containers. The scale must be sturdy and dependable and of high quality, suitable to operate under extreme condition of dust, moisture, corrosion and impact. The gross weight of a chlorine container is 1 600 kg.

PSXMK 4 PLANT

Ancillary equipment

The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant.

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract

PSXMK 8 MEASUREMENT AND PAYMENT

Measurement shall be made for the complete installation and shall be paid for as specified in the Bill of Quantities (BoQ).

No extra will be paid for any item essential for the proper functioning of the system whether specified or not.

PSXML PUMPS

PSXML 1 SCOPE

The This section of the Specification includes the manufacture, testing, protection, supply and off- loading of pumps and baseplates used for the pumping of raw or potable water at ambient.

Temperatures as stated. Pump duties shall be in accordance with the Project Specifications.

Electrical motors do not form part of this section of the Specification. This section of the

Specification must be read in conjunction with the Project Specification and Electrical specifications.

PSXML 2 INTERPRETATIONS

PSXML 2.1 Abbreviations

For the purposes of this Specification the following abbreviations will apply:

BS	:	British Standards Institution.
SABS	:	South African Bureau of Standards.
DIN	:	German Standards Institute.
ISO	:	International Organization for Standardization.
SIS	:	Swedish Standards.

PSXML 2.2 Standards

Pumps shall comply with this Specification and with the current and most recent issues of the

following standards where applicable:

BS 970	:	Wrought steel in the form of blooms, billets, bars and forgings.
BS 1400	:	Copper alloy ingots and copper and copper alloy castings.
BS 3100	:	Specification for steel casting for general engineering purposes.
BS 3468	:	Austenitic cast iron.
BS 4360	:	Specification for weld able structural steel.
BS 4675	:	Mechanical vibration in rotating and reciprocating machinery.
BS 4999	:	General requirements for rotating electrical machines.
BS 5316q	:	Acceptance tests for centrifugal, mixed flow and axial flow pumps.
BS 4504	:	Flanges and bolting for pipes, valves and fittings.
SABS 20	:	Copper alloy ingots and castings.
SABS 1123:		Steel pipe flanges.

SIS 055900: Pictorial surface preparation standards for painting steel surfaces.

PSXML 3 MATERIALS AND MANUFACTURE

PSXML 3.1 General

All materials shall possess qualities adequate for purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South Africa or other internationally recognized standard specification.

For each type of equipment, the Manufacturer shall indicate the materials used for each of the proposed sub-assemblies.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer shall indicate in his tender the proposed materials for each component of the assembly.

Material required

Castings

No repair of cast components will be permitted without the prior approval of the Engineer.

The filling of casting defects shall be carried out by highly qualified welders only, according to the latest welding techniques.

Any cast component requiring filling at any fabrication stage after the first anneal shall be subjected to further annealing treatment unless stipulated otherwise.

Cast components shall not be wrapped or distorted in any way and shall not show any increase in dimensions (beyond that shown on the fabrication drawings) likely to cause interference with other components in the erection of the item of equipment for which they were made.

The structure of cast components shall be homogeneous and free of non-metallic impurity. If, at critical points of a cast component, there is too great a concentration of impurities or alloy, the component shall be rejected.

Pump Casings

Pump casing shall be of cast iron or cast steel. The grade of material proposed should be selected appropriate to the quality of water to be pumped as specified in the Project Specification.

Impellers

Impellers shall be cast in either phosphor bronze (PBI according to BS 1400 or 1 C according to SABS 200), aluminium bronze (AB1 according to BS1400 or 1E according to SABS 200) or chrome steel (316C11 according to BS 3100, or DIN 1.4313), unless otherwise specified in the Project Specification. Cast iron or leaded gunmetal shall not be permitted.

Pump shafts

Pump shafts shall be of EN 26 steel to BS 970 or similar.

If a Tenderer wishes to propose an alternative material this should be motivated with details of the benefits to be achieved.

Stainless steel

The stainless steel used shall be of the type easily jointed or fitted by electric welding.

Stainless steel which cannot withstand the effects of welding or associated heat treatment will not be accepted.

Fasteners

All high tensile bolts and studs used shall bear the letters HTS stamped or engraved on the end.

Washers shall be provided under all bolt heads and nuts. The threads of bolts and studs shall be cleaned and coated with a graphite/grease, copper based or other approved compound before assembly. The threads of all bolts and studs used with the equipment supplied shall be to the same standard. The length of bolts should be such that at least two threads protrude beyond the nuts, but not more than four threads. The threaded end of all bolts must point the downstream direction of flow.

The Tenderer shall indicate in his tender the materials proposed for each part of assembly.

PSXML 3.2 MANUFACTURE

General

Preference will be given to Pumps with non-overloading characteristics and a shaft rotational speed not exceeding 1 500 rpm.

Pumps shall be of the highest quality and suitable for continuous operation over long periods with the minimum of maintenance at high sustained efficiency.

End-suction pumps constructed on the back pull-out principle shall be provided with spacer pump motor couplings to enable the pump bearing housing, shaft and impeller to be removed without disturbing the pipe work or alignment.

The proposed layout of the pump station shall be indicated on the drawings accompanying the tender documents. They shall be studied carefully and all alterations to the lay-out, pipe work or buildings required to suit the pump offered, shall be set out clearly in letters and drawings accompanying the tender. The final layout shall be agreed upon by the Contractor and the Engineer prior to the commencement of manufacture of any of the equipment.

All equipment offered as well as all work carried out, shall comply fully with the requirements of the Occupational Health and Safety Act 85/1993 and the Machinery and Operational Safety Act 6/1983.

Taking into consideration specific speed calculations, efficiencies and reliability of the pump sets the proposed pump types shall be justified in the Tender. Double-Suction Axially Casing Split Pumps will be preferred unless otherwise specified in the Project Specification.

Arrangements incorporating multiple pump units coupled in series to achieve the duties specified in the particular specifications will not be favourably considered unless otherwise specified.

The arrangements of impellers shall be such as to reduce the residual axial thrust to a minimum. Designs incorporating a double suction will be preferred.

A design and arrangement of the pump casing which ensures that it is not necessary to

disconnect the delivery pipe work for the purpose of removing or replacing the complete rotating element will receive favourable consideration.

Suction and delivery details: The orientation of the suction and delivery pipes shall be such as to facilitate maintenance whilst being designed for minimum losses and no air traps.

Pump Characteristics

The pump shall have stable, non-overloading characteristics.

The Tenderer shall submit with this Tender for each pump offered the following characteristic curves.

With respect to flow (in l/s)

total head; in meters (0% to 120% of duty flow)

power absorbed; in kilowatts (50% to 120% of duty flow)

efficiency; (0% to 120% of duty flow)

net positive suction head (NPSH) requirements: recommended, 0% head drop, and 3% head drop relative to pump shaft centre line, in the case of horizontal spindle pumps with respect to speed:

torque requirements rated in absolute units.

The Contractor may be called upon to provide further curves at the request of the Engineer, especially for starting and stopping analysis, in connection with surge analysis in the rising mains.

The efficiency curve shall be flat over a wide range in order to provide efficient working with various pump operating conditions. It shall conform to the requirements of the Project Specification.

Unless specified to the contrary, the proposed pumps shall be able to operate without

perceptible signs of cavitation in the full range of the operating envelope specified, pump sets running singly or in parallel. Throttling shall not be allowed. Should there be any doubts, the Contractor shall be called upon to carry out an inspection of the pumps and carry out NPSH tests to prove the equipment, at the Contractor's expense. If the pumps are found to be faulty, the Contractor shall be given a responsible period to remedy the problem. Thereafter if the Contractor is unable to resolve the problem it shall be cause for rejection.

Pump Casings

No welding, burning, filling or plugging of defective castings shall be permitted without the Engineer's permission in writing, following an inspection of the defects.

The inspection and testing of castings and test bars shall be in accordance with BS 3100.

The dimension and drillings of the suction and discharge flanges integral with the pump casting shall be to SABS 1123 to design pressures specified.

The pressure rating of the delivery flanges shall be at least equal to the maximum suction static pressure, plus the pump shut-off pressure. The minimum pressure rating of the flanges shall be 1 MPa (10 bar).

All pump casings shall be hydrostatically tested at the Manufacturer's workshop and in the presence of the Engineer or his Representative. The test pressure applied shall be equivalent to 1,5 times the pump shut off head, or alternatively twice the duty head specified, whichever is the greater.

Suitable lifting rings shall be provided on the casings.

The pumping casings should be fitted with suitable replaceable stationary wear rings. These wear rings should be appropriately heat treated for operation in conjunction with the impeller, or impeller wear ring material selected.

Impeller

The casting shall be free of blowholes and other defects. No welding, burning, filling or

plugging of defective castings shall be permitted without prior approval being obtained from the Engineer in writing, following an inspection of the defects.

All water passages shall be polished to a smooth finish. Water passages which cannot be machined shall wherever possible be hand ground and filed to template.

Each impeller shall, after final machining and dressing, be independently statically balanced and the completely assembled rotating element with coupling shall be dynamically balanced.

The first critical speed of the rotating element shall be at least 1,3 times running speed.

Pump shaft, Sleeves and Diffusers

Pump shafts shall be of an approved material, and of sufficient dimensions to transmit the power to which they will be subjected without undue torsional or bending stresses and deflection.

The shafts shall be stress-relieved after initial machinery, and ground to final size.

The shafts shall be suitably designed for the reception of the impeller which shall be adequately secured to the shaft in such a manner as to be readily removable without damage to either the shaft or the impeller.

The Contractor shall ensure that both the critical speed and torsional oscillation characteristics of the combined pump and motor rotating elements are satisfactory for all possible condition of operation.

The shafts shall be adequately protected with replaceable sleeves of an approved bronze or other similar approved non-corrodible material at all areas where wear and/or corrosion could possibly be expected. The replaceable shaft sleeves exposed to the pumped water shall be manufactured from a material compatible with the impeller material selected. These sleeves shall be readily removable without causing damage to either the shafts or the sleeves.

Shaft Coupling

The pump and motor shall be connected by a flexible coupling in such a manner that it shall not uncouple whichever way the impeller may be rotating.

The coupling shall accommodate small axial, lateral and angular misalignments without imposing undue stresses on the shaft and bearings. Refer to PT 8.3.

The coupling shall be enclosed in a stationary solid-plate guard to the Engineer satisfaction.

Pump bearing and lubrication

Bearings and Lubrication

If anti-friction bearings are fitted a design life of at least 40 000 operating hours is required.

The bearings in the pump casing together with its lubricating systems shall be suitable for the particular circumstances. The particular type and system offered by the Tenderer shall be fully specified.

The pump rotating element shall be positively located in the axial direction. If specified thrust bearings shall be of the tilting pad-type (Mitchell or similar).

Journal bearings consisting of white metal lined bronze sleeves split on the horizontal centre line and lubricated with an oil ring shall be preferred.

All bearings shall be suitable for shaft rotation in both directions.

Preferably the same type of bearing will be chosen for motor and pump.

If not, the necessary allowance shall be made when aligning pump and motor.

Adequate provision shall be made for the cooling of oil for bearings, particularly as the pumps may run continuously in ambient temperatures of the order of 40°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, clearly marked to indicate the standing and running oil levels.

All internal surfaces in continuous contact with the lubricating oil such as oil reservoirs, piping, etc, shall be thoroughly cleaned either chemically or by shot blasting and protected by a method to be approved by the Engineer until such time as the system is changed with oil. No site welding of oil circulating pipes will be permitted.

The entire lubricating system shall be failed safe with alarms set to indicate automatic change-over to the stand-by unit.

Glands and Seals

Reliability

Reliability of glands is of prime importance. Pumps incorporating low pressure glands where the pressure at the glands does not exceed the main suction supply pressure will be preferred to pump with shaft glands exposed to higher pressures.

Glands

Low pressure glands of the conventional stuffing box pattern utilizing packing rings one each side of lantern rings will be acceptable for the first stage of the pumps. Lantern rings shall be easily removable. The shaft sleeves shall be ground with a polished finish on the wearing surface, and the gap between the sleeves and the follower shall be such that the packing will not be extruded into the gap. Make and type of packing shall be to the approval of the Engineer.

It will be the responsibility of the Contractor to provide filters if the quality of the water necessitates filtration. The flow of water to or from the glands shall be clearly visible.

If mechanical seals are called for, they shall require no separate water supply and shall be suitable for the water to be pumped. Seal selection shall be done in collaboration with the seal manufacturer and proof that this has been done may be requested.

If, in the opinion of the seal manufacturer, the quality of the water is such that a flush would be required to the seals, Tenderers are required to provide for a suitable system. Such a system shall be self-contained and inclusive of all necessary separators, filters, connections and auxiliary pipe work to provide the required flow to the seals at the appropriate pressure. The auxiliary pipe work and fittings should be in a suitable grade of stainless steel.

Mechanical seals shall be balanced and provided to be suitable for the water pumped. Spare wearing components shall be supplied and delivered when the pump is installed, the cost being included in the price of the pump.

The Tenderer shall supply with his Tender, full details of all pump seals and glands.

incorporated showing clearly all proposed materials, finished clearances, etc.

Pump Vent and Drain Fittings

Stainless Steel vent cocks be provided and fitted at all local high points on each pump casing These cocks shall be of adequate size to enable the entrapped air to be released freely. Stainless Steel pipes shall be neatly led from priming cocks' gland, and casing drain points to a suitable main tundish. Galvanized drainage pipe works of adequate size shall be provided and installed to collect the wastewater from each pump set and to lead it to the drain leading to the pump house sump.

Baseplate

The pump and motor baseplate shall be rigid. The upper face of each baseplate upon which the pump and motor are located, shall be machined flat and smooth to ensure that the pump is supported properly directly to the baseplate, without the use of spacers. Provision must be allowed to align the motor correctly to the pump through the use of suitable shims or spacers, the combined height of which should not exceed 3mm.

For every motor, two jacking bolts at right angles with a lock nut shall be provided at every corner.

Monitoring Devices

If specifically stated in the Project Specification, one or more of the following monitoring items shall be required:

Full details of the sensing equipment (thermocouples, etc), and of the associated control and monitoring or indicating equipment shall be submitted with the tender offer. Evidence shall also be submitted that adequate spares and services are readily available in this country.

Temperature Sensors

Either thermocouples or resistance temperature detectors shall be installed, depending on which is more suitable to the duty and application.

Location of temperature probes:

a) Separate temperature probes shall be installed at the sleeve and/or rolling bearings of each pump and motor and at the gland housings of the pump to monitor the temperatures at these points.

b) The probes shall be spring-loaded to ensure positive contact with the bearing shells or gland stuffing boxes.

c) Each probe shall be clearly identified by means of an engraved marking on the sheath and shall be individually calibrated. Test certificates covering the calibration results of all temperature probes shall be submitted to the Engineer.

d) Temperature detectors offered shall be suitable for operation in conjunction with temperature indicating, monitoring, alarm and trip equipment of Conlog or equivalent design.

e) If grease lubricated bearings are offered, the Tenderer shall indicate if temperature detectors can in fact be used. If temperature detectors are not feasible, the Tenderer shall indicate alternative means of monitoring bearings.

f)Pockets for standard mercury filled glass thermometers shall be provided adjacent to all pockets serving temperature-indicating instruments. Pockets for standard thermometers shall have chained covers to prevent the ingress of dirt when not in use and shall be so arranged as to permit accurate measurements of the bearing temperature. The pockets shall contain a small amount of oil and shall therefore be orientated within 30° of the vertical, horizontal pockets are not acceptable.

g) Each pump casing shall be fitted with a thermo switch, Fenwall, or equal approved make to safeguard the pump in the event of inadvertent sustained operation against a closed discharge valve. The thermo switch shall be calibrated to close when the temperature of the water in the pump casing exceeds 40°C.

Pressure gauges

a) Each pump set shall be equipped with two 150mm diameter flush mounting pressure gauges. The gauges shall be calibrated in KPa, and the angle shall suit the particular application. The gauge shall be filled with glycerin, and the bubble shall be out of the range of usual reading. The gauges shall be of a type that is possible to recalibrate (dead-weight method) and reset on Site.

b) These meters shall indicate water pressure in kilopascal and shall have a range at least 50% higher than the normal duty point. However, in all cases the gauges must have a range at least 30% higher than the shut off, or maximum, head which the pump is capable of generating with the system conditions taking into consideration the maximum static suction pressure possible.

c) The meters for the suction side of pumps shall be compound gauges and shall be capable of indicating a negative pressure of up to 100 KPa. However, in all cases the gauges must have a range at least 30% higher than the maximum static suction pressure possible.

d) All pressure gauges shall be supplied and installed complete with isolating Steel cocks, piping, etc. and fitted with a pulsation snubber in stainless steel.

Due to the quality of the water, those submitting tenders should satisfy themselves of the reliable operation of the gauges. Where necessary they must include for the pressure gauges to be fitted with diaphragms.

Pump set vibration sensors.

a) Suitable vibration sensors shall be mounted on each pump set to stop it on detection of detection of excessive vibration. The sensors shall be situated as close as possible to those bearings where the highest vibration levels are encountered.

b) The monitoring of vibration shall be made via a suitable timing device in order to avoid tripping when starting the pump set or during other transitory conditions.

c) The pumps shall comply with the requirements of BS 4999.

Automatic air vents

If an automatic air vent is specified for the pump casing, it shall be fitted with and indicator to show the open and closed positions of the air vent. The air vent shall be suitable for remote operation, and the control of the air vent shall be mounted on the control panel inside the pump house.

Gland leakage detection

A device to monitor gland leakage shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

Wear limit switch.

Multistage pumps should be fitted with a wear limit switch to protect the pumps against damage after normal wear of the wearing rings have taken place after a period of operation.

Corrosion Protection

a) Internal protection

All traces of rust, slag, silica, or other contaminants shall be removed by mechanical wire brushing. Abrasive blast cleans all interior surfaces to SA 22 (near white) metal finish to the Swedish Standard SIS 05 59 00. The blast profile shall fall within the limits 40-60 microns.

A thorough vacuuming of the interior surface shall be carried out to remove all traces of the abrasive grit before application of internal surface finish.

Apply by brush, or airless spray, three coats of an approved two-part epoxy coating, or

equivalent, to give a dry film thickness of between 50 and 70 microns per coat. The intermediate coat shall be a different colour to the first and final coat. The total minimum dry film thickness for the complete system shall not be less than 150 microns.

b) External protection

All sharp edges, laminations and protrusions shall be removed by mechanical grinding,

where after all traces of rust, slag, silica or other contaminants shall be removed by mechanical wire brushing. The entire surface shall be degreased using a suitable water emulsifiable degreaser. Surfaces shall be left clean and dry prior to coating.

One coat of zinc phosphate high build primer shall be applied (Plascon Code UC 183 or similar) by airless spray to a dry film thickness of 75 µm and left 8 hours to dry.

The primer shall be followed by one coat of universal undercoat, (Plascon Code UC 1 or similar) applied by brush, roller or airless spray to a dry film thickness of 30 µm.

This coat shall be left to dry for 16 hours.

The final coat shall be one coat of universal gloss enamel, (Plascon Code G or similar) applied by brush, roller or airless spray to a dry film thickness of 25µm. This shall be left to dry for 20 hours. Colour will be as directed by the Engineer.

Designation and Information Plates

Each pump shall be supplied with an information plate – preferably chromium plates – secured to the pump casing in a visible position indelibly marked with the following details:

- ✓ Maker's name, pump type and serial number.
- ✓ Year of manufacture.
- ✓ Rated duty of pump in litres per second (l/s).
- ✓ Head in meters at rated duty (m).

- ✓ Pump speed in revolution per minute (rpm).
- ✓ Impeller diameter.
- ✓ Mass of completely assembled pump in kilogram (Kg)
- ✓ Types and sizes of Bearings.
- ✓ Letters and figures shall be engraved, or embossed, not stamped.

Interchangeability

Where two or more similar pump sets are required, the pumps and motors shall be interchangeable in all respects.

PSXML 4 PLANT

The Tenderer shall satisfy the Engineer of the sufficiency of the manufacturer's workshops to handle the manufacture, testing and protection of the pumps strictly in accordance with the Specification.

PSXML 5 CONSTRUCTION (INSTALLATION)

PSXML 5.1 Installation of pump sets

Couplings

All pumps are to be matched for coupling to their respective motors. Couplings shall impose no restriction on normal end play or expansion and shall be provided with a

removable guard, painted red. The direction of rotation shall be indicated with a clear arrow painted on the exterior of the coupling guard. The latter shall be designed thus to render reversed mounting impossible.

Grouting of Baseplates

Base-plates shall be grouted after the alignment of pump sets has been approved. The Contractor must provide details of the grouting procedure he intends to utilize. Grouting of baseplates shall be done by the Contractor, and he shall ensure full grout penetration between each pump base and relevant baseplate.

Pump Set Alignment

General

It is accepted that all new pump sets have been aligned on the baseplates in the factory. A certain amount of base-plate deformation is possible during transit and installation. Therefore, the alignment shall be rechecked on site following a hot run as specified hereafter. Two main checks are to be carried out, viz.

a) Angular alignment and,

b) Radial alignment of the pump shaft

The checks are to be done on all pump sets.

Preparation

Before any check, the following preparations shall be completed.

Final grouting to the baseplate shall be completed.

Driving units shall be isolated from the power supply. The Contractor shall ensure that no damage can be caused by turning either unit (driving or driven unit).

Couplings should be fixed to their respective shafts, and the segments must be free to move relative to each other. Where the method of coupling is too tight to allow free movement between the two half-couplings the rims should be marked so that readings can be taken when the two marks are in line.

Alignment Checks (See attached Data Sheet)

a) Angular Alignment

(i) Clamp two clock gauges diametrically opposite coupling pin holes of the driving or driven half-coupling, the plunger ends up resting on the back of the opposite half-coupling.

(ii) With one gauge at the top and one at the bottom, they set both gauges to zero.

(iii) Turn both couplings through 180°. If the alignment is correct, the readings on the gauges should be numerically the same, although not necessarily zero.

(iv) Adjustment should generally be made on the outboard end of the pump.

(v) Turn both couplings through 90° and set the clock gauges to zero. Repeat step (iii).

Note: This method does not require axial location of either half coupling.

b) Intersection of Axis (Radial Alignment)

(i) Clamp one clock gauge into one of the coupling holes in the driving or driven

half-coupling, the plunger end of the clock gauge seating on the rim of the other coupling.

(ii) Rotate the couplings together and note the readings at each quarter turn.

(iii) Adjust the position and heights of the units until uniform clock readings are obtained.

Note: Where the operating temperature of a unit has the effect of lifting the centre line of one machine in relation to the other, allowance in the height of the appropriate machine must be made. Height adjustment must be in accordance with the manufacturer's specifications.

Installation of Dowel Pins

Following approved alignment of pump sets, suitable dowel pins shall be fitted to

facilitate correct re-location of pump sets**.**

PSXML 6 TOLERANCES

a) The tolerances as specified in this Specification or the appropriate SABS or BS Standards shall apply.

b) Angular Alignment: The angle between two half-couplings shall not be more then 0,01° for speeds up to 1 500 rpm. This corresponds to a variation of 0,05 mm and 0,02˚ between readings on a 300 mm Ø coupling.

c) Radial Alignment: If readings vary by more than 0,10 mm (i.e. 0,05 mm eccentricity) for 1 500 rpm adjustments shall be made.

PSXML 7 TESTING AND COMMISSIONING

General

Contractors shall, if requested make available for inspection, their internal Quality System Manual, their Standard Procedure Manual and their Works Instructions. Preferences shall be given to Contractors who have been audited and found to satisfy the requirements of the ISO 9000 Quality system.

Inspection and tests required of the Contractor include the tests and inspections in the workshops and the inspections and tests at Site.

Depending on the results of the tests and inspections, penalties may be applied, and, in certain cases, part or all of the equipment may be rejected, as set out hereinafter.

The cost of all tests and inspections shall be included in the Tender. For instance, the cost of commissioning and testing at Site shall be stipulated in the Price Schedule under the section provided or included as part of the cost of erection. (Except for the cost of power and water consumed.) No claim for travel expenses or further time required for testing will be allowed.

Tenders shall fully acquaint themselves with the properties of the water to be pumped. Any wear of portions of the pump or ancillary equipment that will affect its operating efficiency during the Period of Maintenance will result in the pump set being rejected.

Signs of cavitation pitting on pump parts will not be acceptable.

Leakage forms of any oil, water or air circuit will not be acceptable.

Leakage at the glands shall be controlled to the minimum required and drained to the Pump Station sump.

Operation of pumps shall be free from undue vibrations throughout the full range of normal running conditions. Vibration levels should not exceed the limits determined by VDI 2059 for good vibration behaviour.

In no case shall temperature-rise above the ambient temperature reach or exceed 40ºC for any mechanical component. For temperature-rise of bearings see Clause PT 5.7.7.

In the case of routine tests concerning standard equipment or material quality control tests, not attended by the Engineer or his Representative, tests reports or certificates in duplicate shall be submitted to Engineer.

The Contractor shall notify the Engineer or his Representative in writing two weeks in advance, of the place and dates at which the equipment may be inspected and tested.

The Engineer or his Representative will inform the Contractor of his intention to attend the test or the inspection and propose a date which suits him. If the date preferred by the Engineer is later than ten days after the first possible date, the Contractor shall be entitled to perform the test or inspection without the presence of the Engineer.

If on any agreed date the equipment to be inspected or tested is not ready and the test or inspection has to be postponed the Contractor shall be held responsible for the traveling and/or living expenses of the Engineer and/or his Representative.

When tests and inspection have met the satisfaction of the Engineer or his Representative a certificate of Workshop Acceptance will be issued by the Engineer. The Contractor shall not pack and dispatch to Site any equipment before receiving the relevant “Certificate of Workshop Acceptance.”

The Engineer’s acceptance shall in no way relieve the Contractor of any obligation with regard to the Specification.

Tests

Performance tests

Each pump complete with its driving unit shall be tested at the Manufacturer’s works, or other location approved by the Engineer to “Class B” requirements of BS 5316 Part 2, and the efficiency carefully measured. Variations from the actual running conditions of the pumps are allowed as defined in the standard. Unless otherwise explicitly mentioned, cavitation tests are required at work.

The tests shall be witnessed by the Engineer or his Representative and details of the tests and the results obtained, duly signed by the appointed Witness, shall be submitted to the Engineer before dispatch of pumping units from the Manufacturer’s workshop.

The rotating elements of the pumps and motors shall preferably be dynamic.

balanced before assembly. The residual imbalance should be better than ISO 1940 grade G 6.3. The good balance of the whole pump set will be checked by measuring the absolute vibration of pump and motor bearing housings.

Tests shall be performed with the pump set on sound foundations, similar to those expected at Site.

Measurements shall be taken in the three axes at each bearing, i.e. axial and two redial components at right angles to each other.

Performance and vibration tests as described above are to be performed before installation on Site for all pump sets more than 22 kW. Whether these tests are impractical or

impossible at the pump manufacturer's work, Tenderers must state this in their Tender and explain the reasons why it is so. The Engineer may be prepared to consider alternative proposals for testing provided these proposals are submitted with the Tender and are clearly described and defined. If this is not done, the Tenderer will be penalized for the cost necessary to have the tests performed in another workshop.

All pieces of equipment subject to water, oil or air pressure shall be tested at a pressure not less than one and a half times the design pressure.

Each piece shall withstand the hydrostatic test pressure without exhibiting signs of sweating, undue deformation and stress, or defects of any kind.

Hydrostatic testing shall be done with blank flanges bolted on the flanges of the piece. The use of tie-bolts or other forms of restraint applied across the blank flanges to restrain the bodies from deflecting under the applied test pressure will not be permitted without the Engineer's approval.

The hydrostatic test pressure shall be maintained for a period of at least 10 minutes.

Performance test results at work

a) The overall percentages of efficiency as calculated from the tests should not be less than the appropriate guaranteed figures at the duty points by more than 3%.

b) The measured flow rates should not differ from the guaranteed deliveries at any point other than the duty points on the characteristic curves as supplied by the Tenderer by more than 5%.

c) The NPSH requirement should be met for the specified duty point.

Where requested by the Engineer additional tests will be required to demonstrate the pump performance at run out conditions, or where the NSPH available is critical.

a) The Contractor will be allowed a period of eight weeks to carry out any amendments to the plant which he may consider necessary to meet the guaranteed figures. Any period granted for design amendment shall not extend the Contract Period.

b) Further tests shall then be carried out at the Contractors expense and if the test results in question are still not within the limits specified, the Engineer shall have the right to:

(i) Either reject the entire plant or recover all monies already paid to the Contractor,

(ii) or let the Contractor continue with the installation of the pumps sets which may be subjected to penalties or rejection as defined hereinafter then the performances tests at Site are performed.

At Site

At the time of performance tests at Site:

should the test results obtained for either efficiency, flow rate, NPSH or vibration still vary beyond the limits indicated in clause PT 7.3.1 above, the Contractor will again be allowed a further four weeks to make such amendments as may be considered necessary and if after these amendments have been made the test results in question are still not within the figures which have been guaranteed, the Engineer reserves the right, according to circumstances, to reject the plant entirely any other discrepancies, abnormal wear or malfunctioning of plant which may be observed during the Acceptance Tests shall be corrected by the Contractor without delay.

The date of completion shall be the date on which the Acceptance Tests at site have been satisfactorily completed and the plant is in a fully operational state in accordance with the Specification.

Any period granted for design amendments shall extend the Period of Maintenance by a

corresponding amount.

Commissioning

a) On completion of mechanical and electrical erection and as soon as water is available and other circumstances permit, the Contractor shall arrange for the commissioning of all units of the pumping plant in the presence of the Engineer. The Contractor shall ensure that his equipment is suitably prepared before giving the Engineer fourteen-day notice in writing of the date of commissioning.

b) Before the commissioning, the Contractor shall satisfy himself and subsequently prove to the Engineer that all items on the following checklist have been checked and are functioning correctly.

Visual check of general appearance of plant, check power supply to motor available and

Determine the direction of rotation.

(i) Remove coupling

(ii) Correct if necessary

- ✓ Check if pump is turning freely by hand.
- ✓ Check axial float of pump
- ✓ Check thermocouple operation/calibration if required.
- ✓ Check if pump requires gland packing (Mech. Seal flushing).
- ✓ Check pumps and motors for correct grade and quantity of bearing lubricants (oil/grease packed).
- ✓ Alignment of pump and motor.
- ✓ Suction valve open (bypass open).
- ✓ Discharge valve closed (bypass open).
- ✓ Check if discharge line is full of water.
- ✓ Bleed of air on pump and pipe works.
- ✓ Cooling water to bearings.
- ✓ Check balancing water if required.
- ✓ Monitoring and operating equipment functions correctly.
- ✓ Test run of pump.

(i) Number of recommended start - stop of motor.

(ii) Bearing temperature (motor and pump).

(iii) Pump speed.

(iv) Suction pressure.

(v) Discharge pressure.

(vi) Volts (Amps) (kW).

(vii) Quantity pump is pumping.

(viii) Vibration levels.

(ix) Rundown time of pump and motor.

(x) Simulate an emergency shutdown of pump.

(xi) Check pump and pipe work for water tightness.

NOTE: The Contractor to ascertain from the Pump Manufacturer whether the items on the check list are sufficient for the successful commissioning of the pump sets.

a) The pump sets shall be run without interruptions separately for at least 4 hours or such further time as may be required to reach stable operating conditions (particularly, motor temperatures shall be stable).

b) If the prescribed duration cannot be achieved, the initial commissioning shall take place at a date to be agreed upon by the Contractor and the Engineer. It is to be borne in mind that the penalties for late delivery shall be linked with the initial commissioning.

c) After the above commissioning, the plant shall be run under approved supervision for not less than two months before the Acceptance Tests are conducted. The Contractor must satisfy himself that the operators are in a position to operate the plant safely and correctly should he be absent from Site during this period.

d) Commissioning shall not be considered to be complete until the plant is capable of

e) continuous operation by fully trained operators of the Employer and until two months have elapsed and the plant has passed the Acceptance Tests as specified.

f) The Acceptance Tests shall be performed only if and when every item of the whole

g) Contract is fulfilled and if and when each piece of equipment, including the monitoring and control devices, is working properly. The Engineer is entitled to postpone the Acceptance Tests if any part of the Contract is not to his satisfaction or if the plant has not been successfully operated for at least 200 hours.

h) The Certificate of Commissioning for the equipment is issued by the Engineer only when the results of the Acceptance Test, recorded in a report prepared and submitted by the Contractor, are found satisfactory.

i) Final Operation and Maintenance Manuals shall be made available before the Certificate of Commissioning is issued.

j) The Period or Maintenance (or Guarantee Period) commences at the date of the Certificate of Commissioning.

k) During the first 14 days of operation of the scheme, the Contractor shall be on site to rectify any problems with the scheme within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor shall within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

l) Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor’s cost

m) After the satisfactory conclusion of the Acceptance Tests on Site and the issue of the Certificate of Commissioning, the Contractor shall guarantee the satisfactory operation and functioning of the entire plant covered by the Certificate of Commissioning for a period of twelve months measured from the date of the Certificate of Commissioning.

n) The Contractor shall make good, free of all charges, any defects arising during this Period of Maintenance including the replacement of all defective parts and their installation and commissioning. This guarantee shall apply to all defects arising during proper use of the plant, due to faulty design or maintenance instructions, inferior materials or poor workmanship.

o) Maintenance by the client’s personnel during the Period of Maintenance shall be limited to cleaning and lubrication only as instructed by the Contractor. All other maintenance or adjustments shall be carried out by the Contractor

p) The final Certificate will be issued by the Engineer when the Period of Maintenance has elapsed, and all Contractual obligations have been met in accordance with the General Conditions of Contract.

Commissioning of each pump set/motor as specified.

Individual Performance Checks

Pay – item	Unit
Performance testing of pumps/motors	
by independent institutions	
(Provisional item)	No

Should the Client require performance testing of the pumps or motors by independent institutions such as the South African Bureau of Standards, a separate pay-item will be provided in the Schedule of Quantities. The tendered rate shall include for the transporting to and from the institution, offloading, handling, etc., as well as all fees payable to the institution for each pump/motor unit tested.

Ancillary equipment

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.

The Mechanical Contractor will also be responsible for compiling a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc. for proper running of the plant.

Manufacturer's Certificate of Approval

Following wet commissioning of pump sets, the pump manufacturer or his approved supplier shall check the installation and when satisfied shall issue to the Engineer a certificate approving installation I compliance with the manufacturer's specifications.

The Contractor shall furthermore, upon commission, perform vibration tests in the horizontal and vertical planes of each and every bearing housing. The results are to be endorsed by the pump and motor manufacturers for acceptability and handed to the Engineer within 14 days from the commencement of the Defects Liability Period.

It is further required of the Contractor to perform same measurements upon each maintenance visit during the Defects Liability Period. The results shall be logged and shall be endorsed by the pump and motor manufacturers for acceptability and handed to the Engineer within 7 days after each maintenance site visit.

ALIGNMENT CONTROL SHEET

CLIENT:

CONTRACT NO:

STATION: **MACHINE TYPE:**

UNIT NO: **REF NO:**

ALIGNMENT BETWEEN:

FACE-TO-FACE PERIPHERAL

METHOD OF ALIGNMENT: DIAL INDICATOR

READINGS (mm):.....

ALIGNMENT OF GEAR FITTED ON:.....

MEASUREMENTS TAKEN ON:.....

WHICH SHAFT ROTATED:.....

DISTANCE BETWEEN SHAFT ENDS:.....

WHEN SHAFT IN WHICH AXIAL POSITION:.....

REMARKS: SUCTION/ DELIVERY PIPES. ALL FOUNDATION BOLTS TIGHTENED/ LOOSE. FINAL GROUTING DONE/ NOT DONE.....

.....

.....

.....

.....

.....

Date:..... Time.....

X_____ X_____

CONTRACTOR ENGINEER

PRO FORMA - COMMISSIONING									
	REMARKS					Temperatures (˚C)			

CONTRACT NO: **DESCRIPTION OF CONTRACT:**

DATE OF COMMISSIONING:

COMMISIONED BY: **PUMP MANUFACTUTER:**

WITNESSED BY: **PUMP MODEL:**

PSXML 8 MEASUREMENT AND PAYMENTS

Measurement and payment will be made in accordance with the methods stated below:

Supply and Delivery

Pump sets/motor will be measured per unit including the following:

a) Pumps, motors, couplings, coupling material, baseplates and monitoring items as individually itemized.

b) Design, manufacture, purchase, protection, supply, handling, transport and profit.

c) Fixing material required to secure monitoring equipment to pump/motor.

d) Fixing material required to secure the pump and motor to the baseplate.

e) Temporary storage and maintenance during storage, should it be required.

f) The required tests and inspections at the manufacturer's work.

g) Operating and Maintenance Manuals as well as drawings in accordance with the specification.

PSXMM PENSTOCKS, WIERS, ADJUSTABLE WEIRS, HANDSTOPS AND STOPLOGS

PSXMM 1 SCOPE

This Contract covers the supply, delivery, transport, handling, installation, commissioning, testing, adjustment, handling over in complete working order and upholding during the Defects Liability Period of all type penstocks complete with operating equipment, hand stops, adjustable weirs and stop logs.

PSXMM 3 MATERIALS, DESIGN AND MANUFACTURE

PSXMM 3.1 Material

The thickness of materials shall be suitable for the duty required.

PSXMM 3.2 Manufacture

Penstocks and valves

The frames and gates of wall mounted as well as channel type penstocks shall be made of grade 304 stainless steel.

All gates shall be well guided with no possibility of jamming. The gates shall be held uniformly against the side facings of the frames by the action of adjustable wedges and shall provide drop-tight closure under the conditions listed in project specification.

All penstocks shall be of the level invert type fitted with renewable seals of a non-biodegradable material on the invert.

The sluice gates shall be dimensioned such that their installation in the channels and openings shown on the drawings is facilitated.

The sluice gate shall be standard items and shall be installed so that head frames shall be flushed with vertical channel walls and do not project horizontally into the channel.

All nuts, bolts, washers and other components shall be manufactured from stainless steel.

The channel sluice gates shall be robustly designed and constructed, having vertical and horizontal ribs to withstand pressures from both directions. The matching head frame shall be adequately designed to resist distortion, and both the gate and the frame shall have machined seating faces to ensure perfect sealing. The head frame shall extend above the concrete channel, to support the gate in the fully open position.

Seating pressure as well as unseating pressure may act on any channel or circular sluice gate, and the sluice gate shall be able to resist these pressures.

Holding down bolts of penstock fixed against concrete walls shall be made of Grade 304 Stainless Steel.

Channel sluice gates shall be provided with rising spindles.

Adjustable Overflow Weirs

The adjustable overflow weirs shall comply with the following requirements:

(i) They shall have stainless steel indicators showing the degree of adjustment of the weirs in mm.

(ii) They shall be horizontal after installation with a maximum allowable variation from the horizontal not exceeding 1 mm.

(iii) They shall be watertight underneath and at the sides of the frame.

(iv) All equipment shall be resistant to the corrosiveness of sewage. Holding- down bolts, washers, etc. shall be stainless steel.

Hand stop

The following requirements shall be applicable to hand stops:

(i) Each hand stop shall be supplied with a stainless-steel frame extending to the top of concrete or masonry. The frame shall be grouted into an opening in the concrete or masonry. Each hand stop shall be capable of sliding in and out of the frame.

(ii) Each hand stop shall seal 100% watertight under all circumstances. This may be achieved with the use of Neoprene sealing material.

(iii) Hand stops and frames shall be manufactured from 4,5 stainless steel plates.

(iv) Each hand stop shall be robust and provided with reinforcing elements designed by the supplier to the approval of the Engineer. The reinforcing elements shall effectively prevent buckling under full static head conditions.

Stop logs.

Each stop logs set shall comply with the following requirements:

(i) The stop logs sets shall be supplied with stainless steel frames extending to the top of the concrete or masonry. The frames shall be grouted into the openings in the concrete or masonry in such a way that the stop logs are capable of sliding in and out of the frame. The stop logs sets shall be watertight under all normal operational circumstances.

(ii) The stop logs and frames shall be manufactured from stainless steel plates. Each stop log shall be provided with reinforcing elements designed by the supplier with the approval of the Engineer. The reinforcing shall effectively prevent buckling under full differential static head conditions.

(iii) The maximum vertical dimension of any individual stop log shall not exceed 150 mm.

(iv) Each individual stop log in any one set shall have the same vertical and horizontal dimensions.

(v) Each individual stop log shall be provided with two lifting logs.

(vi) A neat stainless-steel stand or pair of stainless-steel hooks shall be installed at close proximity to each installed set of stop logs for the storing of stop logs when removed from the frame.

(vii) Each set of stop logs shall be provided with two portable stainless steel lifting hooks; each fastened with a 200 kg capacity stainless steel ante-loss chain or UV-stabilized 200 kg capacity nylon rope to a suitable bracket on the hand railing or walkway structure. The chain or rope shall be long enough to facilitate easy operation of the lifting hooks. The lifting hooks shall be used to manipulate individual stop logs by hooking into lifting lugs.

(viii) Enough individual stop logs shall be supplied in each set to effectively span a minimum distance as shown on relevant drawings.

Corrosion protection

Corrosion protection must be carried out according to project specification.

PSXMM 3.3 Design

All parts shall be designed for the duty required, but the minimum factor of safety against structural failure shall not be less than 3, based on the working stress of the material. In the design, due consideration shall be given to the thickness of materials with regard to corrosion and operating conditions. The force required at a hand wheel or crank to raise a gate or open a valve shall be in the order of 100 Newton per hand and the design parameters must be submitted in the Technical Data Sheet.

PSXMN ARCHIMEDEAN SCREW PUMPS

PSXMN 1 SCOPE

Manufacture, supply, deliver, transport, handle, protect, store, install, commission and uphold of two screw complete with Archimedean screws, bearings, drive unit, screw trough and splash plates.

PSXMN 3 MATERIALS, MANUFACTURE AND DESIGN

ROTATING SCREW ASSEMBLY

Centre tube

Tube construction will be of longitudinally or spirally seam welded sections with circumferential butt welds if necessary. Circumferential welds will be as far away as possible from the highest stressed centre portion of the tube. The tube size has been selected so that the design stress during operation is very low.

Flights

Flights are cold formed using a specially designed bending machine and then filled welded to the centre tube into a series of smooth continuous helices with close attention paid to flight pitch accuracy.

After final welding of the flights to the tube the screw assembly is rotated between centres and the outer flight edges are accurately trimmed by flame cutting to give the screw a truly concentric and cylindrical shape.

End plates

The end plates, which are machined and drilled to securely fix the top and bottom of the centre tube, are accurately positioned and aligned prior to being welded to the centre concentric rotation of the end shaft.

Top and bottom assembly

The rotating screw assembly is supported at the end by a sell-aligning double spherical roller bearing that is mounted in a specially selected housing incorporating a removable cap and grease seals.

The bearing, which takes both axial and radial loading, is of the heavy-duty type and is rated well in excess of a B10 – 100 000 hours life.

Lubrication is by manual greasing intermittently from within the motor room.

Bottom Bearing Assembly

The bottom bearing assembly consist of a phosphor bronze bushed housing that is fixed to, and rotates with, the screw. The bush runs on a stationary stub shaft that is supported on a stall housing fixed rigidly to the concrete sump floor, wear is therefore evenly distributed. The Bearing is continuously grease lubricated through piping from a pump situated in the motor room.

A grease seal is incorporated at the lower end of the shaft some distance away from the bush of the bearing and quite a long annulus exists between the bearing bush and the seal. This annulus becomes packed with grease that has passed through the bearing on its way to exit at the lip of the seal. Should a grease pump failure occur, the grease packed annulus protects against the ingress of water and lack of lubrication for longer periods of time.

The bottom bearing is subject to radial loading only and takes no axial loading whatsoever. The rotating parts of the assembly are covered with a cowling to prevent any rags or stringy material from becoming entangled.

Screw trough

Concrete trough

The screw rotating within a specially formed concrete trough that is screeded to give a uniform and carefully selected clearance between the screw flights and the trough surface. The clearance is designed with consideration being given to both hydraulic and any operational eccentricity of the rotating screw. Operational eccentricity will normally only occur upon start up and is caused by the temperature on the upper surface of the screw being higher than the lower surface.

The concrete portion of the trough will extend around the lower 180° of the screw and is to be constructed such that no “wedges” are present which might cause jamming with solid materials.

side profiles

To maintain high pump efficiency and prevent backflow of water, fabricated steel side profiles will be installed. These profiles will be positioned and fixed after installation of the screw and after final screeding of the trough so that the design clearance is maintained around at least 230° of the screw circumference.

Additional covers to enclose the entire unit and contain odours are also included, as specified.

Screw drive

Base plate

A common base plate will be supplied for mounting of the top bearing, gearbox, motor and other ancillary equipment. After final alignment, mass concrete is to be cast around the base plate and framework to form a rigid structure with the motor room floor.

Starter reinforcing bars will be required to project from the motor room floor beneath the base plate concrete. All starter bars and concrete work etc. are excluded from our offer.

Lubricator and piping

Grease lubrication of the bottom bearing is supplied by an automatic lubricator mounted adjacent to the gearbox. A high quality, reliable lubricator has been selected because of the critical nature of the lubrication duly and the life of the bottom bearing depends entirely upon the reliability of this unit.

An independent, directly coupled, motor drives the lubricator. Should the lubricator motor fail the screw motor will be automatically cut out to protect the bottom bearing. The rate of grease supply is adjustable, and the grease reservoir incorporated an external level indicator.

Grease is conveyed to the bottom bearing through stainless steel or heavy-duty copper piping with a flexible nylon pipe connection to the lubricator within the control room. The piping passes through a conduit that runs parallel to the screw and is cast into the concrete by the Civil Contractor.

Covers

Cover plates will be installed on the inside of the motor room over each opening through which the screw drive short passes to protect the drive coupling and top bearing against splashing.

Gearbox

The gearbox offered has been selected for reliability and efficiency over operational range and incorporates helical reduction gear trains mounted within a robust cast iron gear case. The gears are oil bath lubricated, and the box is modified to operate efficiently at the angle of the screw. Gear ratings are to AGMA or DIN standards and incorporate a service factor of indicated in the technical data sheet.

Bearings are rated for a B10 life of at least 100 000 hours, and inspection covers, an oil breather, oil level indicator and oil drain are provided for ease of routine maintenance and inspection.

Motor

The foot-mounted motor is a standardized metric motor of the totally enclosed fan cooled type rated for the maximum power absorbed plus a service of at least 15%.

Vee Belt Drive

The gearbox is driven from the motor by a substantially rated vee belt drive that has the following advantages over direct driven units.

(i) Vee belt drive allows flexibility between motor and gearbox thus limiting stress on the gears and bearings if the screw meets some sudden resistance.

(ii) Direct coupled drives do not possess this flexibility, and the alternative use of overload devices is complicated and expensive.

(iii) Gearbox noise and wear is reduced as the input speed to the gearbox can be reduced by a third and a lower gear reduction used.

Holdback Device

A holdback device is fitted to prevent rotation of the screw and subsequent damage. The device will free wheel smoothly and silently whilst the pump is running in the normal direction of rotation. No ratchets are involved, and wear is almost non-existent.

Guards

Guards will be supplied to cover all moving parts such as the vee belt drives, rotating shafts and couplings.

Screw Rotation

Due to the configuration of the flight-bending machine the screw rotation will be clockwise when viewed from the non-drive end.

PSXMO MANUFACTURE AND SUPPLY OF VALVES

PSXMO 1 SCOPE

The section of the Specification includes the manufacture, testing end supply of valves for the conveyance of raw or potable water at ambient temperatures in pipes under pressure.

PSXMO 2 INTERPRETATION

Standards

The most recent issues of the following standard specifications will apply for the purpose of this Specification.

SABS 144 : Cast-iron single door reflux valves.

SABS 191 : Cast steel gate valves.

SABS 192 : Cast steel single door reflux valves.

SABS 664 : Cast iron gate valves for waterworks.

SABS 665 : Cast iron gate valves for general purposes.

BS 5155 : Cast iron and carbon steel Butterfly valves.

ISO 2441 :	Pipeline flanges for general use – shapes and dimensions of pressure tight surfaces
SABS 1123:	Steel pie flanges
SIS 05 5900:	Pictorial surface preparation standard for painting steel surface

PSXMO 3 MATERIALS

PSXMO 3.1 Material

Sluice Valves

The valve body, bonnet, thrust dome, gate and glands shall be cast iron or cast steel as specified and depending on the required test pressures.

Body and gate sealing rings shall be of bronze, gunmetal or stainless steel. RSV gate shall be nitrile rubber covered, and fully encapsulated. The rubber shall not be removed from the guides of the gate.

Spindles shall be of high-grade stainless steel.

An isolating valve must be able to check the specified water pressure from both sides.

Butterfly Valves

Valve bodies and discs shall be of high-grade cast-iron or cast steel as specified and depending on the required test pressures. The disc shaft or stub-shaft shall be of stainless steel located in self-lubricating bearings. Sealing rings, seal retaining rings, body seat rings and associated screws shall be of stainless steel. A butterfly valve must be able to check the specified water pressure from both sides.

Reflux Valves

Valve bodies shall be of cast iron or cast steel depending on the specification or test pressures. Valve doors shall be of cast iron or cast steel. The valve body and doors or disc shall be fitted with replaceable stainless-steel body and door seat rings.

Air Valves

Valve bodies, covers and shield plates (large orifice) shall be of cast iron.

The balls shall be of stainless steel.

PSXMO 3.2 Manufacture

General

The design pressure of the valves shall not be less than the pressure specified subject to a minimum of 1 000 kPa. All valves shall be double flanged with bolt holes drilled off-centre all in accordance with the requirements of SABS 1123 or as otherwise specified. The Tenderer shall give as a function of the downstream pressure the maximum acceptable discharge of water through the valves without risks of vibration and cavitation. The Tenderer shall also submit the head-loss characteristics of the valves.

The design pressure will be hand stamped on the top edge of the flanges of valves in kPa. If specified, valves shall be supplied with by-passes to be bolted on to the body of the valve and not to the adjoining pipe work.

Valves shall be fitted with position indicators if specified. Fully closed, fully open and intermediate positions shall be indicated in corrosive proof and robust design indicators. Arrows shall be cast on all hand wheels together with the wording “TO OPEN” or “TO CLOSE”. The closing direction shall be clockwise unless otherwise specified.

In the case of cap top valves, an aluminium disc of at least 100 mm diameter and with the same wording and arrows shall be slipped over the spindle and retained by the cap. All valves shall be supplied complete including bolts, nuts, washers and gaskets in accordance with the class of valve. Bolts shall be of sufficient length to allow not more than three screw threads to protrude outside units after complete tightening of the assembly.

Gaskets for flanged joints shall be of compressed asbestos fibre to BS 2815 Grade A and full faced with a minimum thickness of 3mm for pressures up to and including 1 600 KPa cloth-inserted rubber may be used.

The following information shall accompany the tender:

- ✓ Description
- ✓ Flange Drilling
- ✓ Maximum working pressure
- ✓ Maximum unbalanced pressure
- ✓ Test pressure
- ✓ Manufacturers number
- ✓ Material of components
- ✓ Gearing
- ✓ Accessories

Sluice Valves

Double-flanged, wedge-gate, internal (non-rising) spindle sluice valves of the waterworks pattern are required to comply fully with SABS 9191 or SABS 664 where applicable. Only full-way valves will be accepted (i.e. the gate must be clear of the waterway in the fully open position).

The maximum force required to turn the hand wheel at the maximum torque shall not be.

greater than 100 N per hand at the hand wheel run (Total effort = 200 N) when operating at an unbalanced pressure equal to the rated working pressure of the valve. This may be achieved with the aid of gearing of a suitable ratio. Where gears are used replaceable shear pins shall be provided to prevent damage to the valve if excessive pressure is used.

Butterfly Valves

Horizontal spindle type butterfly valves complete with gearing, hand wheels and flanged at both ends with separate bolting for joining to the adjacent pipe work is required.

Wafer valves or valves fitted with studs for attachment to the adjacent flanges are not permitted.

Valves shall be drop-tight when closed and metal to metal sealing is not acceptable.

All resilient seals shall be removed and readily replaceable on Site with the valve in position. Resilient seals shall be retained by corrosion resistant securing elements to prevent corroding in position (e.g. bolts, set screws, etc.)

The valve-water seal shall be of the following types:

(i) a resilient seal fixed to the edge of the disc by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the body.

(ii) a resilient seal fixed to the body of the valve by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the edge of the discs.

Reflux Valves

Reflux valves shall be double-flanged and comply with SABS 144. Valve bodies and seals shall be free of pockets that will allow dirt accumulation and prevent the doors from closing fully Stops or an approved resilient material shall be fitted into the body to prevent the doors from fluttering under full flow conditions. Valves shall be designed to allow for rapid but non-slamming closing characteristics.

Air Valves

Air valves shall be supplied with double-flanged, wedge gate internal (non-rising) spindle sluice valves for isolation, which unless otherwise specified shall confirm in

all respects to this specification.

Electric Actuators (Applicable for Valves and Sluices)

When specified, the valves shall be fitted with electric, motor-driven flood proof IP 67 actuators of robust design, capable of closing the valves under all unbalanced pressures.

The Tenderer shall state the maximum torque required to operate the valve in his tender.

In determining this maximum torque an allowance shall be made for any deterioration that could be expected to occur in the bearings during the life of the valve. The actuator shall be capable of transmitting twice this maximum torque without any of its components suffering permanent damage. This shall be proven to the Engineer's satisfaction by workshop tests.

The actuators shall be capable of restraining the valve in any position under all possible conditions of operation, and shall not, in any circumstances, be capable of becoming self-motorized as a result of the dynamic torque loading on the disc or plunger.

All gearing shall be manufactured in accordance with BS 436 Class C and shall be machine cut. All components requiring lubrication shall be adequately lubricated and totally enclosed flood-proof casing fabricated in cast iron and/or die cast aluminium to suit the service weatherproof casing whether the valve is to be installed in the open or under cover. Actuators shall also be fitted with mechanical stops to prevent excessive turning ad shall be provided with replaceable shear pins.

Hand wheel shall be fitted to all actuators. The direction of rotation to close the valve shall be clockwise when viewed from above the end of the input shaft and from the position of operation. In addition, they shall be clearly and indelibly marked with an arrow showing the direction of closing and the words “Close” and “Toe”.

Whether the valve is actuator driven or manually operated, the maximum force required to turn the hand wheel at the maximum torque defined above shall not be greater than 100 N per hand at the hand wheel rim. (Total effort= 200 N.) For large valves the minimum of complete revolutions of the hand wheel to move the valve gate from fully open to fully closed shall not be less than 100.

All electric actuators shall be provided with reversing contactors: local and remote control shall be provided; a device making the local control non-operative shall also be provided on the relevant remote-control panel.

After factory tests, the actuators shall be removed from the valve and delivered to site in separate boxes to safeguard against damage.

Protection

All materials and workmanship to comply with relevant SABS specifications.

Internal Protection

Internal surfaces of valve bodies and discs shall be grit blasted to a **$2_{1/2}$** of SIS 05 50 00 finish. Successive coast of an approved non-toxic epoxy resin paint suitable for spray application (Copon EP 2300 or similar) shall then be applied to give a final dry film thickness of 250 µm. Drying times between successive layers shall be strictly in accordance with the requirements of the paint manufacturer. As an alternative to the protection as specified above, the Contractor may be required to use either a solvent less epoxy paint system or a fusion bonded epoxy powder coating as specified in the Project Specification.

External Protection

External surfaces of valve bodies shall be wire brushed to a 3 of SIS 05 59 00 standard and painted with one layer zinc chromate primer to SABS 679 Type I (dried film thickness 50 µm). This will be followed by two alkyd-based undercoat (each coat 25µm thick) and one alkyd-based enamel finishing coat to SABS 630 Grade 1 (dried film thickness 25 µm). Final colour will be as specified by the Engineer.

Machined flanges will be panted with a protective coating of shellac or similar.

PSXMO 5 CONSTRUCTION (INSTALLATION)

Ancillary equipment

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.

The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant.

PSXMO 6 TOLERANCES

Tolerances as specified in the appropriate SABS or BS standards shall be apply to this contract.

PSXMO 7 TESTING AND INSPECTION

PSXMO 7.1 TESTING

Testing by Manufacturer

The Manufacturer shall carry out all tests to ensure that valve materials confirm to the requirements of the relevant SABS or BS Specification. This test will not necessarily be attended by the Engineer, but records must be kept, and all test results shall be made available to the Engineer.

Testing by Independent Body

The Engineer may appoint an independent recognized body to conduct control tests. Samples required for such tests will be provided by Manufacturer free of charge and sampling will be done by this body in accordance with the relevant SABS or BS Specification.

Hydrostatic Testing

All hydrostatic tests will be witnessed by the Engineer, and the Manufacturer will give at least one-week prior notification to the Engineer of the proposed dates for such tests.

Valve bodies will be close end tested to at least 1,5 times the working pressure. Test pressures will be maintained for at least 5 minutes, and valve bodies will be watertight in all respects at the test pressure.

Assembled valves will be open-end tested to 1,5 x working pressure for materials strength and soundness. Valves will drop tight from both directions over the complete range of

pressures from 0 to 1,5 x working pressure.

Each valve will be supplied with a test certificate certifying that it complies in all respect with the requirements of this Specification.

PSXMO 7.2 Inspection

Visual, operational and dimensional inspection of valves as well as inspection of protective coatings will be carried out by the Engineer and/or the Manufacturer in the Manufacturers workshops prior to the dispatch of valves to site.

Inspection by the Engineer shall in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply valves strictly in accordance with the specification.

PSXMO 8 MEASUREMENT AND PAYMENT

General

The cost of such control tests will be borne by the Employer.

Tendered prices shall include for the following unless otherwise specified in the Project specification.

- ✓ Protective coating as specified.
- ✓ Couplings and/or jointing material for each type of valve.
- ✓ Packing and temporary protection against damage during transport and delivery.
- ✓ Temporary storage and maintenance if required.
- ✓ Delivery and storage of material on site or in a store as specified.
- ✓ Testing and inspections at Manufacturer's work.

Valves will be measured per unit of each type.

PSXMP MANUFACTURE, SUPPLY AND TESTING OF STEEL PIPES

PSXMP 1 SCOPE

This specification covers the manufacture and supply of bare, electric welded low carbon steel pipes and steel pipe special items for the conveyance of water at ambient temperatures and at medium pressures.

PSXMP 2 INTERPTRETATION

PSXMP 2.2 STANDARDS

Pipes and specials shall be manufactured, tested and inspected in accordance with the latest issues of the following standard specifications unless amended in subsequent clauses in this specification.

Pipes

SABS 719 : Steel Grades A, B and C

SABS 1431: Steel Grades 300 WA

API 5L : Steel Grades x46, x56 and x60

Specials

Specials of 150 mm nominal diameters and smaller to be manufactured with pipe conforming to ASTM Schedule 40. Specials larger than 150 mm nominal diameter shall be manufactured from pipes complying with this specification.

The radiographic technique, adjudication of radiographs and repair of defects shall be in accordance with API 1104.

Qualifications of Welders

All manual or semi-automatic welds and repair welds shall only be undertaken by welder's qualified under the tests laid down in accordance with API 1104.

Non-destructive Tests and Adjudication

Radiographic inspection: API 1104.

Ultrasonic inspection: API 5L.

In this Specification reference is made to the latest issues of the following specifications.

SABS 719, API 5L, API 1104, ASME Section V, BS 2971 and BS 2633.

Stresses

a) All pipes shall be hydrostatically tested as described in PLN 6.5 to a pressure such as to produce a circumferential tensile stress in the steel of not less than 90% of the minimum yield stress.

b) The design stress for pipes subjected to the specified design pressures shall be 60% of minimum yield stress of the steel.

PROCESS OF MANUFACTURE FOR PIPES

Pipes shall be manufactured by an approved semi-automatic submerged-arc welding process or shall be electric resistance welded. Where semi-automatic submerged-arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside. The number of longitudinal weld seams shall not exceed:

a) one seam for pipes up to 1 000 mm nominal diameter.

b) two seams for pipes larger than 1 000 mm and up to 2 000 mm nominal diameter.

Circumferential welds by semi-automatic submerged-arch welding method for factory double jointed pipes shall have at least one pass on the inside and at least one pass on the outside.

Welds

SABS 719, BS 2971 and BS 2633 shall generally apply.

For fusion welded pipes and specials, the internal weld bead shall not protrude more than 1 mm into the bore of the pipe or special.

For electric resistance welded pipes, the height of upset metal and flash on the inner surface shall not exceed 1,0 mm.

For pipes to be joined by butt welding, the internal weld bead shall be ground flush with the pipe body for a length of 200 mm from ends to be jointed.

For pipes to be coupled by flexible couplings, external weld reinforcement or upset metal and flash shall be ground flush with the pipe body for a length of 200 mm from the end to be coupled.

DIMENSIONAL REQUIREMENTS

Pipes

All dimensions will be in accordance with SABS 719 clause 4.

PSXMP 3 MATERIALS

FLANGES

a) Material – shall be steel plates to conform to the requirements of SABS 1123.

b) Dimensions – shall be in accordance with SABS 1123 unless otherwise specified in the Schedule of Quantities or on the drawings.

c) Type – all flanges shall be of the steel-plate for welding type and shall have flat joint faces unless otherwise specified in the Schedule or Quantities or on the drawings.

d) Finish – joint surfaces shall be in accordance with SABS 1123 clause 4.5.

e) All flanges shall be supplied complete with bolts, nuts and washers of a material to conform to the requirements of SABS 1123 where applicable, otherwise to the requirements of the Engineer.

Gaskets for flanges joint shall be of compressed asbestos fibre to BS 2815 Grade A and full faced, unless otherwise specified in the Project Specification, with a minimum thickness of 3 mm.

FLEXIBLE COUPLING

Flexible couplings shall be of the Viking Johnson or Klamflex type with centre register except where specified to the contrary in the Schedule of Quantities or on the drawings.

Couplings must be able to withstand hydrostatic test pressures of 1.5 times the specified design pressures and coupling flanges must be designed to withstand all stresses due to tightening of the bolts. Rubber rings shall generally comply with SABS 974 Class F. The internal face of the sleeve section of each coupling shall be grit blasted to SIS 055900 Grade Sa3 finish with an anchor pattern profile not exceeding 75 micrometres in depth as determined by micrometre gauge or portable microscope fitted with a calibrated focusing knob. Within four hours of grit blasting provided surfaces are kept dry and clean, one coat

of an approved epoxy resin, Copon or similar shall be spray applied, followed by further coats to a dry film thickness of not less than 300 micrometres over the average profile peak. All other surfaces of coupling components shall be grit-blasted to the same minimum finish and shall receive one coat of an approved protective paint which shall be compatible with materials to be used for the exterior moulding of the coupling in the field. Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

MARKING OF PIPES

All pipes and specials shall be clearly hand stamped alongside a longitudinal or spiral weld on one end of the pipe with the following.

a) Grade and thickness of steel.

b) Serial number of the pipe or specials.

c) Nominal diameter.

d) Hydraulic tests pressure.

ANCILLARY EQUIPMENT

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.

The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant.

PSXMP 5 CONSTRUCTION (INSTALLATION)

CORROSION PROTECTION

SCOPE

This section includes the corrosion protection and materials required for this Contract.

GENERAL

The Contractor shall ensure that he has available the latest edition of all the relevant National Specifications and Codes of Practice and the manufacturer's data sheets for materials to be used.

All paints in a paint system shall be purchased from the same manufacturer.

The Contractor shall submit in the Appendices to the document; details of the paints he intends using and shall only proceed with purchase of the paints upon receipt of written approval from the Engineer. Manufacturer's data sheet or legible copies thereof for each product shall be attached to the Appendices.

Materials and procedures shall comply with the appropriate SABS Specifications and Codes of Practice when relevant.

Strict attention shall be paid to fettling of surfaces by the Fabricator (see Clause PZA 4) prior to coating. Surface preparation requirements, the need for strict cleanliness and adherence to specification requirements especially with regards to over coating times are emphasized.

Areas which are inaccessible after assembly shall be prepared and fully coated with the specified system and to the specified requirements before assembly. The coating shall be fully hard dry before assembly.

Mating surfaces shall be coated with primer of first coat only. The coating shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joint shall be fully coated.

The painting sub-contractor shall provide evidence of his competence to apply the specified materials in the specified manner and to apply the necessary Quality Control procedures.

The Engineer, at his discretion, may demand a Quality Audit of the Contractor's facilities by a technically competent and independent organization.

The Contractor shall provide a Quality Plan to show the stages at which Quality Control will be carried out. Further details are given in Clause PZA 10. The Quality Plan is subjected to approval by the Engineer, who may require it to be revised if considered inadequate.

The Engineer will require a Program of Work so that Quality Surveillance inspection can be planned and executed at the appropriate time according to the Contractor's program.

The Contractor shall provide to material suppliers descriptions of materials to be used and shall receive from them a written assurance that the materials to be supplied with the requirements specified.

Design

General

All items shall be designed to minimize corrosion in exposed environments, under immersion conditions and in interior corrosive situations such as in chlorination rooms. The following notes may be used as guidelines.

Water retention area

Avoid water retention areas wherever possible. For example, angle or U section steel should be used with the toes pointing downwards. The concrete base of steel columns should be sloped away from the steel, and the sloping edge should be painted to avoid water ingress at the steel/concrete interface.

Crevices

Crevices give rise to accelerated corrosion by forming an oxygen concentration cell. Crevices may be avoided by using.

(i) continuous welding, not space welding

(ii) mastics or sealants to seal unavoidable crevices such as bolted connections

(iii) insertion rubber or suitable plastic between mating.

Bimetallic Couples

Electrical contact between dissimilar metals gives rise to a corrosion cell when an electrolyte such as water is present. Junctions between dissimilar metals shall be insulated.

Accessibility

Whenever possible, the surface of corrodible materials such as mild steel shall be accessible for maintenance. The use of back-to-back angles, partially open box sections or inaccessible stiffeners shall be avoided.

Differential Aeration

Posts buried in soil are subjected to accelerated corrosion to differential aeration. Additional protection shall be given to that part which is buried and up to at least 100 mm above ground.

Sharp Edges, Weld Spatter and Weld Slag

The designer shall specify that all sharp edges be ground to a radius not less than 2 mm and that all weld spatter and weld slag shall be removed by the Fabricator.

Hot Dip Galvanizing

The design of articles to be galvanized shall be referred to the galvanizer.

Coating materials

No variation in materials tendered and approved by the Engineer shall be permitted without the approval of the Engineer in writing.

Correct material selection shall be confirmed by the material supplier.

All coating materials shall be delivered in the manufacturer's original sealed containers, clearly marked with the following:

(i) Manufacturer's name.

(ii) Product Brand and Reference Number.

(iii) Batch Number which may incorporate the date of manufacture.

(iv) Date of manufacture, unless already incorporated in the batch number.

(v) Abbreviated instructions for storage and use of the material, which shall include mixing ratios of components of multi-component materials, minimum temperature of application and method of application.

(vi) The SABS mark where applicable.

All coating materials shall be kept in an approved store, which shall be dry, enclosed and where the temperature is unlikely to exceed 40˚C or drop below 0˚C.

Usage of materials shall be on a first in, first out basis and no materials may be used which have exceeded the shelf life recommended by the manufacturer.

Fettling or dressing by the fabricator

Before any surface preparation or painting is commenced, dressing shall be carried out to avoid projections, sharp edges, weld slag and spatter that will interfere with the corrosion protection. This includes the following:

Remove all weld flux and weld spatter. Flux is best removed by washing with clean water whilst weld spatter is normally removed by grinding to a smooth surface.

Sharp edges shall be ground to a radius not less than 2 mm.

Welds shall be continuous and shall have a smooth contour. Rough welds shall be ground where necessary to achieve the required smooth profile. Discontinuous welds shall not be permitted except by written approval of the Engineer. Undercuts are not permitted and shall be re-welded and ground where necessary.

Articles for hot dip galvanizing shall not contain overlap joints. Closed sections shall be suitably vented.

Surface preparation for painting

Mild Steel

Oil and grease contamination, when present, shall be removed by degreasing before blast cleaning.

Mild steel shall be blast cleaned in accordance with Section 4.3 of SABS 064 Code of Practice for "The preparation of steel surfaces for coating".

An additional requirement is that water soluble salts present in the steel after blast cleaning shall not exceed the value given in Table 1. Should these values be exceeded, the steel shall be cleaned by washing with clean potable water or by water shrouded or water injected blast cleaning until the soluble salts are within the limits specified in Table 1. The steel shall then be allowed to dry, after which it shall be flash blast cleaned to achieve the required degree of cleanliness.

Cast Iron and Cast Alloys

All cast surfaces shall be blast cleaned with new iron slag, copper slag, or platinum slag abrasives designed for blast cleaning. The abrasive shall not be recycled or re-used. Cast iron shall be blast cleaned until all sand particles, residual burst on sand and casting skin have been completely removed. This blast cleaning shall be carried out by the Foundry prior to dispatch to the galvanizer or painting Contractor, when relevant. Conventional cleaning of castings is inadequate for galvanizing.

Galvanized Steel Surfaces

Galvanized steel surfaces shall be thoroughly degreased prior to painting, using either a water risible solvent degreaser used in accordance with the manufacturer's instructions, or a mild acid-detergent degreasing solution. In both cases care shall be taken to avoid entrapment of cleaning agent in recesses or other retention areas and in both cases the surfaces shall be thoroughly washed until a "water break free" surface is achieved. If necessary, the process shall be repeated until a "water break free" surface is obtained.

A water break free surface is one which, when wetted all over with potable water, maintains a continuously wet surface and the water does not break up into islands of un-wetted surface.

TABLE 1 – STANDARDS FOR BLAST CLEANING REQUIRED

Property	Above Water	Immense Surface	Tape Wrapping
Cleanliness to SIS 06 5900 (min)	Sa2½	Sa3	Sa2
Residual dust and debris	0,5%	0,3%	1%
Oil grease and perspiration	Nil	Nil	Nil
Surface Profile min (micrometres)	25 50	50 10	50 100
Water soluble iron salts maximum at any point	500 mg/m^2	100 mg/m^2	500 mg/m^2
Average of any 250 cm	100 mg/m^2	100 mg/m^2	100 mg/m^2

After degreasing, the surface shall be lightly abraded by one of the following methods:

(i) On small areas using abrasive paper not coarser than 120 grade, or by using non-metallic abrasive pads.

(ii) On large areas by "sweep blast cleaning", using a nozzle pressure not greater than 300 kPa and a very fine abrasive. Cracking, flaking, or any form of delamination of the zinc coating due to excessive blast cleaning shall not be permitted. Removal of zinc by blast cleaning shall not exceed 10 micrometres.

Finally, all dust and debris shall be removed by vacuum cleaning, or by washing, and the surface shall be allowed to dry before coating.

Aluminium

Generally, aluminium surfaces will be anodized, or powder coated and will require no further treatment. Where painting is required, the aluminium surface shall be thoroughly degreased, then rinsed with clean potable water. If the surface is not "water break free", repeat the degreasing process until a water break free surface is obtained. Allow to dry completely, then apply a thin coat (8 to 13 micrometres dry film thickness) of wash primer complying with SABS 723, mixed and applied in accordance with the manufacturer's instructions.

NOTE: Wash primer is an adhesion promoter and does not replace the primer specified in the paint system.

Stainless Steel

Components fabricated from stainless steel shall not be contaminated with iron or mild steel. Sheared edges, welds or surfaces subjected to any form of heat treatment shall be picked and passivated. Stainless steel surfaces shall not be scratched or stressed.

When it is required to paint stainless steel, the surface shall be blast cleaned with non-metallic abrasive such as iron slag, copper slag or platinum slag. The use of steel shot, steel grit or cast iron is strictly prohibited. Any contamination with iron or mild steel is prohibited.

Where blasting is impractical, the surface shall be cleaned with detergent solution and roughened manually by using non-metallic abrasive pads, followed by washing with clean potable water to a "water break free" surface. If a "water break free" surface is not obtained, detergent cleaning shall be repeated until the surface is "water break free". Allow the surface to dry before coating.

Painted Surfaces

(i) Fully painted surfaces to be repaired; Bare areas shall be cleaned with abrasive paper not coarser than 220 mesh to bright metal surface. The surrounding paint, which must be intact, shall be feathered for 20mm beyond the damaged areas. Dust and debris shall be removed using a clean rag dampened with water or clean solvent that will not attack the coating.

The damaged area shall be allowed to dry, after which spot repair shall be carried out with all the coats previously applied and shall overlap the undamaged area by 20 mm. The requirements of the spot repair shall be not less than that specified for the undamaged coating. When additional coats are required over the whole surface, the whole surface shall be abraded to a uniform matt finish, dust and debris removed, and the surface allowed to dry.

All further coats shall then be applied as specified to give a uniform finish. Note that abrasion of the coating is not required for vinyl systems.

(ii) Fully painted surfaces to be overcoated; Where additional coats are required over the whole surface, the surface shall be degreased and abraded to a uniform matt finish. The surface shall be washed to remove all contamination and then allowed to dry. Further coats shall then be applied as specified to give the required coating thickness and specified finish.

(iii) Primed surfaces: Shop applied primers shall be thoroughly sanded with fine abrasive paper to achieve a uniform matt surface, then scrubbed with a solution of suitable water-based detergent-degreaser using a bristle brush, followed by clean water rinses to remove all grease and water-soluble matter.

The surface shall be allowed to dry completely before application of the specified coating system over the whole surface.

Plastic Surface such as u-PVC and Polyester GRP

Sand the surface thoroughly with fine abrasive paper to achieve a uniform matt finish. Remove all debris, oil and grease by scrubbing with a solution of a suitable water-based detergent such as Shell Teepol Lensex. Allow to react for 15 to 30 minutes, then rinse off very thoroughly with clean potable water to remove all residues. Allow to dry completely before painting.

APPLICATION OF PAINTS

Environmental Conditions

Paint shall not be applied in dusty conditions, nor when the steel surface temperature is less than 3˚C above dew point, or higher than the advised by the paint manufacturer, or when humidity is greater than 85%, nor when the ambient temperature is less than the minimum or greater than the maximum specified by the manufacturer of the coating material.

Mixing

All coating materials shall be very thoroughly mixed until completely homogeneous. In the case of two pack materials, each component containing pigments shall be thoroughly mixed. The two components shall then be mixed together in the proportions supplied by the manufacturer until the mixture is completely homogeneous. In the case of solvent-based epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period of 20 to 30 minutes before use.

For two pack materials, the use of part of the contents (Split packs) is strictly forbidden.

Method of Application

Application shall be by brush, roller, spray, airless spray or other suitable equipment as appropriate for the surface to be coated and in accordance with the recommendations of the manufacturer. Application equipment shall be maintained in clean conditions and in good working order. The use of equipment not maintained in good condition may lead to rejection of the coating.

NOTE: Zinc silicate primers shall be applied by conventional spray, using a continuously agitated pressure pot, unless otherwise recommended in writing by the manufacturer.

Over-Coating

Over-coating times shall be not less than the minimum nor greater than the maximum specified by the manufacturer relevant to the ambient temperature. Strict adherence to over-coating times is particularly important for coatings which are subsequently immersed.

The Contractor shall be held responsible for blistering of paint coatings on immersion, when shown to be caused by solvent retention.

All costs shall be clean and free from dust, oil, moisture, perspiration before over-coating. Operators handling blast cleaned or partially painted surface shall wear clean gloves to avoid contamination of the surface.

Manufacturer's Instructions

Recommendations supplied by the manufacturer in the form of the latest edition of printed data sheets, or given in writing on the manufacturer's letterhead, shall be followed. Verbal information by the manufacturer's representative will not be accepted unless confirmed in writing by the company.

Handling

Coated components shall not be handled earlier than the hard dry time recommended by the manufacturer, relevant to the ambient temperature. Coated components shall be handled with broad band slings and suitable packing to minimize damage to the coating. All damage caused in handling, transportation and erection, shall be repaired to the satisfaction of the Engineer at no extra cost.

Metal coating and corrosion resistant metals

Hot dip galvanizing

Design and Fabrication

Components for hot dip galvanizing shall be designed and fabricated in accordance with the recommendations of SABS Code of Practice Project No. 341/50490 (not published at the time of preparation of his specification), except that the use of lead plugs is not permitted.

It is recommended that the manufacturer consults the galvanizer before design and fabrication to ensure that the fabrication will be suitable of galvanizing.

The main requirements are as follows:

(i) Overlap joints shall be avoided wherever possible. If essential, such overlap joints shall be thoroughly degreased before assembly and shall be vented by drilling holes through one or both overlapping materials.

(ii) Closed sections shall be suitably vented. If the inside of a closed section is not to be galvanized, a snorkel vent tube of suitable length and bore shall be attached.

(iii) Gussets and internal baffles in tanks shall be cropped to allow free flow of zinc and air.

(iv) Joints shall be continuously welded, using balanced welding techniques to avoid stresses. Welds shall be free from cavities, undercutting, weld slag and spatter.

(v) Symmetrical design shall be used whenever possible and the use of thin gauge steel adjacent to heavy sections shall be avoided.

(vi) Openings and flanges of manholes and bosses shall finish flush on the inside to ensure complete drainage.

(vii) Castings shall be designed to be of as uniform section as possible and shall be blast cleaned in accordance with Clause PZA 6.2 before dispatch to the galvanizer.

The Hot Dip Galvanizing Process

(i) Hot dip galvanizing shall comply with SABS 763 for fabricated articles, SABS 934 for pre-galvanized sheet, or SABS 935 for wire.

(ii) Mating surface on fabricated or cast-iron components shall be wiped or centrifuged on removal from the galvanizing bath to remove blobs, runs or excess metal that may impair the air/gas/water tightness of the joint.

(iii) Bolts, nuts and washers used for fixing shall be hot dip galvanized to SABS 763. Electroplated fasteners will not be accepted unless otherwise agreed by the Engineer in writing.

Repair of Galvanized Articles

Welding, flame cutting, or other heat processes shall not be carried out on galvanized articles unless permission is granted by the Engineer in writing

If such permission is given, or if mechanical damage has occurred, repair shall be carried out as follows:

(i) All scale; spatter and flux shall be removed by grinding and washing with clean water. Edges shall be ground to a radius not less than 2 mm.

(ii) The preferred repair process is to blast clean the bare steel and apply zinc by the thermal spray process in accordance with SABS 1391 Part 1, Grade Zn 150. On completion of metal spraying, burnish the surface by means of a mechanical wire brush to give a uniform appearance. Such burnishing shall remove not more than 10 micrometres of zinc.

(iii) Where small areas are to be repaired, clean the surface thoroughly with fine abrasive paper, remove all debris with a damp cloth and allow to dry. Apply an approved one pack epoxy ester-based zinc rich primer containing not less than 90% by mass of zinc in the dry film. A sufficient number of coats (usually 3 or 4) shall be applied such that the repair coating thickness is not less than the average zinc thickness specified in SABS 763, 934 or 935, as appropriate. The repair shall extend not less than 5 mm beyond the damaged area.

On completion of the repair and when the zinc primer is completely dry, one coat of alkyd resin aluminium paint may be applied to obtain a uniform appearance.

NOTE: Repair of galvanized surfaces by application of aluminium paint alone IS NOT PERMITTED.

Storage of Galvanized Components

Galvanized components shall be stored to avoid the formation of “white rust” or other forms of storage staining.

Components shall be separated and supported on wooden battens to ensure adequate ventilation of all surfaces and in such a manner to avoid “ponding” by rainwater.

If storage staining does occur, remove the stains by scrubbing with detergent solution and bristle brush or nylon pad. The use of steel wool or other metallic abrasive is not permitted.

Rinse thoroughly and allow to dry. If the residual zinc thickness complies with the requirements of the appropriate grade in the relevant specification, no further action is required unless instructed by the Engineer.

If the zinc thickness is below specification, the article shall be re-galvanized or repaired in accordance with Clause PZA 8.3 as instructed by the Engineer.

Stainless steel fabrications

Grade and Welding Techniques

The grade of stainless steel to be used shall be as specified in the appropriate section of the mechanical specification or drawing. Where welding is necessary, the appropriate "L" (low carbon content) shall be used. Plate shall be supplied as No 1 Finish in accordance with BS 1449 Part 4.

Welding procedures shall be only those recommended by the stainless-steel manufacturer or by the South African Stainless Steel Development Association. Only welders coded to BS 4870 Part 1 or to ASME IX, 1983 shall be employed.

Welds shall be smooth and free from blowholes, undercuts, sharp projections and similar visual defects.

Fabrication of stainless-steel components shall be carried out in clean workplaces where there is no contamination by mild steel. Grinding and polishing equipment shall be dedicated and shall not be contaminated with iron or mild steel.

Stainless steel shall be suitably handled to avoid scratching the surface.

Pickling and Passivation

Cut edges, welds and heat-treated surfaces shall be pickled and passivated to remove all discoloration. Proprietary pickling and passivating pastes (as supplied by Duva Chemicals (Pty) Ltd., or other approved supplier) shall be used in accordance with the manufacturer's recommendations. Care shall be taken not to exceed the maximum contact time recommended.

The safety precautions given in PZA 10.2 shall be strictly observed.

After passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. The surface shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless-steel manufacturer or the South African Stainless Steel Development Association. SAFETY PRECAUTIONS as specified in Clause PZA 10.1 (ii) shall be strictly observed.

CORROSION RESISTANT STEEL 3CR12

Welding Techniques

(i) Welds shall be full penetration welds, using 309 austenitic electrodes of filler wire, or as recommended by the manufacturers (Middelburg Steel & Alloys (Pty) Ltd).

(ii) Welders shall be suitably coded for welding similar thickness of austenitic stainless steel, in accordance with BS 4870 Part 1 or ASME IX, 1983.

(iii) Welding procedures shall comply with the recommendations of the manufacturers of 3CR12 (Middelburg steel & Alloy (Pty) Ltd).

(iv) Welds shall be smooth and free from blow holes, undercuts, sharp projections and similar visual defects.

Pickling and Passivation

(i) After completion of welding, both weld and heat affected zones shall be cleaned, pickled and passivated. Any heat scale on the steel shall be pickled and passivated.

(ii) The procedure shall be as follows:

a) Not to painted surfaces Grind or wire brush, using dedicated grinders or stainless-steel wire brushes to achieve the required smooth profile or remove scale.

b) Pickle with a thixotropic paste containing 15-20% Nitric acid and 1-2% Hydrofluoric acid, with a contact time of 15 to 10 minutes.

c) Rinse thoroughly with clean water until the pH of the washings is the same as that of the wash water.

d) Repeat the above process, if necessary to remove all discoloration.

e) Passivate with 10% Nitric acid solution, or a proprietary passivating paste, for a contact time of 10-15 minutes, keeping the surface wet during this period.

f) Rinse thoroughly with clean potable water until washings are the same pH as the wash water.

g) Operatives shall wear protective aprons, gloves and safety glasses during pickling and passivating operations.

h) Splashes on the skin shall be thoroughly washed with clean water immediately after contact. A weak solution of sodium bicarbonate shall be kept available for neutralization. Seek medical attention if in doubt.

i) Disposal of effluent shall be in accordance with the requirements of the local authority in whose area the work is being carried out. Generally, the effluent is stored in drums containing an excess of lime (calcium carbonate).

Aluminium

Anodizing Aluminium components where specified as anodized shall be natural anodized and sealed in accordance with SABS 999 Grade 25. The corrosion resistance of the coating shall be not less than 8 when tested in accordance with 3.6 of specification SABS 999. Anodising shall be carried out after completion of all welding.

Powder Coating

When specified by the Engineer, aluminium handrails may be coated with polyurethane powder. Such coating shall only be carried out by Contractors with the necessary plant, equipment and experience to pre-treat and power coat aluminium effectively. The coating shall comply with BS6496, 1984.

Fixing

Whenever aluminium components, such as stop log frames, come into contact with concrete or grout, the surface of the aluminium in contact with concrete shall be coated with two coats of an approved epoxy tar composition.

PSXMP 6 TOLERANCE

Specials

The tolerances on specials will be in accordance with BS 534, Section 4.

PSXMP 7 TESTING AND INSPECTION AT MANUFACTURER'S WORKS AND AT SITE

General

Factory and Site inspection, supervision of tests and adjudication of test records shall be carried out by an independent Inspectorate.

Tests and inspections shall be carried out at the manufacturer's work at the expense of the Contractor who shall provide all necessary testing facilities, labour, instruments, equipment and samples that might be required, free of charge. The Inspectorate shall be afforded every facility during the course of manufacture and testing to enable the inspection to be carried out effectively.

All test samples shall be selected by the appointed Inspectors and all instruments used for testing purposes shall be approved by the Inspectors and if in the opinion of the

Inspectors any instrument should require calibration, such instruments shall be calibrated at the expense of the Contractor by the SABS or such other body as may be approved by the Inspectorate.

No mechanical working or straining of pipes and specials shall be allowed after testing and inspection.

Visual Inspection

All finished pipes and specials shall be visually examined and shall be free of injurious defects as defined in API 5L Section 10.7.

Non-destructive Inspection

Ultrasonic Inspection

Pipes shall be made by an approved welding process and 100 % of all longitudinal or spiral welds on straight pipes shall be checked with an approved ultrasonic method capable of continuous and uninterrupted inspection of the weld seam in accordance with

API 5L Section 9.10, 9.11 and 9.12 except that the equipment shall be checked with an applicable reference standard at least twice every working turn.

Radiographic Inspection

a) Longitudinal Weld Pipe: All electric fusion welded pipes shall be inspected by radiological methods for a distance of 200mm from each pipe end.

b) Spiral Weld Pipe: All electric fusion welded pipes shall be inspected by radiological methods for a distance of 100 mm from each end of each length of pipe and of the complete “H” at all scalp and welds including 150mm of the spiral welds in both directions away from the intersection points with the scalp and welds.

c) Circumferential Butt Welds:100% of the length of circumferential butt welds shall be examined provided, when consistently acceptable results are obtained, the number of welds to be so tested may be reduced by mutual agreement between the Engineer, the Inspectorate and the Contractor.

d) Specials: 100% of all manual or semi-automatic welds in specials shall be examined radio graphically provided, when consistently acceptable results are obtained, the number of welds to be so tested may be reduced. Where specials cannot be hydrostatically tested, all welds shall be liquid penetrate tested as per ASME Section V.

e) Repairs Straight Piping :100% of the total length of all repairs shall be examined radio graphically provided, that where repairs are made before ultrasonic inspection and such repairs pass ultrasonic inspection, no further radiographic inspection of same is required.

f) Pipes for Rail, Road and River Crossing 100% of the total length of all welds shall be examined radio graphically.

Hydrostatic Testing

a) Each individual straight pipe shall be subjected to a hydrostatic test in accordance with the methods described in API 5L, Section 5. Test pressures should be such as producing tensile fibre stresses in the pipe wall of not less than 90% of the minimum specified yield strength of steel or shall be 9 MPa whichever is the lesser. Leaks or sweats shall be considered injurious defects.

b) Should it not be possible to hydrostatically test straight piping and/or specials the through liquid penetrate test as per ASME Section V shall be done on all welds over and above the non-destructive tests specified above. This shall only be applicable with the prior written approval of the Engineer.

Repair of Injurious Defects

Injurious defects found by non-destructive testing of welds, visual examination, hydrostatic testing or determined by any other means to exceed the limitations in API 5L, Section 10.7 shall be repaired in accordance with API 5L Section 10.8 and 10.9 but

subject always to the requirements of this specification.

Destructive Testing

The following destructive tests shall be performed in accordance with SABS 719 clause 7.2 on the first pipe and thereafter on one pipe every 500 subsequent pipe.

a) Transverse Tensile Test.

b) Root Bent Test (Electric Fusion Welds).

c) Flattening Test (Electric Resistance Welds).

Sampling for Destructive Tests

a) **First Sample**: A section long enough to provide all the test specimens and material shall be cut from the selected pipe.

b) **Second Sample**: If the test specimens and material from the first selected pipe fail to pass any of the tests, a section long enough to provide the appropriate specimens for the test failed by the first sample shall be cut from two further pipes.

c) **Third Sample**: If the test specimen from the second sample fails to pass the test(s) a similar section shall be cut from each of a further ten pipes.

d) **Compliance**: The piping shall be considered as complying with the specification if after testing of the first or the second or the third sample no defect is found.

PSXMQ QUALITY ASSURANCE REQUIREMENTS

Contractor Qualification

The Tenderer shall state in the Appendix to his document the name of the painting sub-contractor that he proposes to use to carry out the painting or coating. The Engineer may, at his discretion, require a Quality Audit of the painting sub-contractor to ensure that he has the management, facilities, skilled staff, and quality control facilities and staff to carry out quality control during application of coatings to ensure compliance with the specification.

The contractor shall accept full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Engineer or his representative.

The Contractor shall obtain confirmation from the material supplier that materials to be used comply with the specification and are suitable for the intended purpose by having the appropriate Appendix completed by the material supplier.

Quality Control

The Contractor shall have the necessary equipment and staff knowledgeable in test procedures to carry out all the quality control required to ensure compliance with the specification. The Contractor will be required to produce a quality plan and a program for carrying out the work. The Contractor shall maintain quality control records of all stages of the work, batch numbers of materials used, environmental conditions, all as required by the specification. Quality control shall be inclusive in the Contractor's tender price.

Quality Surveillance

Independent surveillance – The Engineer may employ an independent technically of the work on his behalf.

Program – The Contractor shall advise the Engineer timeously, in writing, when and where the following processes will be carried out:

(i) Completion of fettling or dressing prior to leaving the fabricator's works.

(ii) Blast cleaning and application of the first or prime coat.

(iii) After completion of all coats to be applied at the contractor's works.

(iv) At the commencement of repairs to be carried out on site.

Failure of the Contractor to advice the Engineer of his program may result in rejection of the work.

Access for Surveillance

For the purpose of carrying out quality surveillance, the Engineer or his representative shall be granted access to any part of the Contractor's premises relevant to the work being carried out, at any reasonable time. The Contractor shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.

Samples

The Engineer or his representative may remove any reasonable samples of materials to be used in the coating application. Rejection of the sample will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected material.

Destructive Testing

The Engineer or his representative may carry out reasonable destructive tests to ascertain compliance with the specification. Areas thus damaged shall be repaired by the Contractor to the satisfaction of the Engineer at no additional costs.

Cost of Quality Surveillance

Cost of Quality Surveillance shall be borne by the Employer, except when surveillance results in rejection of the lot or when notice by the Contractor results in a fruitless strip, in which cases the cost shall be debited against the Contractor's account.

Quality Control Records

Proper and adequate quality control records shall be maintained by the Contractor for all stages of the work. These records shall be available for inspection by the Engineer or his representative at the time of Quality Surveillance. Incomplete, inaccurate or inadequate records shall be regarded as non-compliance with the specification, and the cost of surveillance will be back charged to the Contractor.

Data Sheets, Specifications, and Codes of Practice

The Contractor shall have available the latest issues of manufacturer's data sheets materials to be used, National specifications and Codes of Practice relevant to the work to be carried out, as well as a copy of his specification, all of which shall be available to the Contractor's Quality Control Manager.

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C3.3.3: Particular specifications (Electrical)

Contents

PSXEA PRELIMINARY AND GENERAL 6

PSXEA 1 SCOPE 6

PSXEA 1.1 Eskom Connection 6

PSXEA 1.2 Eskom deposit 6

PSXEA 1.3 Overhead MV Supply 6

PSXEA 2 INTEPRETATIONS 6

PSXEA 2.1 Abbreviations 6

PSXEA 2.2 Standards 7

PSXEA 3 MATERIALS 8

PSXEA 4 MEASUREMENT AND PAYMENT 8

PSXEB GENERAL TECHNICAL REQUIREMENTS FOR EXECUTION (MATERIAL). 8

PSXEB 1 SCOPE 8

PSXEB 1.1 Standard 8

PSXEB 1.2 System and site condition 8

PSXEB 2 LAWS, REGULATIONS AND CODES OF PRACTICE TO BE OBSERVED 8

PSXEB 3 EQUIPMENT 9

PSXEB 3.1 Radio and TV Interference 9

PSXEB 3.2 Protection of Equipment Against Voltage Surges and Spikes 9

PSXEB 4 DRAWINGS 9

PSXEB 4.1 Standard Drawing Sizes 9

PSXEB 4.2 Document Format 9

PSXEB 4.3 DRAWINGS SYMBOLS AND LETTERING 10

PSXEB 4.4 Specific Requirements for Schematic Diagrams 12

PSXEB 5 OPERATING MAINTENANCE MANUALS 12

PSXEB 5.1 General details 12

PSXEB 5.2 Preparation of the final manuals 13
PSXEB 5.3 Preparation of the final manuals 13
PSXEB 6 ROUTE PLANS TO BE SUBMITTED BY THE CONTRACTOR 14
PSXEB 7 LOW VOLTAGE ELECTRIC MOTORS 16
PSXEB 8 ELECTRICAL ACTUATORS FOR VALVE CONTROL 18
PSXEB 9 MULTICORE CABLES AND EARTH WIRES 18
PSXEB 9.1 Low and Medium Voltage Cables 18
PSXEB 9.2 Fibre Optic Cables 19
PSXEB 9.3 Jointing of Cables 19
PSXEB 9.4 Low voltage power and control cables 19
PSXEB 9.5 Termination of Multicore Cables 19
PSXEB 10 DISTRIBUTION AND MOTOR CONTROL BOARDS 20
PSXEB 10.1 Indoor floor standing distribution and motor control boards Construction 20
PSXEB 10.2 Paint finishes for electrical materials and equipment 21
PSXEB 10.3 Internal wiring 21
PSXEB 10.4 Electronic Equipment 21
PSXEB 10.5 Labelling of Switchboards and Motor Control Boards 21
PSXEB 10.6 Outdoor distribution- and motor control boards 21
PSXEB 11 CONTROL BOARD COMPONENTS 22
PSXEB 11.1 Breakers and isolators 22
PSXEB 11.2 Direct-on-Line starters (400V motors) 22
PSXEB 11.3 Star/Delta Starters (400V motors) 23
PSXEB 11.4 Variable Speed Drives 24
PSXEB 11.5 Current transformers 25
PSXEB 11.6 Indicating instruments 25
PSXEB 11.7 Instrument selector switch 25
PSXEB 11.8 Power factor correction capacitors for 400 Volt motors 25
PSXEB 11.9 Concrete Plinth for Starter Panels and Pedestals 27
PSXEB 11.10 Electronic Level Control 27
PSXEB 11.11 Emergency Stop Push Buttons and Weatherproof Isolators 27
PSXEB 12 CABLE LADDERS 28
PSXEB 13 LIGHTNING PROTECTION 28
PSXEB 14 NOTICES AND DANGER PLATES 29
PSXEB 14.1 Scope 29
PSXEB 14.2 Materials And Finish 29
PSXEB 14.3 Installation and Erection 29
PSXEB 14.4 Rotating Bridge Brush Gear 29
PSXEC GENERAL TECHNICAL REQUIREMENTS FOR EXECUTION (CONSTRUCTION) 30

PSXEC 1 INSTALLATION OF MULTICORE CABLES 30
PSXEC 1.1 Cable Trenches 30
PSXEC 1.2 Underground Cable Pipes 30
PSXEC 2 CROSSINGS WITH OTHER SERVICES 30
PSXEC 3 TESTING OF CABLES 32
PSXEC 4 PLUGGING OF BRICK WALLS AND CONCRETE 33
PSXEC 5 INSTALLATION OF DISTRIBUTION BOARDS AND MOTOR CONTROL BOARDS 33
PSXEC 5.1 Earthing 34
PSXEC 5.2 Balancing of Load 34
PSXEC 5.3 Name Plates 34
PSXED MOTOR CONTROL CENTRES IN GENERAL 34
PSXED 1 MCC 34
PSXED 2 PANEL REQUIREMENTS 34
PSXED 3 MATERIAL REQUIREMENTS 34
PSXED 4 CUBICLES 35
PSXED 4.1 INCOMER CUBICLE 35
PSXED 4.2 MOTOR CONTROL CUBICLES 35
PSXED 5 ELECTRICAL MOTORS 36
PSXED 6 CABLE INSTALLATION 36
PSXED 7 INSTRUMENTATION 36
PSXEE MAIN MOTOR CONTROL CENTRE 36
PSXEE 1 SCOPE 36
PSXEE 2 DESIGN AND DOCUMENTATION 36
PSXEE 3 SUPPLY AND DELIVERY 36
PSXEE 4 INSTALLATION 36
PSXEE 5 TESTING AND COMMISSIONING 36
PSXEE 6 TRAINING 36
PSXEF TRANSFORMER 200KVA/ 400 V 36
PSXEF 1 SCOPE 36
PSXEF 2 DESIGN AND DOCUMENTATION 36
PSXEF 3 SUPPLY AND DELIVERY 36
PSXEF 4 INSTALLATION 37
PSXEF 5 TESTING AND COMMISSIONING 37
PSXEF 6 TRAINING 37
PSXEG GENERATOR (120 KVA) 37
PSXEG 1 SCOPE 37
PSXEG 2 DESIGN AND DOCUMENTATION 37
PSXEG 3 SUPPLY AND DELIVERY 37
PSXEG 4 INSTALLATION 37

PSXEG 5 TESTING AND COMMISSIONING 37
PSXEG 6 TRAINING 37
PSXEH BARE COPPER EARTH WIRE (BCEW) 37
PSXEH 1 SCOPE 37
PSXEH 2 DESIGN OR DOCUMENTATION 37
PSXEH 3 SUPPLY AND DELIVERY 38
PSXEH 4 INSTALLATION 38
PSXEH 5 TESTING AND COMMISSIONING 38
PSXEH 6 TRAINING 38
PSXEI EXCAVATIONS 39
PSXEI 1 SCOPE 39
PSXEI 2 DESIGN OR DOCUMENTATION 39
PSXEI 3 SUPPLY AND DELIVERY 39
PSXEI 4 INSTALLATION 39
PSXEI 5 TESTING AND COMMISSIONING 40
PSXEJ CABLE SUPPORT 40
PSXEJ 1 SCOPE 40
PSXEJ 2 DESIGN AND PAYMENT 40
PSXEJ 3 SUPPLY AND DELIVERY 40
PSXEJ 4 INSTALLATION 40
PSXEJ 5 COMMISSIONING 40
PSXEK CONTROL AND INSTRUMENTATION CABLES 41
PSXEK 1 SCOPE 41
PSXEK 2 DESIGN AND PAYMENT 41
PSXEK 3 SUPPLY AND DELIVERY 41
PSXEK 4 INSTALLATION 41
PSXEK 5 COMMISSIONING 41
PSXEL SMALL POWER AND LIGHTINING 41
PSXEL 1 SCOPE 41
PSXEL 2 DOCUMENTATION 41
PSXEL 3 SUPPLY AND DELIVERY 41
PSXEL 4 INSTALLATION 42
PSXEL 5 TESTING AND COMMISSIONING 42
PSXEM PROGRAMMABLE LOGIC CONTROLER (PLC) 42
PSXEM 1 SCOPE 42
PSXEM 3 SUPPLY AND DELIVERY 42
PSXEM 4 INSTALLATION 42
PSXEM 5 COMMISSIONING 42
PSXEM 6 TRAINING 42

PSXEN TELEMETRY SYSTEMS....42
PSXEN 1 SCOPE....42
PSXEN 3 SUPPLY AND DELIVERY....43
PSXEN 4 INSTALLATION....43
PSXEN 5 COMMISSIONING....43
PSXEN 6 TRAINING....43
PSXEO COMMUNICATION NETWORK....43
PSXEO 1 SCOPE....43
PSXEO 3 SUPPLY AND DELIVERY....43
PSXEO 4 INSTALLATION....43
PSXEO 5 COMMISSIONING....43
PSXEO 6 TRAINING....44
PSXEP SCADA SYSTEM....44
PSXEP 1 SCOPE....44
PSXEP 3 SUPPLY AND DELIVERY....44
PSXEP 4 INSTALLATION....44
PSXEP 5 COMMISSIONING....44
PSXEP 6 TRAINING....44
PSXEQ AREA AND OUTDOOR LIGHTINING....44
PSXEQ 1 SCOPE....44
PSXEQ 3 SUPPLY AND DELIVERY....44
PSXEQ 4 INSTALLATION....45
PSXEQ 5 COMMISSIONING....45
PSXER PROTECTIVE SYSTEMS....45
PSXER 1 SCOPE....45
PSXER 1.1 Fire detection....45
PSXER 1.2 Intruder alarm....45
PSXER 1.3 Lighting protection....45
PSXES APPENDIX A....46

PSXEA PRELIMINARY AND GENERAL

PSXEA 1 SCOPE

PSXEA 1.1 Eskom Connection

Allow a provisional sum for the payment of all charges levied by Eskom for the electrical connection to the site, including application, administration, inspection, and connection fees. The Contractor shall be responsible for coordinating with Eskom to ensure that the electrical connection is completed in accordance with Eskom's requirements and within the project programme.

This includes:

- Submission of application for new supply connection.
- Liaison with Eskom for quotation and approval.
- Payment of all prescribed connection fees as required by Eskom.
- Coordination of all site readiness requirements prior to energisation.
- Provision of necessary documentation, as-built information, and certificates.

PSXEA 1.2 Eskom deposit

Allow a provisional sum for the security deposit required by Eskom for the supply of electricity to the site. This sum shall cover all deposit amounts payable to Eskom before the energisation of the supply.

This includes:

- Obtain and verify the required deposit amount from Eskom.
- Make the necessary payments to Eskom and provide proof of payment.
- Ensure all Eskom conditions regarding deposits and refunds are fulfilled.

PSXEA 1.3 Overhead MV Supply

Allow a provisional sum for the supply and installation of the overhead medium-voltage (MV) line from the nearest Eskom point of supply to the project site. The work shall be executed by Eskom or an Eskom-approved Contractor, in accordance with Eskom's technical standards and safety regulations.

This includes:

- Coordination with Eskom for design approval, wayleave acquisition, and installation scheduling.
- Payment of all Eskom charges related to the overhead MV supply.
- Supervision and facilitation of access to the site for Eskom's contractors.
- Ensuring compliance with SANS and Eskom standards for MV supply installations.

PSXEA 2 INTEPRETATIONS

PSXEA 2.1 Abbreviations

For the purposes of this Specification the following abbreviations will apply:

BS	British Standards Institution.
IEC	International Electrotechnical Commission.
ISO	International Organisation for Standardisation.
MCC	Motor Control Centres.
SABS	South African Bureau of Standards.
SANS	South African National Standards.

PSXEA 2.2 Standards

All materials and equipment to be supplied and installed under this contract shall be new and of the best quality available.

The following Standard Specifications and drawings shall apply:

SABS:	780	Distribution Transformers
SABS:	555	Transformer oil
SABS:	833	Bushings
SABS:	97	Medium voltage cables
SABS:	763	Galvanizing
SABS:	0142	Code of Practice for the wiring of Premises
BS:	923	Testing
BS:	2631	Switch gear
BS:	162	Switch gear
BS:	159	Bus bars
SABS:	1091	Paint colour
BS:	3938	Current Transformers
BS:	3941	Potential Transformers
BS:	89	Ammeters
BS:	638	Welding cables
SABS:	1507	Electrical cables with extruded solid dielectric insulation for fixed Installations (300/500V to 1900/3300V)
SABS:	256	Moulded Case Circuit Breakers
SABS:	767	Earth leakage protection units
SABS:	1084	Cover plates for wall outlet boxes
SABS:	1085	Wall boxes for the enclosure of electrical accessories
SABS:	1065	Metal conduit Part 1
SABS:	1065	Metal fittings Part 2
SABS:	1574	Electric cables and flexible cords
SABS:	163	Wall and appliance switches
SABS:	1119	Ballasts for fluorescent lamps
SABS:	890	Fluorescent lamp reference ballasts
SABS:	086	Interior luminaries for fluorescent lamps
SABS:	1029	Miniature substation
SABS:	1152	Metal working chisels for hand use
BS:	3939	Graphical symbols for electrical power, telecommunication and Electric Diagrams
BS:	148	Specification for unused mineral insulating oils for transformers and s witch Gear.
BS:	142	Electrical Protection relays
BS:	1650	Specification for capacitors for connection to power – frequency System.
BS:	4504	Circular flanges for pipes, valves and fittings (PN Designated)

SANS: 1765: 2003.

SANS: 10142 (Wiring of Premises).

SANS: 1473-1: 2023 (Low-voltage electrical switchgear and controlgear assemblies)

SANS: 60439-1 :2004 (Part 1 of Low-voltage electrical switchgear and controlgear assemblies).

PSXEA 3 MATERIALS

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document comply with the requirements of the most recent edition of the appropriate South African or other internationally recognised standard specification.

PSXEA 4 MEASUREMENT AND PAYMENT

Payments under these items shall be paid as Psum as stated in the BoQ.

Payment under these items shall be made against verified documents or/and proof of actual costs incurred and approved by the Engineer.

PSXEB GENERAL TECHNICAL REQUIREMENTS FOR EXECUTION (MATERIAL)

PSXEB 1 SCOPE

PSXEB 1.1 Standard

All materials and equipment to be supplied and installed under this contract shall be new and of the best quality available.

All materials and equipment shall comply with the requirements laid down in the latest editions of the BS, SABS and IEC specifications and their amendments (if any) as well as those laid down in this specification. Where items bearing the SABS mark are available for any of the materials and equipment specified, only materials bearing the said mark, will be acceptable.

PSXEB 1.2 System and site condition

All materials and equipment supplied under this contract shall be suitable for operation under the following conditions unless specifically specified otherwise elsewhere in this document:

- Low voltage system: 400/230V, 50 Hz, 3 phase, 4 wire, alternating current with solidly earth neutral.
- Atmosphere: dry, dusty, warm and highly corrosive.

PSXEB 2 LAWS, REGULATIONS AND CODES OF PRACTICE TO BE OBSERVED

The work shall be carried out strictly in accordance with and all material and equipment supplied shall comply with the following laws and regulations where applicable:

- The latest edition of the “Code of Practice for the Wiring of Premises”, SABS 0142, as amended.
- Occupational Health and Safety Act (Act No.85 of 1993).
- The “Electricity Supply By-Laws and Regulations” of the Local Supply Authority.
- The local Fire-Office Regulations.
- The Requirements of the Department of Communications.
- The Acts and Regulations applicable to the use of explosives.
- “The Code of Practice for the Installation and Maintenance of Electrical Equipment used in Explosive Atmospheres” (SABS 086).

The contractor will be responsible for serving all notice and paying all fees due in terms of the above laws and regulations.

PSXEB 3 EQUIPMENT

PSXEB 3.1 Radio and TV Interference

All equipment installed under this Contract shall comply with the Government Notice. R.2246 and any other applicable rules and regulations in respect of radio and TV interferences. Any equipment found producing interference subsequent to commissioning shall be suppressed or replaced to the satisfaction of the Engineer without any additional cost.

PSXEB 3.2 Protection of Equipment Against Voltage Surges and Spikes

Tenderers shall allow in their tender prices for adequate protection of the equipment supplied and installed under this Contract against direct as well as induced voltage surges and spikes which may be experienced on the system.

Surge arrestors shall be provided on each phase as well as neutral on the incoming power supply terminals of each board.

Electronic equipment shall be adequately protected on both the incoming and outgoing terminals as well as on both ends of cables leaving and entering a building by means of suitable arrestors compatible with the relevant equipment.

Arrestors shall be of COPA manufacture (as supplied by Surge Technologies (Pty) Ltd.).

All arrestors shall be connected to earth along the shortest possible route and only conductors of adequate rating for the discharge currents catered for shall be used for connections to arrestors.

Tenderers shall submit full particulars of the arrestors offered as well as written confirmation that it will provide adequate protection for the relevant equipment against possible voltage surges and spikes on the system.

PSXEB 4 DRAWINGS

PSXEB 4.1 Standard Drawing Sizes

The following standard drawing sizes are preferred.

Electrical Single Line Diagrams	A1 or A2
Electrical Schematic Diagrams	A3
Electrical Wiring Diagrams	A3
Electrical Cable Schedule.	A3 or A4
Electrical Connection Schedules	A3 or A4
Electrical Panel General Arrangements	A1, A2 or A3
PLC Hardware Configurations	A2, A3 or A4
Electrical Substation	A1
Electrical Cable Pouting and Racking	A1
Lighting Layout Drawings	A1

A0 drawings are to be avoided due to the difficulty in physically handling the drawing. If an A0 drawing is reduced in size when using AutoCAD all scales shall be removed and the drawing designated “Not to Scale”.

PSXEB 4.2 Document Format

The following defines which documents shall be prepared as “drawings” or which are to be prepared as computer generated schedules:

Drawings

- Electrical Single Line Diagrams
- Electrical Schematic Diagrams
- Electrical Wiring Diagrams
- PLC I/O Schedule
- Electrical Panel General Arrangements
- PLC Hardware Configurations
- Electrical Substation Layouts
- Electrical Cable Routing and Racking
- Lighting Layout Drawings
- Electrical Equipment Lists

Schedules

- Electrical Cable Schedules
- Electrical Connection Schedules
- PLC I/O Listings (optional as schedule)

Where document is specified as a schedule it shall be prepared as a spread sheet file with field names and lengths as specified.

Drawing Sheets

All drawings shall be drawn on the Employer's drawing sheets unless otherwise approved by the Engineer. Contractors may add their own logos, title blocks and numbers provided that the main title block is the Employer's title block. The requirement shall apply for the following drawings:

- Single line diagrams
- Schematic diagrams
- Equipment schedules

Drawing Numbers

All drawings shall bear the Project number as the main number. Contractors may add their number as a secondary number in which case the number shall be clearly identified as the contractor's number. This requirement shall apply for the following drawings:

- Single line diagrams
- Schematic diagrams
- Equipment schedules

Equipment Numbering

All electrical equipment shall be numbered using an acceptable equipment numbering system.

Provision shall be made on the drawings to incorporate this number.

Electronic format

All drawings, schematic diagrams and schedules shall be handed over to the Engineer on Compact Disk on completion of the project.

PSXEB 4.3 DRAWINGS SYMBOLS AND LETTERING

Drawing Symbols

All electrical symbols shall be drawn as detailed in the South African Rationalized Specification NRS 002 – 1990 Graphical Symbols for Electrical Diagrams.

Symbol sizing shall be according to that specified in the NRS. Electrical symbols shall not be reduced in size to fit into a drawing. Attention shall be paid to the layout to allow for future drawing additions.

Where the NRS 002 – 1990 does not propose a suitable symbol reference shall be made to IEC 617, or a purpose made symbol may be developed. In such case the symbol selected from IEC 617, or created, shall be to the approval of the Engineer.

Lettering Requirements

The following lettering sizes shall be used (dimensions in mm)

Item	A0	A1	A2	A3 & A4
Drawing Number	7	7	7	5
Mark, Item No. View, Section No.	5	5	5	3,5
Title – in the block	3,5	3,5	3,5	2,5
Title under detailed item, info on sections	5	3,5	3,5	2,5
Letters and Figures (Body of Drawings)	3,5	3,5	2,5	2,5
Exponents, Small Letters in SI units	3,5	2,5	1,8	1,8

Specific Requirements for Single Line Diagrams

General Requirements

Single line diagrams shall be updated regularly during the project to include plant additions as and when they occur.

Pumping Station Overall Single Line Information Requirements

The plant overall single line diagrams shall not be oversimplified for the sake of maximizing the amount of information on a single sheet. If necessary, the drawing shall be split into more than one sheet in a logical manner so that information is grouped by plant sections on each of the sheets.

For this purpose, the single line diagrams shall include the following information:

- Protection scheme details
- Cable sizes
- Cable lengths
- Transformer ratings, ratio, vector group and impedance
- Large motor details (typically only MV motors for overall single line diagrams)
- Supply authority substation details including transformer size and impedance

Drawing layout

The overall single line drawing shall be laid out with the power flow from top to bottom or left to right. The drawing layout should avoid unnecessary crossing of lines.

Individual Switchboard Single Line Diagrams

These drawings shall be comprehensive in detail and shall, along with the requirements listed for overall single line diagrams, show all the feeder and motor circuits connected to the board, with the following information:

- Rating of all circuit breakers
- Load details including rating and full load current

- Normal running load (calculated) of the incomer circuit(s).
- On the incomer circuit the source of the power shall be specified
- Cross reference to the overall single line diagram on which the specific single line diagram appears.

PSXEB 4.4 Specific Requirements for Schematic Diagrams

Use of Multiple Drawing Sheets on One Drawing Number

Schematic diagrams for a particular plant item e.g. a motor control centre, M.V. switchgear panels or similar shall be drawn under one drawing number with multiple sheets.

The set shall include a cover sheet (Sheet 1) and an index sheet (sheet 2, 3 etc. as required). The index sheet(s) shall list all drawings in the set and shall include the sheet number, drawing title and latest revision for that sheet.

Drawing information

The information depicted on a single schematic sheet shall be limited to the equipment within a particular panel cubicle. A panel cubicle may extend over more than one sheet, but a sheet may not contain more than one panel cubicle's equipment and wiring schematic.

Grid System

Schematic diagrams shall be drawn on a grid system, columns numbered from 0 to 9 rows numbered from A. to E. Equipment shall be numbered and cross referenced on this grid system.

All n/o and n/c relay contacts and auxiliary contacts on equipment shall be listed in close proximity to the relevant component with cross reference to the specific sheet where that contact is utilized.

Schematic Diagram Layout

Schematic diagrams shall be laid out with a minimum spacing of 10mm between vertical lines. Components shall be laid out evenly in the horizontal plane with the requirements that relay type devices are drawn at the bottom of the sheet.

The power circuit section shall be drawn on the left of the schematic diagram.

Schematic Diagrams – Medium Voltage Switchgear

Each MV circuit shall have the schematics split over a number of sheeting as follows:

- 1st sheet in sequence AC circuit details including protection and metering
- 2nd sheet in sequence Closing circuits
- 3rd sheet in sequence Tripping circuits
- 4th sheet in sequence Indication and interlocking with external devices

The drawing shall cross reference each other.

PSXEB 5 OPERATING MAINTENANCE MANUALS

PSXEB 5.1 General details

Separately bound operating manuals and maintenance manuals shall be provided.

Final versions of the operating and maintenance manuals shall contain the following sections:

Equipment maintenance:	Maintenance data Setting and resetting information
General technical data including spare parts lists and drawings	Fault diagnoses procedures

Test and Guarantee:	Protection test report Final test report
Equipment operation:	Operating instructions (Summary version) Start and stop instructions
Equipment operation:	Operating instruction (Detailed version)
Drawings:	All relevant drawings
Electronic version:	Electronic version of all drawings Electronic copy of PLC programming software

Quantities

The following quantities of the above manuals shall be provided:

- Originals: 3 (with original brochures)

Preparation sequence

The above manuals shall be made available in the following sequence:

- Draft version: To be submitted to the Engineer for approval before the beginning of erection.
- Preliminary version: To be submitted when initial commissioning begins.
- Final version: To be submitted when acceptance tests are over.

Preliminary operating and maintenance manuals

During the commissioning period the Contractor shall submit two draft copies of each of the following, for all equipment supplied, for the Engineer's approval:

- Operating manuals (including technical data, check lists, procedures etc.)
- Maintenance manuals (with schedules of routine and regular maintenance and routine tests of equipment).
- Technical data manuals (including schematic wiring diagrams, particular technical data, adjustments details, reference lists, local agents for supply and repair, spare lists etc.).

PSXEB 5.2 Preparation of the final manuals

After the Engineer has approved the draft manuals described above, copies of each manual shall be supplied by the Contractor.

These manuals shall be permanently bound in book form, together with "as installed" drawings where applicable, with hard plastic covers able to withstand prolonged and repeated use.

Manuals shall be properly indexed to facilitate quick reference.

PSXEB 5.3 Preparation of the final manuals

The abovementioned copies of the final "Operating and Maintenance Instruction Manuals" shall be prepared as follows:

- Binding: The manuals shall be securely bound in A4 size heavy duty hard backed plastic/waterproof 4 ring binders with clear pockets on the spine and front cover for insertion of title slips giving Contract number, scheme, dam and equipment supplied, etc.
- Separate plastic pockets: Drawing larger than A3 size, index and other title pages shall be contained in separate pockets.

- Layout: Each manual shall contain sections separated by subtitle sheets in plastic pockets that are clearly and visibly marked to match the index.

Sections of manual

These various sections of each manual shall be arranged as follows:

- Title page
- Index
- Final acceptance certificate relating to tests carried out
- Operating instructions: These should be clear, concise and easy to follow and must include where applicable pre-start, safety and shut down procedures
- Routine maintenance and lubricating schedules
- Fault diagnosis and repair procedures
- Spare parts lists; names of suppliers/agent's details
- Drawings: These shall include general arrangements, assembly drawings, parts and materials lists, etc. in A3 size. The names of suppliers/agents, original brochures and instrument literature shall also be included in the manual.

PSXEB 6 ROUTE PLANS TO BE SUBMITTED BY THE CONTRACTOR

On completion of the work, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, route plans as well as electronic copies, indicating cable routes in a satisfactory manner:

- The exact cable routes with reference to fixed points (e.g. buildings).
- The exact length of cable (HT and LT) installed between terminating points and between joints where relevant; and
- The exact positions of cable joints with reference to fixed points (e.g. buildings).

Prints of the various plans for the marking up of the information required will be supplied to the contractor on request.

Interchangeability

All equipment must be manufactured to such close tolerance that all similar components and spares must be fully interchangeable without any further alterations or adjustment being necessary.

Water and Debris Accumulation

All outdoor equipment shall be designed so that water and debris will not readily accumulate to cause deterioration of equipment or an electrical discharge hazard. Where this cannot be avoided, such places shall be easily accessible for cleaning.

Name Tags

Identification tags shall be attached to all equipment, sub-assemblies, components such as instruments, fuses etc., cable ends etc. The tags shall be screws on with brass or plated steel screws (no self-tapping screws will be permitted). Where screws are not possible such as on the cable, other means of attachment must be submitted for approval to the Engineer.

Cables shall be tagged at end, whether the end terminates in a through joint or an end box, and at regular intervals in between as prescribed in the Detail Specification. Outdoor tags shall be of stainless steel or brass.

Tags mounted indoors or protected by an enclosure shall be made of Ivorene or similar sandwich material with black letters on a white background.

All lettering and text shall be approved by the Engineer.

Letter sizes must be compatible with the application, e.g.

- For fuses, terminals, relays etc. 3 to 5 mm.

- For panels or cubicles 12 to 20 mm.
- For switchboards or MCC board names about 50 mm.

Fasteners

All bolts and studs shall protrude at least one thread but not more than four threads through the nut, with all washers in position.

If any bolts, nuts, screws or other fasteners are placed in a position that are not accessible to conventional tools, then the Contractor shall provide special tools. This also applies where the size or shape of the fastener is not conventional.

Colour and Finishing

All metal parts of equipment shall either be finished in baked enamel or powder coating or galvanized (depending on the circumstances) after manufacture and treatment to SABS 064.

Colours of paint to be used shall be confirmed with the Engineer prior to application.

All steel areas subjected to corrosive atmospheres, which cannot be painted, and the paint work must be maintained afterwards, or specified to be galvanized must be hot dip galvanized to SABS 763. The galvanizing must be clean, smooth, of uniform thickness and unblemished. The galvanizing must not affect the mechanical properties of the covered metal.

All drilling welding, cutting and bending must be complete, and the metal must be cleaned of any machining blemishes, mill scale, rust and lubricants before galvanizing. If site trimming, drilling and cutting cannot be avoided then all such denuded surfaces must be dressed in cold galvanizing paint.

The Engineer must approve any other proposed corrosion protection before it is applied.

Galvanized areas must be kept free of lubricants.

Wire must be galvanized to SABS 935.

Inspections and Tests

All equipment will be inspected and tested both in the factory during manufacturing and on-site during installation. The Engineer will prescribe the inspections and tests required elsewhere in this specification. The Engineer will do all inspections accompanied by the Contractor and the Contractor will do all tests with the Engineer as witness.

The Engineer will require seven (7) days notification to avail himself for any test or inspection and the Contractor must arrange for the maximum number of inspections and tests to be done on the same day. The Contractor must provide all testing facilities and instruments, all equipment required for a test or inspection and all safety clothing prescribed by the Engineer.

The instruments must have valid test certificates issued by an accepted testing authority and the results of the test done must be recorded on a test certificate, of which the Engineer must receive two copies. The Engineer reserves the right to call for a calibration test on any instruments used during the test.

The cost of all tests must be included in the tender price.

Performance Tests

On completion of erection and installation the Contractor must carry out the following tests, where applicable, in addition to any other tests, which may be specified elsewhere before commissioning:

- Cable Insulation test.
- Earth continuity test.
- Test for correct direction of rotation of motors and reverse if necessary.
- Tests for correct operation of control gear, setting of overload protection equipment, etc.

- The Contractor must obtain SABS test certificates for samples of insulating oil in HT switchgear and transformers. These certificates must be submitted to the Engineer.

On completion of installation and putting into proper operation all the plant and equipment, the Contractor will be required to make suitable arrangements for the testing of all plant and equipment supplied under his Contract and running the plant for at least one week, during which time he shall also train the operators in the correct running of the plant. He shall also explain the maintenance manuals to the operator during this time.

The entire cost of testing including supply of test equipment, must be borne by the Contractor and an adequate allowance for such tests must be made in the Tendered price.

Defects Liability Period

During this period the Contractor must visit the Site at least three times, say 1, 6 and 12 months respectively after the Commissioning Date, to inspect and check all the plant supplied and installed by him for proper operation and to adjust where necessary, and to satisfy himself that the regular maintenance of the plant is being carried out correctly and in accordance with the written instructions supplied by him. The Contractor shall make sufficient provision in the correct price for these visits.

Spares

Tenderers shall submit on the appropriate Schedule in this document a list of spares and special tools which is recommended and should be kept by the Employer for maintenance of the plant. Spares which the Employer decides to order must be manufactured simultaneously with the rest of the equipment and be subjected to the same tests for dimensions, tolerance, strength, etc. All spares and special tools must be packed separately and the cases appropriately marked. All spares and special tools must be new and unused and where possible should be standard to all sections of the plant.

PSXEB 7 Low Voltage Electric Motors

All electric motors shall fully comply with the following relevant standards:

- SABS 1189, SABS 948, BS 4999 and BS 5000 or IECS 34 and IECS 72.

When ordering electric motors for a specific application the Contractor shall ensure that the orientation of the terminal boxes on the motors is suitable for vertical cable entry from below with the motor installed in position and provided with suitable cable entry holes to accommodate the specific cable glands (Holes to be tapped in case of cast boxes).

All three phase low voltage motors shall be of the squirrel cage induction type.

Unless a power rating for a motor is specified, all motors shall be rated for continuous operation (Duty Class S1) at an output of 15% in excess of the maximum power requirements of the associated driven plant when operating at the maximum specified duty at an ambient temperature of 40 ˚C and an altitude of 1300 m (above sea level). The minimum class of insulation shall be class F according to SABS 948.

The motors shall be of a recommended standard rating and if the requirements given above fall between two standard ratings, motors of the next higher standard rating must be provided.

The motors shall be either fixed speed, dual speed or speed control units, as required. All motors shall, where possible, be from the same manufacturer to prevent stocking a variety of spares.

The motor speed shall match that of the driven plant but shall not be in excess of 1500 rpm unless otherwise required.

All motors shall be suitable for “direct-on-line” starting unless “star/delta” or other starting methods are prescribed by the supply authority.

The maximum starting current of these motors under locked rotor conditions with specified voltage applied to the motor terminals shall not exceed six times normal full load current.

The motors shall be suitably rated for 15 starts per hour at an ambient temperature of 40 ˚C and an altitude of 1300m (above sea level.)

All submersible motors shall be of the IP 68 type, and all other motors shall be of the IP 55 IC 01 41 type.

Motors rated at 22kW and above shall each be equipped with three thermostats with a positive temperature coefficient of resistance embedded in the overhang of the stator windings (one per phase) to facilitate the operation of protective devices on overheating of the relevant motor. These thermostat and heaters shall be wired to suitable separate terminal boxes on the outside of the motor.

All submersible motors shall be supplied complete with adequately rated underwater cables factory connected onto the motor, for power supply as well as sensing where applicable. These cables shall be sufficient length to reach the connection points, i.e. the nearest readily accessible dry area, without straining the cable and shall have watertight connections onto the motor. Exact lengths of cable required shall be verified on site before finalizing orders.

Motor selection for frequency converter speed applications shall allow for the following:

- The rated motor power shall be in excess of 35% of the maximum power required by the driven machine and shall have the written consent of the manufacturer that the motor rating will suit the application. Motors shall be suitable for continuous operation over the variable speed range of between 50% and 100% of the specified motor speed.
- The ratio between the maximum torque and the rated torque of the motor must be less than 2.5.
- The method of cooling of the motor shall be efficient for continuous operation over the abovementioned speed range of the motor and shall either be self-ventilated or separately ventilated type of motor.
- The rated speed of the motor shall be as close as possible to the nominal speed of the driven plant.
- Four-pole motors will be preferred but more pole motors will be acceptable if direct-on-line starting will adversely be affected by the four-pole motor.
- Motor winding insulation must be compatible with frequency converter variable speed operation.
- Noise levels of the motor shall not exceed the value given in SABS 948 appropriated to the rated output and speed range of the motor.
- Variation levels of the motor shall not exceed acceptable vibration amplitudes through the speed range when operating in conjunction with frequency converter variable speed applications.

Dual speed motors shall have separate windings each with differing number of poles. Motor ventilation shall be efficient at the required load torque of the driven plant at both speed settings.

Vibration and noise levels shall not exceed values given in SABS 948 appropriated to the rated output and speed of the motor.

Each motor shall be provided with a grade 304 stainless steel or brass nameplate.

The following information shall be submitted with each Tender in respect of all the three phase low voltage motors offered:

- Two copies of an outline drawing showing main overall dimensions.
- Guaranteed continuous rating under site conditions.
- Guaranteed number of starts per hour at an ambient temperature of 40 ˚C.
- Guaranteed maximum starting current under locked rotor conditions with the normal voltage connected to the incoming terminals.
- Guaranteed efficiency of the motor at 50% and 100% normal full load with motor windings connected in delta.

- Guaranteed power factor of the motor at 50% and 100% normal full load with the motor windings connected in delta.
- The mass of each motor.
- Copies of SABS test reports if these motors carry the SABS mark.

The following tests shall be carried out at the Manufacturer's Works on these motors after manufacture:

- If the motor does not carry the SABS mark, performance and efficiency tests shall be carried out to prove the guaranteed information submitted with the successful Tender. These tests must be performed by the South African Bureau of Standards, and a certificate of approval must be submitted stating that the motors comply with the requirements of SABS 948.
- All motors shall be subjected to routine tests as prescribed in Appendix A to SABS 948.

The manufacturer must submit to the Engineer two certified copies of test certificates reflecting the conditions and results of the tests carried out on each motor.

After installation on Site, but prior to commissioning, the following test shall be carried out:

- Ensure that the bearings are properly lubricated.
- Ensure that all power and earth connections are properly made.
- Check all ventilation openings for obstruction.
- Measure the insulation resistance between phases mutually and between each phase and earth to ensure that the winding is dry.
- Spin the motor by briefly switching the supply on to check the correctness of the direction of rotation. After the motor has started the following shall be observed:
- Smoothness and period of acceleration up to maximum speed.
- Noise, vibration and temperatures of motor and bearings.
- Seal leak detectors for submersible pump and motor sets.

All submersible pump motor sets shall be provided complete with humidity sensors to facilitate seal leak detection as well as an underwater cable connection for each detector as specified for submersible motors.

PSXEB 8 Electrical Actuators for Valve Control

Electrical actuator motors for valve and sluice gate control shall be rated in excess of 50% of the maximum power required to open and close the valve or sluice gate.

The actuators shall be complete with continuous local position indication providing a 4-20mA signal for remote position indication and suitable for remote control by means of a 4-20ma signal if required as indicated in the detail technical specification.

Electric actuators for plug valve control shall be suitable for valve position selection by means of a local as well as remote non-maintainable signal and limit switches built into the actuator to facilitate positive positioning of the plug valve in any of the positions selected. The actuator shall be provided with local valve position indication as well as facilities for remote indication.

NB: Gears of synthetic materials will not be acceptable in these units.

PSXEB 9 Multicore Cables and Earth wires

PSXEB 9.1 Low and Medium Voltage Cables

All multi core-cables used on this contract shall comply with the requirements laid down in SABS 1507 – 1990 as amended to date for PVC SWA PVC cables with copper conductors and insulated for 500/3300-volt grade.

Cables for status and analogue signals shall consist of the requisite size and number of copper twisted pairs, individually and overall screened, PVC sheathed, steel wire

armoured, and PVC covered, complying with the requirements of SABS 1507 where applicable.

Cable and earth wires for a specific application shall be selected strictly in accordance with the requirements laid down in SABS 0142 in respect of current rating and voltage drop. Where practicable the earth continuity conductor shall form an integral part of the cable.

PSXEB 9.2 Fibre Optic Cables

The cable shall have a GRP centre strengthening member, colour coded fibres in gel filled loose tubes, surrounded by interstitial water blocking gel, aramid strengthening member, paper binder, polyethylene bedding sheath, plastic coated corrugated steel type armour and polyethylene water resistant outer sheath.

The steel armour shall be polymer coated and bonded to the sheath.

The fibre shall be manufactured from pure silica cladding, minimally doped with Phosphorous and Fluorine to achieve a matched cladding and a graded Germanium doped silica core. The primary coating shall consist of two layers of UV curable acryline resin.

Attenuation uniformity shall be checked at both 850nm and 1300nm with a pulse width not exceeding 1 micro. Fibers with points or steps of discontinuity greater than 0,3dB shall be rejected. For fibre lengths in excess if 1km the attenuation coefficient over the length of fibre shall not vary by more than 0,3dB/km.

The fibre shall withstand a mechanical strain of at least 8N for 1 second and shall have an attenuation increase of less than 0.005dB/turn under a bend resistance test using 100 turns around a 75mm diameter mandrel.

PSXEB 9.3 Jointing of Cables

Joints will only be allowed where more than one full drum length of cable is necessary to complete a specific circuit and must be restricted to the absolute minimum. All joints shall be made to the best practice by competent cable jointers using first class material. The contractor shall maintain the electrical continuity of the armouring in an approved manner at all straights through joints.

PSXEB 9.4 Low voltage power and control cables

Joints shall only be allowed where more than one drum length of cable is necessary to complete a specific circuit.

The jointing kit shall be equal and similar to Raychem heat-shrinkable joints for cables up to 1 kV.

The joints shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

PSXEB 9.5 Termination of Multicore Cables

Low voltage multi core power and control cables

Cables are to be terminated with glands manufactured of bronze and comprising a barrel with sealing washer and bush nut screwed into one end and a compression nipple with wire clamping ring screwed onto the other end. The opposite end of the compression nipple must have a male electrical thread with locknut. The glands shall be suitably sized for the relevant cables, be of the adjustable type complete with armour clamps and with watertight neoprene shrouds.

Cable terminating glands for outdoor use shall be provided with waterproofing inner seals as well as waterproofing seals on nipples. Cable armouring shall be earthed at each end but may not be used as earth continuity conductor.

Fiber Optic Cables

Fiber optic cables shall be terminated by means of suitable glands, ST connections and bus terminals capable of direct connection to the bus interfaces on the bus stations. These bus stations will be housed in separate panels of various control centres.

PSXEB 10 DISTRIBUTION AND MOTOR CONTROL BOARDS

PSXEB 10.1 Indoor floor standing distribution and motor control boards Construction

The board shall be designed for front access only unless stated otherwise in the schedules.

The boards shall be of the free-standing floor mounted cubicle type with IP 55 insert proofed enclosure, constructed of at least 2mm 3CR12 steel or mild steel powder coated on a rigid channel iron or similar frame, and shall be bolted down in position by means of M16 high tensile stainless-steel bolts grouted into the concrete floor.

The bolts shall be inside the board.

The overall height of the board shall not exceed 2,00m and the overall depth shall not be less than 450mm and shall not exceed 0,6m. The construction of the board shall be such that future extension panels may be fitted on both sides and alterations can be done without major changes to the board. (Modular construction will be preferred.)

The board shall be provided with readily removable covers on the side and hinged panels on the front.

All removable covers shall be provided with pre-approved handles or similar approved to facilitate, removal. These covers shall be suitable braced and reinforced to ensure rigidity.

All hinged panels shall be reinforced to ensure rigidity and shall be provided with heavy duty rust proof hinges.

These panels shall also be provided with approved knobs or handles.

Each door shall be supplied with completely concealed hinges, each fastened with not less than four (two on each side) brass bolts and nuts. In the case of double doors, the first door shall be locked with two slides on the inside, onto the kiosk shell. The second door shall close over a lip on the first one.

The doors shall be provided with a locking system suitable for padlocking. The locking system shall consist of a 3-way locking mechanism locking the door at the top, middle and bottom. The padlock shall be enclosed in a tamper proof enclosure as part of the door construction.

All switch gear, instruments and equipment for the control of any specific motor or other electrical device, shall be mounted flush behind a common hinged panel, with only operating handles, push buttons and instrument faces protruding through neatly machine punched holes in the panel.

The board shall be provided with a readily removable, rigidly supported unpainted 3CR12 or HDG cable end support gland plate along the entire length of the board and at least 230mm above floor level.

Space shall be provided for future switchgear and equipment where specified.

The board shall be suitably sized to accommodate without cramping, all the switchgear and equipment specified.

Screwed-on engraved labels in English shall be provided below all switchgear and equipment on the panels, to facilitate identification.

The board shall be provided with one set of four solid, copper bus bars in the top section and extending over the entire length of the board. Provision shall be made at the end of each bus bar for future extensions.

Bus bars shall comply with the requirements of BSS 1433 and the relevant clauses of BSS 159.

Bus bars shall be rigidly supported at suitable intervals to prevent undue damage resulting under short circuit conditions. Ceramic or other approved bus bar insulators shall be used. The bus bars shall be arranged horizontally with the longer sides of the cross-sections in the vertical plane and one behind the other, in the horizontal plane, at 90 mm centres.

Bus bars shall be clearly and indelibly marked Red, White and Blue for the three phases and Black for Neutral.

Connections to bus bars shall be affected by means of cable lugs and suitable sized cadmium-plated, high tensile steel bolts and nuts with cadmium-plated cup washers or lock washers.

All screws, studs, bolts, nuts and washers used for these boards shall be Grade 304 Stainless Steel. The use of self-tapping screws will not be permissible. A solid copper earth bar shall be provided inside the board at the back and along the entire length, at a height of approximately 0,6m above floor level.

The earth bar shall have a cross-section of 150mm^2.

The earth bars shall be drilled and provided with the required number of 6mm Dia and 10 mm Dia cadmium plated, high tensile steel bolts and nuts, complete with cadmium-plated washers and cup washers or lock washers, for making the earth connection. The earth positions shall be evenly spaced along the entire length of each bus bar.

PSXEB 10.2 Paint finishes for electrical materials and equipment

The paint finishes for electrical materials and equipment where applicable shall strictly comply with the quality specification.

PSXEB 10.3 Internal wiring

The internal wiring of the boards shall consist of coloured PVC-installed conductors of adequate copper cross-section, which shall be neatly installed horizontally and vertically installed in PVC trunking. Numbered ferrules of an approved type (clip on type not acceptable) shall be provided on each end of each wire, to facilitate the tracing of circuits.

PSXEB 10.4 Electronic Equipment

Where electronic equipment such as transmitting I/O units are incorporated in a distribution- and motor control board, this equipment shall be installed in a separate and special compartment.

Sufficient room shall be provided for the rail mounted terminal strips, equal and similar to Klippon Type SAKR, which will be supplied and installed by the monitor and control system contractor.

The door must be labelled: “ELECTRONIC EQUIPMENT”.

PSXEB 10.5 Labelling of Switchboards and Motor Control Boards

A screwed on engraved label of the black on white “trefolite” type shall be provided below each item of equipment on the front panel of each board as well as on the chassis in close proximity to the relevant equipment to identify such equipment in the English language in 6 mm high lettering.

Each board shall further be provided with a screwed-on reverse engraved yellow Perspex nameplate with black 20 mm high lettering to identify the board in the English language on the outside of the door at the top thereof.

PSXEB 10.6 Outdoor distribution- and motor control boards

The outdoor motor control boards shall be of the grade 304 stainless steel or mild steel powder coated cubicle type complying with the specification for indoor boards but shall be not more than 2 000 mm high.

Where electronic equipment such as transmitting I/O units are incorporated in a distribution- and motor control board, this equipment shall be installed in a separate and special compartment.

Sufficient room shall be provided for the rail mounted terminal strips, equal and similar to Klippon Type SAKR, which will be supplied and installed by the monitor and control system contractor.

This compartment shall consist of an outer and inner shell with at least 10 mm insulation or polystyrene between the inner and outer shell all round to keep the temperature inside the compartment at least 5˚ C below the temperature surrounding the compartment in summer. If necessary, ventilation fans shall be installed.

The doors of this compartment must also be of a double wall construction with insulation or polystyrene between the two walls. The door must be labelled:

"Electronic Equipment"

Sufficient provision for breathing and heat dissipation must be made in this compartment.

PSXEB 11 CONTROL BOARD COMPONENTS

PSXEB 11.1 Breakers and isolators

Isolators

All isolators shall be of the "Load-breaking" and "fault-making" type and shall comply with the requirements of BS 5419-1977 where applicable. Where relevant, isolators shall be provided with auxiliary contacts for signal purposes.

Fused switches

All fused switches shall be of the "load-breaking" and "fault-making" type complying with BS-5419 where applicable and fitted with HRC cartridge fused links to BSS-88. Auxiliary contacts shall be provided where relevant for signal purposes.

Moulded case circuit breaker

All moulded case circuit breakers shall comply with the requirements of SABS specification No 156-1977 and shall be equal and similar to Heinemann manufacture.

These circuit breakers shall be fitted with copper terminal collector bars where more than one cable tail has to be terminated on the same terminal.

400 Volt air-break contactors

All contactors shall be of the totally enclosed, three pole, double air-break per pole, automatic magnetic type complying with the requirements of IEC 158-1 for Class AC3 contactors of Intermittent Duty Class 0, 3.

All contactors shall be provided with arc extinguisher and readily replaceable silver or silver-alloy contacts rated for at least 2 million "on" and "off" switching operations at rated current.

Each contactor shall be provided with a 240 Volt, 50 Hz closing coil suitable for continuous operation and at least 15 closing operations per hour.

An adequate number of auxiliary contacts shall be fitted.

The contactor may not hum or chatter in service and the contacts may not bounce on closing.

Current Limiting Circuit Breakers

The current limiting circuit breakers shall be capable of remaining in service and of carrying their normal rated current after having interrupted the maximum rated short circuit current at least three times.

The current limiting circuit breaker shall be equal and similar to the Merlin and Gerin or Unelec type for air circuit breakers and Merlin and Gerin or CBI for moulded case circuit breakers.

PSXEB 11.2 Direct-on-Line starters (400V motors)

These starters shall be of the manually operated (locally and remotely) type and each starter shall be contained in its own separate compartment on the relevant motor control board.

Each of these units shall comprise amongst other the following components:

- 1 Only mains fused switch connected to the bus bars of the board and interlocked with the door of the compartment to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open.
- 1 Set of HRC control fused links with carriers and basis.
- All necessary relays as required.

- 1 Only mains contactor.
- 1 Set of START and STOP push buttons.
- 1 Only mains operated timing device to limit starts to 15 starts per hour; and
- 1 Only power factor correction capacitor unit for motors of 5 kW and more.

The following protective and indicating devices complete with necessary suitable rated potential fuses, current transformers, test blocks and auxiliary relays.

- 1 Only motor protection relay (Electronic type equal and similar to Newelec KC) for motors of 11kW or more or as specified.
- 1 Only motor under current relay (Where specified)
- 1 Only instantaneous indicating ammeter for motor current.
- 1 Only ammeter selector switch for motors of 5kW or more.
- 3 Current transformers for motors of 5 kW or more.
- 1 Only running hour meter.
- 1 Only anti-dither circuit.
- 1 Only anti-cycle timer; and
- 1 Only thermistor relay for motors of 22 kW or more
- 1 Only blue LED type indicator light to indicate the time delayed starting period
- 3 Only LED type indicator lights as follows:

Green – 'Supply on'; Amber – 'Motor Running'; and Red – 'Motor Tripped'.

It shall further be possible to trip and lock-out the starter by means of a remote stop button to be provided at the relevant motor.

Provision shall also be made for locking the mains fused switch handle in the OFF position.

PSXEB 11.3 Star/Delta Starters (400V motors)

These starters shall be of the automatic star/delta type, and each starter shall be contained in its own separate compartment on the relevant motor control board.

Each of these units shall comprise amongst others provided for direct-on –line starters the following components as:

- 1 Only Main Isolator connected to the bus bars of the board and interlocked with the door of the compartment to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open.
- 3 Only HRC fuses rigidly attached to the load side of the abovementioned Mains Isolator and the rating of which shall be carefully selected for back-up protection for the relevant motor.
- 1 set of HRC control fused links with carriers and bases.
- 1 only Mains Contactor.
- 1 only Star Contactor.
- 1 only Delta Contactor.
- 1 only Star to Delta timer of the clockwork or electromagnetic type.
- 1 only Mains operated timing device to limit the starts to 15 starts per hour.
- 1 set START and STOP pushbuttons.
- 1 only three phase Factor Correction Capacitator unit for motors of 5kW or more
- All necessary relays.

PSXEB 11.4Variable Speed Drives

These variable speed drives shall each be contained in its own separate panel, manufactured and equipped to the satisfaction of the variable speed drive manufacturer to suit their own requirements with regard to ventilation of the variable speed drive.

The variable speed drive panel shall be equipped with air filters.

The frequency converter shall make use of flux vector control without encoder or tachogenerator feedback and shall incorporate direct torque control technology so that the overall effectiveness of the drive shall only be limited by the performance of the motor.

Semi-conductor shall be determined by the values of flux and torque and shall not have a predetermined pattern an in conventional pulse width modulation flux vector drives.

Each of these drives shall comprise amongst others the following components:

- 1 Only main isolator that shall be interlocked with the door of the panel to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open.
- 3 Only ultra rapid fuses rigid connected to the load side of the above-mentioned mains isolator and the rating of which shall comply with the manufacturer's specifications for the drive.
- 1 Only direct torque control frequency converter.
- 1 Only door mounted control panel complete with cable connections.
- 1 Only Thermister relay for motors of 22 kW or more.
- 1 Only external EMC line filter.
- All equipment necessary for remote emergency stop device.
- All equipment necessary for remote speed control via a monitoring and control SCADA system as well as PLC control.
- All equipment necessary for remote motor status and speed monitoring.
- A hot dipped galvanized gland plate must be provided at least 250mm above floor level for cable connection.

(a) The control panel shall be the user interface for monitoring, adjusting parameters and controlling the drive operation. It shall be possible to:

- Enter start-up data into the drive.
- Control the drive with start, stop and reference signals.
- Display actual values of motor performance.
- 4.Display information on at least the five most recent faults.

(b) The drives shall satisfy the following technical requirements:

- The static speed control error shall not exceed ± 0,5% of motor nominal speed.
- Fundamental power factor shall be at least 0,97 at nominal load.
- Efficiency shall be at least 98% at nominal power level.
- The drive shall operate satisfactorily under all ambient temperature conditions between -5ºC and + 40ºC at an altitude of 1260m above sea level and humidity up to saturation point.
- The drive shall provide output protection of motor overload, over current, short circuit at start, earth fault, missing motor phase and over frequency.
- The drive shall satisfy the following minimum harmonic voltage limits. Total harmonic distortion of 6%, odd harmonic distortion of 4% and even harmonic distortion of 2%. These harmonic distortion parameters shall be measured by the Contractor after commissioning of the system and if the equipment fail to comply

with this requirement, the Contractor will have to rectify the same to the satisfaction of the Engineer.

- The drive shall be equipped with an AC choke for harmonic current reduction and shall be placed on the AC side of the rectifier bridge in order to protect the rectifier semiconductors against power line transients.
- Torque step rise time shall typically be less than 5ms.
- Stringent precautions must be taken in the design of the protection equipment to assure adequate lightning and surge protection.

PSXEB 11.5 Current transformers

All current transformers shall be of the air insulated type complying in all respects with the requirements laid down in BS 3938: 1973.

The contractor shall carefully select the ratio, burden and accuracy class to suit its application in accordance with the recommendations and requirements of BS 3938.

PSXEB 11.6 Indicating instruments

All indicating instruments shall comply with the requirements laid down in BS 89: Part 1: 1970 for instruments of a 2, 5 Accuracy Class. All indicating instruments shall have 96 mm square dials.

The maximum demand ammeters shall be of the 6-amp combined maximum demand registering and instantaneous type having MISC movement and thermal demand indication with an integrating time lag of 15 minutes. The ammeter scales shall be direct reading with a full-scale deflection corresponding to 120% of the rated primary current of the relevant current transformer. Each ammeter shall be clearly and indelibly marked to indicate the colour of the phase to which it is connected.

The ammeter for motor starters shall be 5 amp instantaneous indicating meters with MICSC movement and direct reading scales. The meter shall be able to withstand over currents resulting under starting conditions and the full load current of the relevant motor shall be clearly marked in red on the face of the meter.

Voltmeter shall be of the direct reading moving iron suppressed zero type.

The power factor meters shall indicate from 0,7 lagging to 0,7 leading.

The running hour meters shall have cyclometer dials indicating up to 5 digits and two decimals.

PSXEB 11.7 Instrument selector switch

A four-position rotary type instrument selector switch shall be mounted directly below the relevant instrument in such a way that only the selector knob and indicator plate are on the panel, and the switch itself is behind the panel.

The selector knob shall consist of bakelite, and shall have an arrow engraved on it, indicating the switch position.

The switch shall have a positively driven switching mechanism.

The indicator plate shall consist of bakelite and shall have the positions of the three phases and “OFF”, engraved on it in 5 mm high lettering.

PSXEB 11.8 Power factor correction capacitors for 400 Volt motors

Each of these capacitors shall be the indoor switchboard mounting 400 Volt 50 cps three phase self-contained type with a dead casing and shall fully comply with the requirements laid down in BS 1650-1971.

Each capacitor unit shall be of carefully selected rating to correct the power factor of its associated motor to 0,95 at full load and should not exceed a value which compensates for 85% of the no-load magnetizing currant.

The dielectric shall consist of plastic film and low-loss paper situated between aluminium foil and impregnated with a synthetic liquid agent with scavenger additive.

The capacitor losses shall not exceed 1 Watt/k VAr.

The capacitor units shall have the following admissible overload at an ambient temperature of 40ºC and an altitude 1260 m above sea level:

- 10% excess volts continuously.
- 50% excess current continuously; and
- 30% excess kVAr continuously.

Each of these capacitor units shall be provided with discharge resistors and a fuser each winding element that will disconnect the affected element in event of a de-electric breakdown.

Information to be submitted with Tenders in respect of the 400 Volt distribution boards and motor control boards. The following information shall be submitted with each Tender in respect of all boards offered:

- Full technical details and descriptive literature regarding all equipment and instruments offered.
- Three paper prints of an outline drawing of each board indicating the main overall dimensions and general lay-out of the boards; and
- Three paper prints of an outline drawing of the front-end processor cabinet indicating the main overall dimensions, general layout and type of material employed on the face of the panel.

Information to be submitted by the successful Tenderer in respect of all boards. The successful Tenderer shall submit three paper prints of each of the following drawings, in respect of each of the boards to the Engineer for approved prior to manufacture:

- Outline and general arrangement drawings, showing main overall dimensions and construction details.
- A wiring diagram; and
- A single line diagram.
- Plastic transparent prints of the following drawings shall be supplied to the successful Tenderer in respect of each of the final layout of the boards.
- Outline and general arrangement drawing of each board.
- A wiring diagram of each board and mimic panel.
- A single line diagram of each board.
- A paper print of the single line diagram for that specific distribution board, shall be framed and installed behind glass in each of the switch rooms. These drawings shall be furnished on A2 prints; and
- A paper print of the single line diagram for each LT starter panel shall be installed behind Perspex inside the door of each starter panel.

Testing of distribution/motor control boards at the manufacturer's works

Each distribution/motor control board shall be subjected to the following tests in the manufacturer's works after manufacture:

- A thorough inspection shall be carried out to ensure compliance with the specification and approved drawings and wiring diagrams and to ascertain that all connections are properly made.
- A high voltage test on all primary connections to check the insulation between phases manually and between each phase and earth.
- The polarities and ratios of all potential and currant transformer shall be checked.
- Primary and secondary injection tests shall be carried out on all switching, protection, metering interlocking and indication circuits.

The manufacturer shall submit three copies of test certificates giving details of conditions and results of tests carried out to the Engineer.

PSXEB 11.9 Concrete Plinth for Starter Panels and Pedestals

The plinth shall be cast 150 mm below as well as 150 mm above the ground level. It shall have neatly bevelled edges and shall be 75 mm wider than the panels all round.

An opening of sufficient width to allow for cable entry, shall be provided under the starter panels.

The grade 304 stainless steel foundation bolts for mounting of the panels be cast or grouted into the plinth. The plinth shall be in Class 20/19 concrete and shall be suitably reinforced if necessary.

It is recommended that the casting of these foundations must be carried out by the Civil Contractor at the cost of the Contractor under this contract in accordance with his instructions and under his supervision.

PSXEB 11.10 Electronic Level Control

The micro based electronic controllers which will be mounted in the starter shall be easy to calibrate and reliable in service.

The power units for all the pumps in a specific pump station shall be installed in a separate compartment of the starter and clearly labelled in accordance with the pumps it controls.

These level controls shall be designed to automatically select the pump sequence to ensure that all the pumps will at random be a duty pump.

Where a controller controls only two pumps and one pump is always a standby pump, the standby pump shall automatically become the next duty pump after each duty cycle, unless one pump is taken down for service. When that occurs, the duty pump shall remain on duty until the normal operation is restored.

When a pump selected for duty fails to respond to the start signal from the control, and then the next duty pump shall automatically start-up after five minutes.

The level control must also stop all the pumps, whether on manual or automatic selection, when the pump has reached a predetermined low level.

The transducers shall be designed to operate in air, been capsulated, of rugged construction and impervious to submergence.

The transducers shall, where possible, be installed at a point 500 mm away from a wall or pipe, which may cause a false signal, and at least 500 mm above maximum water level.

The coaxial cable between the transducer and power unit shall be of sufficient length to avoid any joints in this cable, as no joints will be permissible.

The grade 304 stainless steel brackets must be provided and installed under this contract.

PSXEB 11.11 Emergency Stop Push Buttons and Weatherproof Isolators

Each of these units shall consist of a totally enclosed outdoor type heavy duty “push and turn to lock” stop push button station with a cable gland entry at the bottom to accommodate a 3 core 1,5mm^2 LT PVC SWA PVC cable.

This push button station and weatherproof isolator shall be mounted on a rigid 1-meter-high grade 304 stainless steel pedestal with 2mm radius rounded edges, designed to be bolted to a concrete floor.

(Refer to the relevant drawing.)

An emergency stop push button shall be installed where indicated near the coupling between each motor and its associated pump and shall be connected to the relevant starter panel via the specified cable to stop the motor.

The pedestal shall be securely bolted to the floor by means of stainless-steel foundation bolts grouted into the concrete and care shall be taken to ensure that it is installed plumb.

PSXEB 12 CABLE LADDERS

Cable ladders shall be of the heavy-duty type, equal and similar to O-Line.

Cable ladders shall be hot dipped galvanized or as specified on the drawings the height of the sides shall be 76 mm with the width to suit the number and size of cables to be installed.

The cable ladders shall be secured on suitable lengths, which shall be suspended from the roof slab by means of suitable lengths 8 mm Dia threaded hot, dipped galvanized steel rods.

The threaded rods shall be secured to the roof slab with suitable sized hot dipped galvanized steel raw bolts and shall be secured to the channel sections by means of two hot dipped galvanized nuts and washers.

Clamps of the “K” series, suitable for the specific cable shall be employed to secure the cable onto the tray.

PSXEB 13 LIGHTNING PROTECTION

Plant

The lightning protection of the lightning structures, poles and plant of the works, including all the buildings and handrails on the new plant, form part of this contract.

The lightning protection must be a SABS approved scheme and SABS approved drawing of the scheme must be submitted to the Engineer.

Lightning arrestors

Tenderers shall allow in their Tender prices for adequate protection of the equipment supplied and installed under this contract against direct as well as induced voltage surges and spikes which may be experienced on the system.

Surge arrestors shall be provided on each phase as well as neutral on the incoming power supply terminals of each board.

Electronic equipment shall be adequately protected on both the incoming and outgoing terminals by means of suitable arrestors compatible with the relevant equipment. 4-20mA signal cables shall be protected on both sides of the cable against surges.

Arrestors shall be of DEHN manufacture (as supplied by Surgetech (Pty) Ltd. or equal and similar thereto).

All arrestors shall be connected directly to earth along the shortest possible route and only conductors of adequate rating for the discharge currents catered for shall be used for connections to arrestors.

Tenderers shall submit full particulars of the arrestors offered as well as written confirmation that it will provide adequate protection for the relevant equipment against possible voltage surges and spikes on the system.

Earth Clamps

Earth clamps shall consist of 12 mm x 1,5 mm thick copper strap provided with a 25mm^2 x 3 mm Dia, brass bolt, nut and washers. The design of the clamp shall be such that it will fit snugly around the conduit without necessitating any extra packing.

Underground Cable Sleeves

All cable sleeves shall be of the Kabelflex type, manufactured and supplied by Nextube (Pty) Ltd.

Unused sleeve ends shall be sealed by means of Nextube Closure Caps.

Cable sleeves to be installed across the roads shall extend at least 450 mm beyond the edge of the road on each side. Each run of cable sleeve shall be laid straight and without any projections on the side, which may cause damage to or obstruct the threading through of cables.

PSXEB 14 NOTICES AND DANGER PLATES

PSXEB 14.1 Scope

This specification deals with the provision of Notices and Danger Plates as required in terms of the Occupational Health and Safety Act No. 85 of 1993, as well as any other notices that may be required by law or by the nature of the finished Works.

The following standard specifications are referred to in this specification: -

- SABS 0140; Parts I to IV: Identification colour marking.
- SABS 1186: Symbolic safety signs.
- Occupational Health and Safety Act No 85 of 1993.

PSXEB 14.2 Materials And Finish

Outdoor signs shall be either of vitreous enamelled type or of cast aluminium with raised or embossed letters.

Indoor notices shall be of non-deteriorating plastic, Perspex or fiberglass.

The colours and size of letters and colours of background shall be in accordance with requirements of SABS 0140 and as approved by the Engineer.

Symbolic signs shall conform to the requirements of SABS 1186.

Signs shall be pre-drilled for fixing.

All fixing accessories shall be of non-corrosive material.

PSXEB 14.3 Installation and Erection

The Contractor shall supply and fix permanently in position the signs and notices required by law for all the relevant working areas of the Works. Positions of signs shall be as prescribed by the relevant Regulations and as agreed by the Engineer.

PSXEB 14.4 Rotating Bridge Brush Gear

The brush gear to be **installed** on the kingpost on the bridge at the centre of the tank to facilitate connections between the incoming supply cable and the cable from the kingpost to the motor starter via the rotating arm, shall consist of the following:

(a) A set of four 20 mm wide and three 8 mm wide brass slip rings on an ebonite or equivalent insulating sleeve (i.e. three slip rings or phase connections, one for the earth connection, three slip rings for the control circuit, namely, start, common and stop connections). Connections to these slip rings shall be affected via an approved heavy duty terminal block with stud brass terminals onto which the lugs on the cable tails shall be bolted. This terminal arrangement shall be completely independent of fixing screws for the slip rings.

(b) A set of four main circuits and three control circuit "Morganite" carbon brushes, or equivalent. Each of these brushes shall be spring-loaded to ensure high contact pressure and the springs shall be rust-proofed.

The abovementioned brush gear shall be installed in a weatherproof IP55 grade 304 stainless steel housing with a weatherproof access door, on the kingpost of the bridge. This brush gear-housing shall be suitably sized to accommodate the relevant equipment without cramping and shall be insect proofed.

The brush gear housing shall be designed and constructed to prevent the accumulation of gas and the condensation of moisture inside the housing and the pressure of the brushes on the slip rings shall be high enough to obtain a self-cleaning effect during operation.

The driving motor must be provided with a weatherproof emergency stop push button station mounted on the bridge in close proximity to the bridge access ladder. The supply and installation of cables between the motor, emergency push button station, brush gear and kingpost, shall form part of this Contract. The cable shall be installed in a grade 304 stainless steel conduit mounted on the underside of the bridge.

PSXEC GENERAL TECHNICAL REQUIREMENTS FOR EXECUTION (CONSTRUCTION)

PSXEC 1 INSTALLATION OF MULTICORE CABLES

PSXEC 1.1 Cable Trenches

The Contractor will be responsible for the excavation, bedding, back-filling, consolidating and making good of all cable trenches along the routes indicated on the drawings, with the exception of those sections of the cable routes where it is specifically on the accompanying drawings that open cable ducts will be provided by others. Where indicated on drawings ducts inside new buildings will be provided by others. The Contractor however will be responsible for the bedding and filling soil in cable ducts where necessary. A sealing screed to cover the cable duct shall be provided by others.

NOTE: Tenderers shall acquaint themselves fully with the nature and formation of the ground in which the cables are to be laid, before submitting a Tender. No subsequent claim for extras due to lack of knowledge in this respect will be entertained by the Employer.

Cable trenches for L.T. power and lighting cables shall be deep enough to facilitate the laying of these cables at a depth of 750 mm below final ground level.

Trenches for H.T. power cables shall be deep enough to facilitate the laying of these cables at a depth of 1 m below ground level. The floors of all cable trenches shall be smooth and free from boulders and sharp rock projections.

Plastic danger tape shall be installed in all cable trenches 300 mm above the cables for cable protection during future excavation.

Each cable shall be laid in a bedding of river sand or sifted soil 75 mm over and 75 mm below the cable-clayey soil will not be accepted as bedding.

No cable trench shall be backfilled before the cable(s) in the trench has been inspected and approved by the Engineer.

All excavation, backfilling, bedding, and reinstatement for cable trenches. Danger tape, marker posts, and concrete protection slabs shall be provided as specified. All work shall comply with **SANS 1200 DB** and applicable OHS regulations.

PSXEC 1.2 Underground Cable Pipes

Cable pipes will be supplied and installed by others unless indicated otherwise on the drawings.

Each cable pipe shall be sealed by the Contractor under this Contract at both ends by means of bitumen impregnated jute bags or similar material, after the cable have been installed.

PSXEC 2 CROSSINGS WITH OTHER SERVICES

General

Where a cable is laid above another service it shall not be less than 750 mm below ground level, and if this is not possible, the cable shall be laid underneath the other service and shall be protected by means of concrete slabs in the manner prescribed. The deeper or shallower positions of the cable shall only apply for a distance of 1 m both directions of the crossing.

If not possible to cross underneath the other service, the matter shall be referred to the Engineer for a decision.

Clearances

The following minimum clearances shall be maintained between electrical cables and other services:

	VERTICAL	HORIZONTAL
Telkom cables	0,3 m	0,3m
Other water pipes	0,3m	0,3m

Sewerage pipes	0,3m	0,8m
Storm water pipes	0,3m	0,6m
Other Electrical cables	150mm	150mm

Laying of Cables

Cables must be laid without delay.

The cables shall be laid with minimum of delay in order to backfill the trenches as soon as possible.

The Contractor shall, however not backfill the trench until each length of cable has been tested, inspected and approved by the Engineer.

Only one cable shall be laid at a time, and the Contractor shall ensure that cables already laid are not damaged.

Method

All cables shall be handled with the utmost care and shall be laid in accordance with the best methods observed in good modern practice. All cables shall be run out on rollers in order to prevent abrasion and no cable shall be dragged along the ground. No cables shall be bent to a radius of less than 12 times its overall diameter.

Installation of Multi core Cables:

(a) In concrete ducts: Cables shall be laid neat parallel with each other on the floor of the duct with the maximum spacing

(b) On cable ladders: Cable shall be installed neat and parallel with each other with the maximum spacing. On Horizontal sections the cables shall be secured to the cable ladders with intervals of not more than 2 m. On vertical sections or where the cable ladders are installed at an angle the cables shall be secured to the cable ladders with intervals of not less than 500 m. Sections of the cable ladders shall be electrically connected, and provision shall be made for crimping and expansion of the racks.

(c) In Trenches: Two or more L.T. cables in the same trench shall be laid in parallel and not less than 75 mm apart, except where otherwise approved.

H.T. cables in the same trench shall be laid parallel and not less than 150 mm apart, except where otherwise approved.

All L.T. power cables shall be laid 750 mm below final ground level and H.T. power cables shall be laid 1 m below final ground level.

The contractor shall provide 3 m slack at each run of power cable and its associated earth wire and bury the same in the ground as near to the relevant end as possible. Where the cables and earth wires are to be installed in open ducts outside buildings, the slack shall be coiled in the ducts.

The separation between any signal cable and the nearest parallel power cable shall not be less than 150 mm.

(d) Against Walls: Cables and earth wires to be installed on walls, where approved by the Engineer, shall be neatly installed on heavy duty hot dipped galvanized steel cable racks. Cables and earth wires on outside walls shall be installed in a similar manner or in suitably sized hot dipped galvanized conduit from 300 mm below up to 2,4 m above final ground level or as required. These conduits shall be secured to the walls by means of hot dipped galvanized steel bath holders at intervals not exceeding 600 mm. (Hospital Saddles).

Saddles shall be secured by means of round headed hot dipped galvanized screws and plugs of an approved type. (Wood will not be accepted as plugging material.) Plugs will not be allowed in joints between bricks.

(e) On Poles: Cables and earth wires to be installed on poles shall be secured to the poles at intervals not exceeding 600 mm by means of 25 mm x 1,5 mm adjustable Grade 304

Stainless Steel straps. Each cable together with its associated earth wire shall be installed in a suitably sized stainless-steel pipe or channel from 300 mm below up to 2,4 m above ground level. This pipe or channel shall be secured to the pole by means of 25 mm x 1,5 mm adjustable stainless-steel straps at intervals not exceeding 600 mm. To avoid metallic action between different materials Neoprene rubber strip shall be installed between the pole and the strap.

(f) Cable Channels on Structures and in Buildings: Where cable channels have been provided on structures and in building these must be backfilled with river sand by the contractor.

Backfilling of Trenches

Once the cable has been laid, straightened, inspected, approved and covered with the top layer of bedding soil, the trenches shall be backfilled with soil which does not contain more than 40% rock or shale and will pass through a sieve with 100 mm diameter holes that has been approved by Engineer.

Back-filling of cable trenches shall be done in layers of 150 mm and shall be compacted and consolidated to 95% modified AASHTO. Test shall be carried out to ensure the required compaction at the cost of the Contractor.

The closed-up sections of the cable trenches shall be maintained by the Contractor in a proper, safe condition for the duration of the contract. Where the soil in the trenches subsides, it shall be refilled and compacted to the satisfaction of the Engineer.

Jointing and Terminating of Cables

No joint will be allowed in any run of power cable.

All multi core PVC SWA PVC cables shall be terminated at each end by means of a suitably sized cable gland with amour clamp and Neoprene shroud. The armoring of the cable shall be bonded to earth at each end.

All 11 kV cables shall be terminated in compound filled end boxes.

The termination shall be made to the manufacturer's instructions and with materials stipulated in such instructions and with materials stipulated in such instructions.

Where panels are provided with end boxes, these boxes shall be employed to terminate the cable end boxes and shall be filled with the prescribed mass of compound type Henley list No 57040.

The making off of cable ends shall be done strictly in accordance with the manufacturer's instructions as well as the filling of the boxes.

PSXEC 3 TESTING OF CABLES

Low voltage cables

On each completed section of laid and joined cable, the insulation shall be tested to approval with an approved "Megger"-type instrument of not less than 500 V.

11 kV cables

On each completed section of laid and jointed high-tension cable a high voltage test shall be carried out. The test shall be performed according to SABS 97 of 1991. Alternating or direct current may be used.

Earth wires

Earth wires shall be installed with L.T. cables as and were indicated on the drawings or specified here in and shall consist of bare hard-drawn copper wire.

These earth wires shall be installed at the same depth as the relevant cables, with at least 75 mm clearance between any earth wire and the nearest cable, unless specifically approved otherwise.

No joint will be allowed in any run of earth wire.

Each earth wire shall be terminated at each end by means of a suitably sized bolted lug either sweated or crimped onto the wire. The lugs shall be bolted onto the relevant earth bars or earthing terminals.

Cable Markers

Cable markers with lead labels cast into the top of the cable markers shall be supplied and installed along the cable routes under this Contract as follows:

- Along straight runs of the route, not further than 25 m apart.
- At turns - one on each side of the turning point, 900 mm from such turning points.
- At each branch, 3 markers – i.e. one on each side of the branch, 900 mm from the branch.
- The cable marker shall be installed deep enough to ensure that the top of the marker will protrude 50 mm above final ground level.

Route Plans to be Submitted by the Contractor

On completion of the works, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, route plans (polyester prints) indicating in a satisfactory manner:

- The exact cable routes with reference to fixed points (e.g. buildings).
- The exact lengths of cable (H.T and LT) installed between terminating points and between joints where relevant; and
- The exact position of cable joints with reference to fixed points (e.g. buildings).

Prints of the various plans for the marking up of the information required, will be supplied to the contractor on request.

PSXEC 4 PLUGGING OF BRICK WALLS AND CONCRETE

Only plugging material of an approved type may be used for fixing to brick walls and concrete, wood will not be acceptable. Plugging in joints of brick walls will not be acceptable. Only round headed brass screws shall be used for fixing.

Steel structures may not be drilled without written approval of the Engineer. Where steel structures may not be drilled the electrical contractor shall use suitable Grade 304 Stainless Steel clamps for securing the equipment.

PSXEC 5 INSTALLATION OF DISTRIBUTION BOARDS AND MOTOR CONTROL BOARDS

Each of the relevant distribution boards and motor control boards shall be securely bolted down on the floor or plinth by means of the requisite number of foundation bolts grouted into the floor in the positions indicated on the drawings.

These positions shall be confirmed with the Engineer on site, prior to installation.

Testing and Commissioning of Distribution/Motor Control Boards After Installation on site.

After installation on site but prior to commissioning the following inspections and tests shall be performed on each distribution/motor control board:

- Check all components to ensure that they are free from dust and protective packing material.
- Check operation of all components liable to damage in transit such as meter and protection measured.
- The insulation of all primary circuits between phases mutually and between each phase and earth shall be measured.
- All fused links shall be checked for electrical continuity; and
- All control supplies shall be checked.

All adjustable protection devices shall then be met and the boards commissioned all in consultation with and to the instruction of the Engineer.

PSXEC 5.1 Earthing

The contractor shall do all the bonding and ear thing in accordance with the latest addition of the "Code of Practice for the Wiring of Premises" SABS 0142

The substation and HT switch room ear thing shall consist of a 70 mm2 bare copper earth wire installed in the same trench as the HT supply cables.

PSXEC 5.2 Balancing of Load

The contractor shall balance the load as evenly as possible over three phases on the main board, as well as on all the motor control boards.

PSXEC 5.3 Name Plates

Cubicles and pedestals shall be marked with the associated motor number. A list of numbers will be provided by the Engineer. The numbers shall be rear engraved on Perspex or similar material. The number shall be black, 40 mm high on a yellow background. The height of the plate shall be 50 mm. The number shall be secured, on top of the pedestal, as prescribed for distribution boards.

PSXED MOTOR CONTROL CENTRES IN GENERAL

PSXED 1 MCC

SANS STANDARDS

SANS: 1765: 2003.

SANS: 10142 (Wiring of Premises).

SANS: 1473-1: 2023 (Low-voltage electrical switchgear and control gear assemblies)

SANS: 60439-1 :2004 (Part 1 of Low-voltage electrical switchgear and control gear assemblies).

NOTE: All cable trenching shall be carried out by the Civil Contractor. Cable supports shall consist of Unistrut channels, cable trays, and associated accessories, with cables securely strapped at intervals of 300 mm. All electrical motors shall be squirrel-cage type, rated at 380V/415V, 3-phase, 50Hz, and efficiency class IE3. Instrumentation shall be either Motor Control Centre (MCC) mounted, or enclosure mounted.

PSXED 2 PANEL REQUIREMENTS

The MCC shall be a free-standing, indoor type with front bottom access and hinged doors. It shall have a fault rating of 25kA at 400V and be constructed with horizontal and vertical flat busbars. All cable terminations shall be crimped connection lugs. The panel shall be fabricated from 3.5mm mild steel, finished in electrical orange epoxy coating

The MCC shall be designated as Bathurst Wastewater Treatment Works – MAIN MCC and located in the Pump Station Room. It shall include power factor correction on the incoming electrical supply, and an earthing system designed, supplied and installed as part of the MCC panel.

PSXED 3 MATERIAL REQUIREMENTS

- Push buttons shall be Siemens, Schneider or approved equivalent.
- Indicating lights shall be Siemens, Schneider or approved equivalent.
- Ammeters shall be instantaneous type, 90˚ movement, 100% overscale, 100mm face.
- Voltmeters shall be 100mm face.
- Circuit breakers shall be motor starting type, with motor curve characteristics.
- Motor control components shall be Telemechanique, Siemens, Schneider, or approved equivalent.

PSXED 4 CUBICLES

PSXED 4.1 INCOMER CUBICLE

The incomer cubicle shall include the following:

- A main switch with instantaneous and overload protection
- A 400V, three-phase voltmeter.
- Surge protection (3-phase + neutral to earth, SURGETEX/HEHN or approved equal).
- A three-phase kWh meter with maximum demand and energy measurement.
- Over and under-voltage protection.
- Phase failure and reversal protection.

PSXED 4.2 MOTOR CONTROL CUBICLES

Each motor control cubicle shall provide for the control and protection of the following:

- Aeration pumps 1, 2 and 3.
- Sludge returns pumps 1 and 2.
- Recycle pumps 1 and 2.
- Drainage pump.
- Supernatant return pumps 1 and 2
- Chlorine dosing MCC.
- Ultrasonic inflow and out flow meters.
- Dissolved oxygen (D.O) meter.
- Area lighting.
- Welding plug, 220v plug, and local DB.

Each motor shall be fitted with following provisions as applicable:

- Circuit breakers with door mounted operation.
- Overload protection.
- Current transformer (CT) protection and metering.
- Motor starters (Star/Delta of DOL, depending on size).
- Door-mounted voltmeter and amp meter.
- Manual/Off/ Auto selector switch.
- Start, Stop, Alarm reset, and lamp test buttons.
- Run-hour meters.
- Adjustable timers for alternating duty pumps.
- Emergency low, high, start, and stop levels (where required).
- Pressure protection and motor thermal protection.
- Motor heaters and torque protection / no-flow protection where specified.
- Emergency stop pushbuttons with release function.
- Isolators for safe maintenance.

PSXED 5 ELECTRICAL MOTORS

All motors shall be Squirrel Cage type, operating at 380V /415V, 3-phase, 50Hz, and of IE3 efficient class.

PSXED 6 CABLE INSTALLATION

The Cable trenching shall be carried out by the Civil Contractor. Cable support shall be provided by means of Unistrut and cable tray systems, with cables strapped at 300mm intervals.

PSXED 7 INSTRUMENTATION

All instrumentation shall be MCC-mounted or enclosure-mounted, as appropriate for the function.

PSXEE MAIN MOTOR CONTROL CENTRE

PSXEE 1 SCOPE

This section covers the design, manufacture, delivery, installation, testing, commissioning, and training for the Main MCC. The MCC shall comply with SANS 10142-1 and SANS 1973.

PSXEE 2 DESIGN AND DOCUMENTATION

The Contractor shall prepare detailed panel layout drawings, single line diagrams, and control schematics for Engineer's approval.

PSXEE 3 SUPPLY AND DELIVERY

The Contractor shall supply, deliver, and safely store the MCC and ancillary equipment as per approved drawings and specifications.

PSXEE 4 INSTALLATION

The MCC shall be installed and terminated in accordance with SANS 1973 and SANS 10142-1. Alignment, earthing, and interconnection shall be verified.

PSXEE 5 TESTING AND COMMISSIONING

The MCC shall be tested and commissioned with all feeders, starters, protection, and control circuits verified in the presence of the Engineer.

PSXEE 6 TRAINING

The Contractor shall train the Employer's personnel on operation, fault finding, and maintenance of the MCC.

PSXEF TRANSFORMER 200kVA/ 400 V

PSXEF 1 SCOPE

This section covers the design, supply, delivery, storage, installation, testing, commissioning, and training related to the 200kVA 11kV/400V Transformer. The transformer and associated LV distribution box, switchgear, and metering shall comply with SANS 60076 (Power Transformers) and SANS 10142-1 (Wiring of Premises). Refer to APPENDIX A.

PSXEF 2 DESIGN AND DOCUMENTATION

The Contractor shall prepare and submit detailed layout drawings, single line diagrams, and related documentation for approval by the Engineer prior to procurement and installation. No equipment may be ordered or manufactured without such approval.

PSXEF 3 SUPPLY AND DELIVERY

The Contractor shall supply, transport, deliver, offload and safely store the transformer and all ancillary equipment at site. All equipment shall be factory tested prior to delivery. Storage shall be in an area approved by the Engineer.

PSXEF 4 INSTALLATION

The Contractor shall install and terminate the transformer and associated equipment in accordance with approved drawings, manufacturer's instructions, and SANS 10142-1 requirements. Installation shall only proceed once civil and mechanical works are complete and clearance has been given by the Engineer.

PSXEF 5 TESTING AND COMMISSIONING

Testing and commissioning shall include insulation resistance, ratio, polarity, earthing, and functional tests. Commissioning shall be carried out in the presence of the Engineer and shall comply with SANS 10142-1 and SANS 60076.

PSXEF 6 TRAINING

The Contractor shall provide on-site training to the Employer's operational personnel on the operation, maintenance, and safety procedures associated with the transformer. O&M manuals shall be submitted to the Engineer for approval.

PSXEG GENERATOR (120 kVA)

PSXEG 1 SCOPE

This section covers the design, supply, delivery, installation, testing, commissioning, and training for the 120kVA standby generator. All works shall comply with SANS 60034 (Rotating Electrical Machines) and SANS 10142-1.

PSXEG 2 DESIGN AND DOCUMENTATION

The Contractor shall prepare and submit complete generator layout drawings and wiring diagrams to the Engineer for approval.

PSXEG 3 SUPPLY AND DELIVERY

The Contractor shall supply, deliver, and safely store the generator and associated accessories on site. All equipment shall undergo factory acceptance testing prior to delivery.

PSXEG 4 INSTALLATION

The generator shall be installed and terminated according to approved drawings and manufacturer's specifications. Proper earthing, fuel connections, and vibration isolation must be ensured.

PSXEG 5 TESTING AND COMMISSIONING

The Contractor shall perform functional, load, and safety tests in the presence of the Engineer. Commissioning shall comply with SANS 60034 and SANS 10142-1.

PSXEG 6 TRAINING

On-site operational training shall be provided to the Employer's staff. Manuals shall be submitted and approved.

PSXEH BARE COPPER EARTH WIRE (BCEW)

PSXEH 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of bare copper earth conductors. All earthing shall comply with SANS 10313 and SANS 10142-1.

PSXEH 2 DESIGN OR DOCUMENTATION

The Contractor shall prepare detailed earthing layout drawings, showing earth conductor routing, connection points, and earth electrode positions. Drawings shall clearly indicate earthing loops, main earth bars, earth pits, bonding points, and interfaces with structural steel, MCCs, DBs, and equipment.

The earthing resistance design values shall comply with the project specification and statutory requirements. All designs shall be submitted to the Engineer for review and approval prior to commencement of installation.

Shop drawings, technical datasheets, and method statements shall be provided as part of the documentation.

PSXEH 3 SUPPLY AND DELIVERY

The Contractor shall supply bare stranded copper conductors, earth rods, clamps, bonding straps, lugs, earth bars, labels, and other accessories required to complete the earthing system.

Materials shall comply with SANS 10313 and be of high conductivity, corrosion-resistant copper.

Delivery shall include proper storage and protection measures to prevent damage or contamination.

Manufacturer's test certificates and product data sheets shall be submitted to the Engineer before installation.

PSXEH 4 INSTALLATION

Installation shall be carried out strictly in accordance with approved drawings, the SANS standards, and the Engineer's instructions.

Bare copper conductors shall be installed at a minimum depth of 600 mm (or as specified in the design) and laid directly on compacted soil or in trenches prepared according to SANS 1200 DB.

All joints and connections shall be made using approved clamps or exothermic welding, ensuring low resistance and mechanical strength.

Conductors shall be bonded to equipment, MCC panels, metal structures, fences, and all metallic parts that may become live during a fault.

Danger tape shall be installed 300 mm above buried conductors.

All earth pits shall be installed with inspection chambers and clearly labelled.

PSXEH 5 TESTING AND COMMISSIONING

The earthing system shall be tested after installation to confirm compliance with the specified earth resistance values.

Tests shall include:

- Earth resistance testing (fall-of-potential or clamp-on method).
- Continuity tests for bonding conductors.
- Visual inspection of all earth pits, bonds, and terminations.
- All test results shall be recorded and submitted to the Engineer for review and approval.
- Any deviations shall be rectified at the Contractor's cost.

PSXEH 6 TRAINING

The Contractor shall provide on-site training for the Employer's maintenance personnel on the earthing system.

The training shall cover the layout of the earthing network, inspection procedures, maintenance requirements, and troubleshooting of earth faults.

A record drawing (as-built), O&M manuals, and test certificates shall be handed over at the end of training.

The training shall be witnessed and signed off by the Engineer.

PSXEI EXCAVATIONS

PSXEI 1 SCOPE

All excavation, backfilling, bedding, and reinstatement for cable trenches. Danger tape, marker posts, and concrete protection slabs shall be provided as specified. All work shall comply with SANS 1200 DB and applicable OHS regulations.

PSXEI 2 DESIGN OR DOCUMENTATION

The Contractor shall prepare detailed trenching and excavation drawings, including routes, trench depths, widths, joint bays, and protection measures. Any changes to trench routes or levels shall be submitted for approval before execution.

Drawings shall clearly show cable routes, crossings with existing services, and marker positions.

Method statements for excavation, shoring, backfilling, and compaction shall be submitted to the Engineer for approval.

The Contractor shall ensure coordination with civil and other service contractors to avoid clashes.

Where required, wayleaves or permits must be obtained prior to commencement of work.

All trenches must comply with the required depth and separation between different services as indicated in **PSXEC.**

- LV cable depth: 750 mm below final ground level.
- MV/HT cable depth: 1 000 mm below final ground level.

The Contractor shall ensure coordination with civil and other service contractors to avoid clashes.

All permits, wayleaves, and service crossing approvals shall be obtained prior to commencement.

All excavation, backfilling, bedding, and reinstatement for cable trenches. Danger tape, marker posts, and concrete protection slabs shall be provided as specified. All work shall comply with **SANS 1200 DB** and applicable OHS regulations.

PSXEI 3 SUPPLY AND DELIVERY

The Contractor shall provide all necessary equipment, and materials to complete the excavation works including trench shoring, warning tape, marker posts, bedding sand, and protection slabs.

Materials used for backfilling shall comply with SANS 1200 requirements and be approved by the Engineer prior to use.

Warning tape shall be durable, electrically non-conductive, and installed as per specification.

Warning tape shall be non-conductive, durable, and **installed 300mm above** the cables.

PSXEI 4 INSTALLATION

Trench excavation shall be carried out to the lines, levels and dimensions indicated on the drawings.

The floor of all trenches shall be smooth and free of boulders, sharp objects, and obstructions.

Depth shall comply with the following:

- LT cables – 750 mm minimum.
- HT/MV cables – 1 000 mm minimum.

Danger tape shall be installed at a depth of 300 mm above the cable.

Where cables cross other services, minimum clearances shall be maintained as per **PSXEC**:

- 0.3 m vertical and horizontal clearance from Telkom and water pipes.
- 0.3 m vertical and 0.8 m horizontal from sewer.
- 0.3 m vertical and 0.6 m horizontal from stormwater.
- 150 mm clearance from other electrical cables.

Trenches shall be inspected by the Engineer before backfilling.

Trench bottoms shall be trimmed and free from sharp objects. Bedding sand shall be placed and compacted prior to cable installation. Warning tape shall be placed approximately 300 mm above the cables or conductors.

Backfilling shall be done in 150 mm compacted layers, compacted to 95% Mod AASHTO, and restored to original ground profile.

After laying the cables or earth conductors, the trench shall be backfilled in layers and compacted to the required density.

Where soil subsides, the Contractor shall reinstate and compact at no additional cost.

Marker posts and concrete slabs shall be installed where specified.

Any surplus material shall be removed from site and disposed of at approved spoil areas.

PSXEI 5 TESTING AND COMMISSIONING

Excavations shall be inspected prior to and after backfilling to ensure compliance with depth, compaction, and alignment requirements.

Compaction tests shall be carried out at intervals determined by the Engineer.

Any failed sections shall be reworked and retested at the Contractor's cost.

The Contractor shall prepare as-built trench route plans indicating cable positions, depths, marker post locations, and crossings with other services.

No cable trench shall be backfilled before inspection and approval by the Engineer.

PSXEJ CABLE SUPPORT

PSXEJ 1 SCOPE

This section covers the design, supply, delivery, installation, testing and commissioning of cable support systems including UniStruts, trays, brackets, and accessories. Cable routing plans and schedules shall be approved by the Engineer prior to installation.

PSXEJ 2 DESIGN AND PAYMENT

Compile a cable route plan, electrical motor and cable schedule for all the Electrical cables Supports, to submit for the approval of the Engineer.

The item will be certified for payment when the drawings & schedules is approved by the Engineer. The Contractor will be liable for any costs incurred for equipment ordered without approval of the drawings & schedules.

PSXEJ 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Electrical cables Supports and all ancillary equipment. The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXEJ 4 INSTALLATION

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the Engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the Engineer.

PSXEJ 5 COMMISSIONING

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation

and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the engineer.

PSXEK CONTROL AND INSTRUMENTATION CABLES

PSXEK 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of control and instrumentation cables. Cables shall comply with **SANS 1507** and relevant EMC standards. Routing plans and schedules shall be submitted for Engineer's approval.

PSXEK 2 DESIGN AND PAYMENT

Compile a cable route plan, electrical motor and cable schedule for all the Control and Instrumentation cables, to submit for the approval of the Engineer.

The item will be certified for payment when the drawings & schedules is approved by the Engineer. The contractor will be liable for any costs incurred for equipment ordered without approval of the drawings & schedules.

PSXEK 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the control and Instrumentation cables and all ancillary equipment, as specified in the project specification and approved drawings and schedules.

The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.

PSXEK 4 INSTALLATION

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the Contractor has permission from the Engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.

PSXEK 5 COMMISSIONING

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the engineer.

PSXEL SMALL POWER AND LIGHTINING

PSXEL 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of small power outlets and internal lighting systems. All installations shall comply with SANS 10142-1 and SANS 60598 for luminaires.

PSXEL 2 DOCUMENTATION

Compile a schedule for the install or replacement of all the Small Power & Lighting, to submit for the approval of the engineer, as specified in the project specification.

The item will be certified for payment when the drawings & schedules is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered without approval of the drawings & schedules.

PSXEL 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Small Power and Lighting, and all ancillary equipment, as specified in the project specification and approved drawings and schedules.

The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.

PSXEL 4 INSTALLATION

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the Contractor has permission from the Engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.

PSXEL 5 TESTING AND COMMISSIONING

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the Contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the Engineer.

PSXEM PROGRAMMABLE LOGIC CONTROLER (PLC)

PSXEM 1 SCOPE

This section covers the supply, delivery, installation, programming, testing and commissioning of PLC systems including Remote I/O, HMI and UPS equipment. The PLC shall comply with the approved control philosophy and communication protocols.

PSXEM 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Programmable Logic Controllers and all ancillary equipment including RIO, HMI and UPS.

The equipment must be stored on-site, or an extended site, accepted by the Client and the Engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXEM 4 INSTALLATION

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the Contractor has permission from the Engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the Engineer.

PSXEM 5 COMMISSIONING

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the engineer.

PSXEM 6 TRAINING

Training of the plant operators on the Programmable Logic Controllers and accessories. The contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the engineer has proof that this training was done.

PSXEN TELEMETRY SYSTEMS

PSXEN 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of the telemetry system for data acquisition and remote monitoring of plant processes. Equipment shall comply with relevant communication and EMC standards.

PSXEN 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Telemetry and all ancillary equipment, as specified in the project specification.

The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.

PSXEN 4 INSTALLATION

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.

PSXEN 5 COMMISSIONING

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the Contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the Engineer.

PSXEN 6 TRAINING

Training of the plant operators on the Telemetry and accessories. The Contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the engineer has proof that this training was done.

PSXEO COMMUNICATION NETWORK

PSXEO 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of the communication network cabling and devices. This includes network switches, cabling, termination and labelling.

PSXEO 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Communication network and all ancillary equipment, as specified in the project specification.

The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.

PSXEO 4 INSTALLATION

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.

PSXEO 5 COMMISSIONING

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the engineer.

PSXEO 6 TRAINING

Training of the Plant Operators on the communication network and accessories. The Contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the engineer has proof that this training was done.

PSXEP SCADA SYSTEM

PSXEP 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of the SCADA system including software licenses, workstations and servers. Integration with PLCs, telemetry and communication network shall be included.

PSXEP 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Scada and all ancillary equipment and licenses, as specified in the project specification.

The equipment must be stored on-site, or an extended site, accepted by the client and the Engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXEP 4 INSTALLATION

Install and terminate the Scada with all the ancillary equipment, as specified in the project specification.

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the Engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the Engineer.

PSXEP 5 COMMISSIONING

Commission the Scada and ancillary equipment.

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the Engineer.

PSXEP 6 TRAINING

The contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the Engineer has proof that this training was done.

PSXEQ AREA AND OUTDOOR LIGHTINING

PSXEQ 1 SCOPE

This section covers the supply, delivery, installation, testing and commissioning of outdoor area lighting including galvanised steel poles and luminaires. All equipment shall comply with SANS 60598 and SANS 10142-1.

PSXEQ 3 SUPPLY AND DELIVERY

Supply, deliver and safe keeping of the Outdoor Area Lights and all ancillary equipment including galvanised 9m steel pole, as specified in the project specification. The equipment must be stored on-site, or an extended site, accepted by the Client and the Engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXEQ 4 INSTALLATION

Install and terminate the Outdoor Area Lights with all the ancillary equipment including galvanised 9m steel pole, as specified in the project specification.

The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the Engineer.

PSXEQ 5 COMMISSIONING

Commission the Outdoor Area Lights and ancillary equipment including galvanised 9m steel pole, as specified in the project specification.

The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use, and the operation and maintenance manual has been approved and accepted by the engineer.

PSXER PROTECTIVE SYSTEMS

PSXER 1 SCOPE

This section covers provisional allowances for **Fire Detection**, **Intruder Alarm**, and **Lightning Protection Systems**. The contractor shall submit quotations, design, supply, deliver, install and commission the systems upon written instruction by the Engineer. All installations shall comply with applicable SANS standards.

PSXER 1.1 Fire detection

The appointed Contractor to provide quotations for the design, supply, deliver, install, commission and training of the system. The equipment must be stored on-site, or an extended site, accepted by the client and the Engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXER 1.2 Intruder alarm

The appointed Contractor to provide quotations for the design, supply, deliver, install, commission and training of the system. The equipment must be stored on-site, or an extended site, accepted by the client and the Engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXER 1.3 Lighting protection

The appointed Contractor to provide quotations for the design, supply, deliver, install, commission and training of the system. The equipment must be stored on-site, or an extended site, accepted by the client and the Engineer. The item will be certified for payment when the equipment has been inspected by the Engineer.

PSXES APPENDIX A

NDLAMBE MUNICIPALITY									**LOGO**												
UPGRADE OF BATHURST BULK SEWER																					
Project No. PC20013							SEPTEMBER 2025														
UPGRADING OF THE WASTEWATER TREATMENT WORKS - ELECTRICAL EQUIPMENT SPECIFICATION																					
EPS_01: MAIN MCC																					
1.		**Panel Requirements:**																			
1.	1	Type	Free standing, indoor, front bottom access with hinged doors.																		
1.	2	kA Rating	25kA, 400V.																		
1.	3	Busbar Type	Horizontal and vertical flat busbars.																		
1.	4	Cable terminations	Crimped connection lugs.																		
1.	5	Material & Finishing	3.5mm mild steel, electrical orange, epoxy coated.																		
1.	6	Panel designation	Bathurst Waste Water Treatment Works - MAIN MCC.																		
1.	7	Panel placement	Pump Station Room.																		
1.	8	Power Correction	Power correction, on incoming electrical supply.																		
1.	9	Earthing	Earth-mat to be designed, supplied and installed as part of the MCC panel.																		
2.		**Incomer Cubicle:**																			
2.	1	Main switch	Instant, overload protection.																		
2.	2	400V volt meter	3 Phases.																		
2.	3	Ampere meter	3 Phases.																		
2.	4	Surge protection	3 Phases + Neutral to earth, (SURGETEK/DEHN or similar).																		
2.	5	kWh meter	3 Phase, Max. demand and kWh meter.																		
2.	6	Voltage protection	Over & Under.																		
2.	7	Phase protection	Failure & Reversal.																		
3.		**Motor Controls Cubicles:**																			

		EQUIPMENT	Aeration Pump No.1	Aeration Pump No.2	Aeration Pump No.3	Sludge Return Pump No.1	Sludge Return Pump No.2	Recycle Pump No.1	Recycle Pump No.2	Drainage Pump	Supernatant Return Pump No.1	Supernatant Return Pump No.2	Cl2 Dosing MCC	Ultrasonic Inflow Meter	Ultrasonic Outflow Meter	D.O. Meter	Area Lighting	Welding Plug	220 V Plug	Local DB
3.	1	Motor Size (kW)	5.5	5.5	5.5	1.5	1.5	1.5	1.5	1	5.5	5.5	3	TBA	TBA	TBA	0.384	TBA	TBA	TBA
3.	2	Motor FLC (A)	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	10	10	10	TBA	35	20	80
		<u>Main</u>																		
3.	3	Circuit Breaker (CB)								✓			✓	✓	✓	✓	✓	✓	✓	✓
3.	4	CB, Door Operated	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	5	O/L protection	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	6	CT protect/meter	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	7	Motor Starter	SS	SS	SS	DOL	DOL	DOL	DOL		SS	SS								
3.	8	Motor Reverse																		
		<u>Door Mounted</u>																		
3.	9	Voltmeter																		
3.	10	Amp meter	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	11	**Man/OFF/Auto** select	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓			
3.	12	**On/OFF** select																		
3.	13	**START** button	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	14	**STOP** button	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	15	**Alarm Reset** button	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	16	**Reverse** button																		
3.	17	**Lamp Test** button	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	18	**RUN** light	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	19	**STOP** light	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	20	**TRIP** light	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	21	**Reverse** light																		

3.	22	Run-hr Meter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
		<u>Control/Protect</u>																		
3.	23	Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer								Adjustable Timer			
3.	24	Alternate	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	25	Start level								✓	✓	✓								
3.	26	Stop level								✓	✓	✓								
3.	27	Emg Low								✓	✓	✓								
3.	28	Emg High								✓	✓	✓								
3.	29	Proportional Flow																		
3.	30	Day/Night															✓			
3.	31	Pressure	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	32	Solenoid Valve																		
3.	33	Motor heater	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	34	Motor therm.	✓	✓	✓	✓	✓	✓	✓		✓	✓								
3.	35	Torque																		
3.	36	No flow	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	37	Power Surge												✓	✓	✓				
3.	38	Other																		
		<u>Remote Control (Field)</u>																		
3.	39	**START**																		
3.	40	**EMG. STOP** (Push/Release)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
3.	41	Isolator												✓	✓	✓	✓			
4.		**<u>Material Requirements:</u>**																		
4.	1	Push Buttons	Siemens, Schneider or similar in performance.																	
4.	2	Indicating Lights	Siemens, Schneider or similar in performance.																	

4.	3	Amp meter	Instantaneous 90° movement , 100% over scale, 100mm face, max. Amp indication device.																		
4.	4	Voltmeter	100mm face.																		
4.	5	Circuit Breaker	Motor starting suitable (motor curve).																		
4.	6	Motor Control Components	Telemechanique, Siemens, Schneider or similar in performance.																		
		Electrical Motor Type:	All electrical motors, Squirrel Cage, 380V/415V, 3 Phase 50Hz, IE3.																		
		Cable Trenching:	Done by Civil contractor.																		
		Cable support:	Unistrut and cable tray equipment and accessories, strap at 300mm intervals.																		
		Specifications:	**SANS 10142, 1473-1:2003, 1765:2003 & 60439-12004**																		
		Instrumentation:	MCC or enclosure mounted.																		

NDLAMBE MUNICIPALITY																
UPGRADE OF BATHURST BULK SEWER																
Project No. PC20013							SEPTEMBER 2025									
UPGRADING OF THE WASTEWATER TREATMENT WORKS - ELECTRICAL EQUIPMENT SPECIFICATION																
EPS_05: Electrical Cables																
ITEM		CABLE ROUTE			DESCRIPTION		MOTOR		CABLE				EARTH Conductor			
		FROM	TO		LV	Control	SIZE		SIZE	TYPE	Length		Size	Length	TYPE	
					Supply	/ Signal	(kW)		(mm^2)		(m)		(mm^2)	(m)		
MAIN MCC																
1.	1	Supply Transformer/GenSet	Main MCC Incomer		✓	-	TBC		TBA	Cu, PVC/SWA/PVC	150		TBA	150	Bare Cu	
1.	2	Main MCC	Aeration Pump No.1		✓	✓	5.5		TBA	Cu, PVC/SWA/PVC	16		TBA	16	Bare Cu	
1.	3	Main MCC	Aeration Pump No.2		✓	✓	5.5		TBA	Cu, PVC/SWA/PVC	18		TBA	18	Bare Cu	
1.	4	Main MCC	Aeration Pump No.3		✓	✓	5.5		TBA	Cu, PVC/SWA/PVC	18		TBA	18	Bare Cu	
1.	4	Main MCC	Sludge Return Pump No.1		✓	✓	1.5		TBA	Cu, PVC/SWA/PVC	20		TBA	20	Bare Cu	
1.	5	Main MCC	Sludge Return Pump No.2		✓	✓	1.5		TBA	Cu, PVC/SWA/PVC	22		TBA	22	Bare Cu	
1.	6	Main MCC	Recycle Pump No.1		✓	✓	1.5		TBA	Cu, PVC/SWA/PVC	24		TBA	24	Bare Cu	
1.	7	Main MCC	Recycle Pump No.2		✓	✓	1.5		TBA	Cu, PVC/SWA/PVC	26		TBA	26	Bare Cu	
1.	8	Main MCC	Drainage Pump		✓	✓	1.1		TBA	Cu, PVC/SWA/PVC	38		TBA	38	Bare Cu	
1.	9	Main MCC	Supernatant Return Pump No.1		✓	✓	5.5		TBA	Cu, PVC/SWA/PVC	150		TBA	150	Bare Cu	
1.	10	Main MCC	Supernatant Return Pump No.2		✓	✓	5.5		TBA	Cu, PVC/SWA/PVC	150		TBA	150	Bare Cu	
1.	11	Main MCC	Cl2 Dosing MCC		✓	✓	3		TBA	Cu, PVC/SWA/PVC	44		TBA	44	Bare Cu	
1.	#REF!	Main MCC	Ultrasonic Inflow Meter		✓	✓	10 A		TBA	Cu, PVC/SWA/PVC	150		TBA	150	Bare Cu	
1.	#REF!	Main MCC	Ultrasonic Outflow Meter		✓	✓	10 A		TBA	Cu, PVC/SWA/PVC	150		TBA	150	Bare Cu	
1.	#REF!	Main MCC	D.O. Meter		✓	✓	10 A		TBA	Cu, PVC/SWA/PVC	50		TBA	50	Bare Cu	
1.	#REF!	Main MCC	Area Lighting		✓	✓	TBA		TBA	Cu, PVC/SWA/PVC	900		TBA	900	Bare Cu	
1.	#REF!	Main MCC	Earth-Mat		-	-	-		TBA	-	-		TBA	-	Bare Cu	
		Cable Trenching:	Done by Civil Contractor.													
		Cable support:	Unistrut and cable tray equipment and accessories, strap at 300mm intervals.													
		Specifications:	SANS 10142, 1473-1:2003, 1765:2003 & 60439-12004													

C3.4: SMME Specifications

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C3.4: SMME SPECIFICATIONS

Contents

1 DEFINITIONS 2
2 RESOURCES STANDARDS 2
3 SUBCONTRACTING (SMME PARTICIPATION GOAL) 2
4 TENDER PROCESS FOR APPOINTING SMMES 8
5 SMME COMPETENCY TRAINING 9
6 CONTRACTOR'S OBLIGATIONS TO SUBCONTRACTED SMMES 9
7 QUALITY OF WORK AND PERFORMANCE OF THE SMME SUBCONTRACTOR 9
8 ISSUING OF COMPLETION CERTIFICATE 10
9 CONTRACTOR'S LIABILITY 10
10 MEASUREMENT AND PAYMENT FOR SMME WORKS 11
11 MEASUREMENT AND PAYMENT FOR FULFILLING THE REQUIREMENTS OF THIS SPECIFICATION 11

1 DEFINITIONS

For the purposes of the Scope of Works, the definitions given in the General Conditions of Subcontract for Construction Works (2018), the Standard Specifications and the Scope of Works, together with the following additional definitions shall apply:

a) "Subcontract" shall have the meaning assigned thereto in Clause 1.1.1.7 of the General Conditions of Subcontract for Construction Works (2018).

b) "Subcontractor" shall have the meaning assigned thereto in Clause 1.1.1.9 of the General Conditions of Subcontract for Construction Works (2018).

c) "Main Contract": shall mean the Contract entered into between the Employer, who is the Ndlambe Local Municipality (NLM) and the Contractor.

d) "EME/QSE Committee": The EME/QSE Committee shall be selected after award of the Main Contract, and its members shall consist of:

- The Contractor, or his/her representative.
- The Employer's Project Manager.
- The Employer's Agent/s, or his/her representative/s.

The Committee will sit on a monthly basis to review, discuss, assist and advise on all matters pertaining to the EME/QSEs. The Committee may be required to meet on other occasions to address specific matters that may require attention.

e) "EME/QSE's Subcontract" shall mean the Contract entered into between the Contractor and any EME/QSE Subcontractor.

f) "EME/QSE Work Package" shall mean that portion of the Works which shall be set aside for construction by an EME/QSE.

g) "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. For the purposes of this Contract EMEs must be at least 51% owned by black people.

h) "QSE" means a **qualifying small 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. For the purposes of this Contract EMEs must be at least 51% owned by black people.

i) For the purpose of this specification **Small Medium and Micro Enterprises (SMMEs)** shall mean Exempt Micro Enterprises (EMEs) and Qualifying Small Enterprises (QSEs).

2 RESOURCES STANDARDS

SMME appointments will be evaluated in terms of the NLM's Supply Chain Management Policy and terms and conditions of the main contract unless otherwise specified in this specification.

3 SUBCONTRACTING (SMME PARTICIPATION GOAL)

3.1 Scope of mandatory Subcontract Works

It is an express condition of this Contract that a portion of the Works shall be subcontracted to SMMEs that are at least fifty-one percent (51%) black-owned and duly registered on the NLM database, in compliance with the stipulated threshold requirements. Such subcontracted Works shall be allocated in work packages to SMMEs holding the appropriate CIDB grading corresponding to the value of the subcontracted Works tendered.

The value of the subcontracted Works shall be determined with reference to the Contract Sum as set out in the summary page of the Bill of Quantities (BoQ). This value may be adjusted, either upward or downward, in order to align the subcontracted portion with the tender price submitted by the Main Contractor. **The Employer's Agent shall have the discretion to amend or reallocate the scope of the Works to ensure compliance with the stipulated requirements, which may include reallocating portions of the Works initially assigned to the Main Contractor to SMMEs.** Any matter which, in the opinion of the Contractor, may affect the subcontracted value shall be promptly reported to the Employer's Agent as soon as it becomes known

The final selection of the SMMEs will be done by and "open tender" or negotiation process as none of the proposed SMMEs have the necessary expertise to complete this process on their own. The Contractor will lead this process as detailed below.

In the Subcontract agreement, the Contractor is to clearly state the scope of the work to be subcontracted in each specific package identified by the Contractor. It must also identify the agreed value of works as per a BoQ showing the P&G's and payment intervals as well as time of payment from submission of an approved invoice. The Subcontract Agreement must in line with the terms and conditions of the main contract. A copy of the Subcontract Agreement must be submitted to the Employer's Agent prior to finalising the agreement with the Subcontractor. Any unfair subcontracting practices will not be permitted.

The Subcontract agreement must include as a minimum:

- Detailed drawings of each package
- Rates breakdown (plant, labour, materials, profits)
- Fixed and anticipated deductions inclusive of Retention
- Costs per unit (deduction per measured unit)
- EPWP requirements

The Contractor will only be provided with a list of the selected SMMEs provided by the NLM. Packages will be negotiated with the SMMEs and any variance in the tendered rates and SMME rates, both positive and negative will be accommodated under a provisional item included in the Preliminary and General Section of the Bills of Quantities.

Provision for payment for attendance, mentoring and supervision of the SMMEs will also be made in the Preliminary and General Sections for the tenderer to price, for the management of SMMEs in terms the Tender Document.

Provision for an item is also made in the Summary of the BoQ for the mark up on the value of works carried out by SMMEs under this provision. This item will cover all other costs and profits on the value of this work. No other additional costs will be entertained as a result of these requirements. In addition, should SMMEs carry out any works measured under provisional/prime costs sums where the Contractor has had the opportunity to tender a mark-up on these provisional/prime cost sums, the Contractor will not be eligible to claim the mark up on the provisional/prime cost sum. He will however be entitled to the mark up tendered for works carried out by SMMEs.

A. SMMEs (General):

This section provides the specifications that relate to the Contractor's implementation of the policies and initiatives of the Government, community participation, and employment of SMMEs. These specifications should be read in conjunction with the various statutes and legislation that relate to small businesses and Broad-Based Black Economic Empowerment. In this regard all tenders will be considered with specific reference to applicable legislation in force from time to time and which are specifically applicable to organs of state for example the following:

a) The Constitution of the Republic of South Africa, 1996;

b) Public Finance Management Act, 1999 (Act No 1 of 1999);

c) Municipal Finance Management Act, 2003 (Act No 56 of 2003);

d) Preferential Procurement Policy Framework Act, 2000 (Act No 5 of 2000);

e) Broad-Based Black Economic Empowerment Act, 2003 (Act No 53 of 2003);

f) Construction Industry Development Board Act, 2000 (Act No 38 of 2000) and Regulations;

g) National Small Business Amendment Act, 2003 (Act No 26 of 2003); and

h) Preferential Procurement Regulations of 2022.

SMMEs: a separate and distinct business entity, including cooperative enterprises and non-governmental organisations, managed by one owner or more, including its branches or subsidiaries, if any, and is registered with the South African Revenue Service, and which can be classified as a micro enterprise by satisfying the size variation criteria according to the type of enterprise in **Table 1** below:

TABLE 1 : SMME SUPPLIERS AND OTHER SERVICE PROVIDERS *				
Size	Total Full-time Equivalent of Paid Employees	Total Annual Turnover	Total Gross Asset Value (fixed property excluded)	CIDB Grading
	less than	less than	less than	
Medium	200	R26 m	R5 m	7
Small	50	R6 m	R1 m	5 & 6
Micro	5	R0.2 m	R0.1 m	1 to 4

* In terms of the National Small Business Amendment Act, 2003 (Act No 26 of 2003)

It is the Employer's objective, and a specific condition and material obligation under this Contract, that a portion of the Contract Value shall be subcontracted to SMMEs within the relevant **CIDB gradings of 1 to 4**. It must be noted that the majority of the SMMEs are classified within Grade 1,

It should be noted that only one work package may be subcontracted to one specific Subcontractor where possible.

It shall remain the Contractor's responsibility to ensure that this target percentage is attained, irrespective of the difference in rates between what the main contractor tendered and the award rates and resulting amounts as negotiated by the SMMEs for the various works packages.

No additional mark-up or costs will be payable to the Contractor for SMME work packages described above other than the tendered mark-up rate as entered by the Contractor in the BoQ.

3.2 Overhead Charges, Profit, etc. on SMME sub-contract works

The percentage tendered shall cover all costs, including but not limited to administration, overheads, finance charges, transportation, risk, and profit, on the value of the work allocated to SMME subcontract packages as stipulated in the Contract Data and not otherwise provided for under other items. The management of the SMMEs during the execution of the Contract shall be remunerated under a separate item.

3.3 Preferred EME/QSEs

As indicated in paragraph 3.1 above, the successful tenderer will only be informed after the award of the selected SMMEs provided by NLM. Packages will be negotiated with the SMMEs in conjunction with the Contractor, Employer's Agent/s, and NLM officials.

SMMEs must be registered on the NLM database at the time of calling for SMME work packages. Enterprises shall comply with the following:

- Business shall be registered within the NLM boundaries;
- Must be registered with the CIDB to a relevant class e.g. CE; and
- Must have a current valid Tax Clearance Certificate.

3.4 Subcontracting procedures

A. <u>General:</u>

A list of SMMEs will be provided to the contractor by the NLM after the award of the contract. Only SMMEs registered on the NLM database will be considered.

The Employer, Employer's Agent/s together with the Contractor shall evaluate the negotiated prices for the various packages. The evaluation and adjudication panel shall comprise of equal representatives from the Employer, Employer's Agent/s, and the Contractor. The Employer requires the SMME Committee to form the Evaluation Panel.

The Contractor, with assistance from the Employer's Agent, will draw up procurement documents for the SMMEs to price with the assistance of the Contractor to arrive at economically viable rates. A closing date by when this process is to be completed will be announced by the committee. The Main Contractor, with the SMME will be required to submit each work package and present the work packages to the SMME committee for approval. Rates are to be agreed by the SMME committee.

Any rates balancing exercise will be carried out between the main contractor and recommended SMME will be subject to the approval of the SMME committee. Any variations in the final agreed rates and rates tendered by the Main Contractor will be accommodated in the Provisional Sum provided in the Bills of Quantities for such occurrences.

All Subcontractors shall be appointed by the Contractor and the contents and requirements of Clause 4.4 of the Conditions of Subcontract shall apply in full.

The Contractor shall without delay award and enter into Contract with the successful tendering Subcontractor based on their accepted tender submission. Deviations from the tender document shall not be accepted by the Employer.

The Subcontractors will be issued with a programme showing the anticipated starting dates. They must also be advised of factors that may affect this date. Any events that will affect this date is to be conveyed to them so that they are fully aware of any variances in the proposed programme.

Subcontractors shall comply in full, to all aspects of the Conditions of Subcontract and the Subcontractor's attention is drawn to the contents of Clause 4.4 of the Conditions of Subcontract.

The Contractor shall remain responsible for providing the subcontracted portion of the works as if the work had not been subcontracted.

Claims for extension of time due to delays caused by SMMEs as a result of the Contractor's action or inaction will not be entertained. The onus remains with the Contractor to prove that the delays were outside his control. The Main Contractor is to programme in his work, factoring in the use of SMMEs expected production rates under his supervision (reference sub-clause 5.6.2.4 of GCC 2015 for Contactor's time risks). Non-performance of SMMEs shall be dealt with in terms of the Subcontractor agreement.

A five percent (5%) Excluding VAT of the Subcontract value will be deducted as retention on SMMEs Contracts to be released on the completion certificate for the SMME work package. This is to be explained to the Subcontractors at the start of the pricing negotiations.

The Main Contractor shall not permit the SMME Subcontractor to further subcontract any portion of the work package without express written permission of the SMME Committee. This also applies to the Main Contractor carrying out such work as a subcontractor to the SMME subcontractor. This will not be permitted.

B. <u>Subcontract agreements with the Subcontractors:</u>

The Contractor will be required to submit a copy of the signed Subcontract Agreements for all SMME work packages which will include the Scope of Works and a BoQ for each Subcontractor, as well as agreed rates showing the production targets.

This must be submitted prior to any work being undertaken in the relevant SMME work package.

It must be further noted that the Subcontractor must be registered with the Construction Industry Development Board, in the relevant category, in accordance with the estimated value of the work package, as well as being registered on the NLM Supplier Database. Should the Contractor have any doubts about the SMMEs acceptability as a Subcontractor, he is to refer the matter in writing to the Committee for their comment.

All the Conditions of Tender and Tender Data, as they have applied to the Main Contract, shall apply where relevant, to the various Subcontracts.

The Contract Data in the associated Subcontract documents shall be based on the General Conditions of Subcontract, with minimal project specific variations and amendments that do not constitute a material change (where practically possible).

Notwithstanding, the Specific Provisions and Conditions of the Subcontracts must however allow for the following amendments and variations to the Standard General Conditions of Subcontract:

- **Subcontract Sureties** – The Subcontract shall be drafted to allow the omission and requirement for sureties and performance bonds.
- **Insurances** – The Subcontract shall be drafted to allow the omission of insurances and to specify that such responsibility remain with the Contractor.
- **Penalty for Delay** – The Subcontract shall be drafted to specify that the Contractor shall issue and give written notice and warning to the Subcontractor prior to any penalties being deducted. Penalty amounts will be agreed by the SMME Committee in consideration of the penalties for the Main Contract. The amount of

penalty to be included in the agreement is also to be determined in consultation with the Committee.

- **Valuations and Payments** – The Subcontract shall be drafted to allow the Subcontractor to submit bi-weekly statements.
- **Valuations and Payments** – The Subcontract shall be drafted to specify that the Contractor shall pay the Subcontractor within two working days of the Contractor receiving his payment for such work.

The subsequent Conditions of Subcontract Agreement shall be in accordance with the Conditions of Subcontract for Construction Works (2018). The Subcontract shall also specify:

a) The terms and conditions relating to the recruitment, employment, and remuneration of workers engaged on the Subcontract Works; and

b) Details of any training to be provided to the temporary workforce.

3.5 Attendance on Subcontractors / Subcontracts

The Contractor shall, in addition to the requirements of Clause 4.4 of the Conditions of Contract guide, assist and mentor all the SMME Subcontractors through all stages of the works packages.

The Contractor shall closely manage and supervise all SMMEs and shall manage, guide, and assist each SMME in all aspects of management, execution and completion of his subcontract. The above shall include inter alia, but is not limited to, the following:

a) Planning and programming of the Works;
b) The sourcing, ordering, acquiring, assist with hiring all the necessary construction equipment, materials, tools, and accidentals necessary and required for the successful execution and completion of the Permanent as well as the Temporary Works;
c) Ensuring the efficient use of all plant and materials;
d) Labour relations and employment;
e) Monthly measurements, costing and invoicing;
f) General safety, occupational health and safety matters, compilation of OHS files, OHS compliance, take full responsibility for all obligations stated in the OHS Act and Specifications;
g) Functions of civil engineering infrastructure, structures, services and systems;
h) Interpreting and understanding the Contract and Subcontract;
i) Construction and maintenance methods and procedures;
j) Communication;
k) Cash-flow control, submitting invoices and payment certificates;
l) Planning, programming, scheduling, critical path control and acceleration;
m) Maintenance planning;
n) Material procurement and control;
o) Risk limitation and management;
p) Quality assurance and procedures;
q) Compliances with all applicable laws, regulations, statutory provisions and agreements;
r) General Conditions of Subcontract and Subcontract Data;
s) Contractual claims, if situations arise that entitle a contractor to claims in terms of the Conditions of Contract;
t) Profit and loss; and
u) Replacement and running costs of construction equipment.

The extent and level of management, mentorship, supervision, guidance, and assistance to be provided by the Contractor shall be in commensuration with the expertise of the relevant Subcontractor and should be so directed as to enable the Subcontractors to achieve the successful execution and completion of the respective Subcontracts. To this end it must be noted that some proposed SMMEs are graded as CIDB Level 1 and as such have little or no experience. The Contractor is therefore expected to provide enough supervision taking into account that there will be a minimum of **3 Subcontractors** as well as his Subcontract implementation as programmed. This information will be required to be included in his Works Programme for approval.

3.6 SMME Construction Manager

The Contractor shall be required to appoint an **SMME Construction Manager** whose sole responsibility will be to assist SMMEs as and when required in terms of this specification. The

SMME Construction Manager's duties are specified in paragraph 3.7 below. The SMME Construction Manager must have 15 years of construction (civil/building) experience and have a NQF 6 in the built environment. The SMME Manager must be full time on site for the duration of the contract and will not be permitted to fulfil any other function on site. The SMME Manager does not replace the Contractor's need for experienced foreman to supervise the day-to-day construction activities but rather to assist and prevent any conflicts developing on site.

3.7 Assistance to the SMME Subcontractors

The Contractor shall, in addition to the requirements of Clause 4.4 of the General Conditions of Contract for Construction Works (2015), guide, assist, and mentor all eligible potential SMMEs in the rate negotiation process and submission of their particular tenders with the negotiated rates, including advice and guidance on how to establish rates.

The SMME Manager will manage the SMMEs and report on progress to the SMME Committee. The assistance rendered by the Construction Manager, shall inter alia:

a) Be given at a level and to the extent which is commensurate with the expertise and resources of the SMMEs;

b) Be given in a manner which is neither prescriptive, dictatorial, nor coercive towards the SMMEs;

c) Not be utilized by the Contractor to manipulate the rates and prices submitted, to his advantage;

d) Be given in a manner which does not unfairly prejudice or favour any particular SMME;

e) Act as a liaison between the Subcontractors and other parties and try to diffuse or prevent any potential conflicts; and

f) Assist with contract and company administrative requirements.

The SMME Manager will work with and manage the SMME Subcontractors throughout the Contract. The SMME Manager shall be a dedicated resource whose only responsibility is to manage the SMME Subcontractors in such a way as to promote the smooth running of operations and as such shall not be the Site Agent, or any other person employed on the Contract for other purposes.

3.8 Procedure for Engaging SMMEs on the Project

The Conditions of Subcontract shall stipulate that the SMMEs must be registered with the Construction Industry Development Board, in the relevant category, according to the estimated value of the Work Package.

The Contractor, with assistance from the SMME Committee must undertake the following tasks in appointing SMMEs:

- Obtain a list of SMMEs from the NLM Committee;
- Together with the SMME Committee, adjudicate and award the negotiated tenders;
- Sign a Subcontract agreement for each Work Package with the successful SMME;
- Subcontractor using the General Conditions of Subcontract for Construction Works (2018);
- Assist, manage and mentor the SMME in meeting the required Contractual and Statuary requirements, inclusive of the H&S plan;
- Assist, manage, mentor, and monitor the SMME Subcontractors with the acquisition and economical use of all resources, being plant, materials, and labour.
- Assist, manage, mentor, and monitor the SMME Subcontractors with their work output and quality;
- Issue subject to the approval of the Employer a Certification of Completion for each SMME; and
- Subcontractor work package.

The Contractor shall ensure that SMMEs are appointed timeously, so as not to delay the Construction Programme of the Main Contract in any way. The above tasks are more fully described below.

He shall also ensure that the Subcontractors understand how many and when they are to be used on site.

4 Tender Process for Appointing SMMEs

4.1 Supply Chain Management Policy

The Contractor shall procure the services of SMMEs by following a process similar to that of the Municipality's Supply Chain Management Policy, so as to ensure fairness and equity. Tenders, of which the estimated value is below R 300 000, may be procured by obtaining three quotes. However, for work packages whose estimated value exceeds R 300 000, tenders shall be invited from names of SMME that will be agreed to with the Ndlambe Project Manager. The final choice will be done in conjunction with the SMME Committee.

The Contractor shall invite tenders and shall be responsible for the issuing of the Subcontract tender documents to prospective tenderers. As the tenderers are mostly Grade 1-4 the Tender process is to be an open process whereby the Main Contractor assists the Tenderers in arriving at fair market related rates. The Employer's Agent will monitor and approve this process.

The Contractor shall adjudicate the tenders with the assistance of the SMME Committee and shall enter into a Subcontract agreement with the successful SMME.

All conditions of, where applicable, as they applied to the Main Contractor on this Contract, shall apply where relevant, to the tenders for SMME Subcontracts.

4.2 Conditions of Tender

The Conditions of Contract of the Subcontract agreement shall be in accordance with the General Conditions of Subcontract for Construction Works (2018).

The Contract will also specify:

- The terms and conditions relating to the recruitment, employment and remuneration of workers engaged on the Contract Works;
- Details of any training to be provided to the temporary workforce;
- Detail of accepted rates;
- Details of any penalties and the amounts; and
- Payment terms which should be 7 working days after issuing of an invoice on labour only contracts and where the Main Contractor is supplying material and plant. No early settlement discount will be permitted to be charged.

4.3 Assistance to the Tenderers

The Contractor shall be responsible for ensuring that prospective SMME tenderers fully comprehend the following:

- Implications of the liabilities and responsibilities inherent in the Subcontract into which the tenderer proposes entering;
- Implications of the tendered rates;
- Scope and extent of the works included in the Subcontract;
- Proper procedures for the submission of the tender; and
- Procedures and basis on which tenders will be adjudicated and the Subcontract awarded.

The Contractor is to provide support for the above as the tenderers will be unable to complete the process on their own. This is therefore to be done as an "open" or "negotiated" process.

4.4 Adjudication

a) After the Contactor has assisted the tenderers and at the time agreed with the Committee, the Contractor shall receive all duly signed negotiated tenders at a location identified by him, with all sealed tender submissions being placed in a proper tender box for this purpose.

b) All tenders received shall be evaluated by the Committee, inclusive of (SMME Manager) mandated to act and sign on behalf of the Main Contractor.

c) After evaluation the SMME Committee shall have the right to interview all tenderers for the purpose of:

- Clarifying any aspect of the tender;
- Verifying the eligibility of the tenderer;

- Querying abnormally high or low rates and prices;
- Clarifying rates and prices which are not in balance with other tendered rates and prices; and
- Ensuring understanding of scope and conditions.

d) The correction of obvious errors shall be carried out in accordance with the requirements of the CIDB Conditions of Tender.

e) Adjudication of the tenders received will be made by the SMME Committee. The Contractor shall be prepared to explain the process of adjudication to all tenderers and motivate his method of award, as may be necessary. All unsuccessful and successful tenderers need to be notified in writing.

4.5 Award of Tenders

The Contractor must award the work to the successful SMME tenderer where after a Subcontract agreement will be signed between the Contractor and the successful SMME tenderer.

5 SMME Competency Training

The Contractor shall be responsible for providing competency training to the appointed SMME's, or SMME's identified by the Employer. The training provider shall be SETA accredited. The following training courses must be provided:

- Tendering for Construction Contracts.
- Set up and Manage a Construction Business.
- Manage Construction Resources.
- Implement site administration procedures on Construction site.
- Preparing a Certificate.

The Contractor shall pay each SMME course attendee a daily stipend, as indicated by the Employer's Agent.

6 Contractor's Obligations to Subcontracted SMMEs

6.1 Dispute Avoidance and Resolution Procedures

The Contractor shall at all times:

a) Apply the terms and conditions of the Subcontract fairly and justly, taking due cognizance of the level of sophistication and experience of the particular SMME concerned;

b) Closely manage and supervise all SMMEs and wherever possible, give reasonable warning to SMMEs when any breach of the terms of the Subcontract has occurred or appears likely to occur. The Contractor shall whenever possible, give the SMMEs reasonable opportunity to remedy any such breach or to avoid such breach and shall render all reasonable assistance to the SMMEs in this regard; and

c) Inform the SMME Committee in writing of any breeches and his intended actions as well providing supporting evidence of such breeches.

When taking any disciplinary actions or imposing any penalties as are provided for in the Subcontract, the Contractor shall explain fully to the SMMEs that such actions are provided for in the Subcontract.

If any dispute should arise between the Contractor and an SMME such dispute shall be resolved in accordance with the provisions of the Subcontract.

7 Quality of Work and Performance of the SMME Subcontractor

7.1 Quality

The Contractor shall be fully liable for the quality of work carried out by the SMMEs as if this work is carried out by the Main Contractor. All works are to be carried out in accordance with the standard and project specifications and Construction Drawings provided in the Contract Document and issued by the Employer's Agent.

7.2 Performance

If the SMME Subcontractor, in the opinion of the Employer's Agent, fails to comply with the criteria as listed below, the Employer's Agent shall issue a written warning to the Main Contractor, stating all the areas of non-compliance. A copy of the letter of warning shall be forwarded to the Committee. The criteria may include, but are not limited to, the following:

a) Acceptable standard of works as set out in the specifications in the Subcontract;

b) Progress in accordance with the time provisions of the approved programme;

c) Punctual and full payment of the workforce and suppliers;

d) Site safety and H&S compliance; and

e) Accommodation of traffic.

The SMME Subcontractor shall have 7 days from the date of receipt of the letter of warning by the Contractor to address and rectify the issues raised by the Employer's Agent, with the exception of points (d) and (e), for which the reaction time shall be immediate. Failure to do so will be sufficient grounds for the Contractor to terminate the Subcontract, provided that the SMME Committee is satisfied that the Contractor has made every effort to correct the performance by the SMME Subcontractor.

8 Issuing of Completion Certificate

The Contractor shall, within 7 days of the completion of each Subcontract completed in accordance with the provisions of this specification, issue free of charge to the SMME, a Certificate of Completion. The format, layout and appearance of certificates issued shall be agreed by the SMME Committee, provided always that they shall be respectable and presentable in accordance with the general standards of normal business practice. All certificates issued shall be co-signed by the Employer's Agent, SMME Manager and Construction Manager.

The Certificate of Completion shall provide the following information:

MAIN CONTRACT DATA:

a) Contract title;

b) Contractor's full name and address;

c) Employer's Agent name and address; and

d) Employer's name.

SUBCONTRACT DATA:

a) SMME name and address;

b) Scope or extent of the Subcontract Works;

c) Value of the Subcontract Works;

d) Duration of the Subcontract;

e) Date of completion of the Subcontract;

f) Description of the training undergone by the SMME; and

g) Value of Contract.

9 Contractor's Liability

No provision or requirement set out in this specification shall be deemed to relieve the Contractor of any liability or obligation under the Contract, and in accordance with the provisions of Clause 4.4 of the General Conditions of Contract for Construction Works (2015), **the Contractor shall be fully liable for the acts, defaults and neglects of any SMME, his agents or employees**, as fully as if they were the acts, defaults and neglects of the Contractor, his agents or employees.

10 Measurement and Payment for SMME Works

Under the work packages determined by the SMME Committee for SMMEs, the SMMEs shall be responsible for all labour, plant, equipment, tools, materials, and any other incidentals that may be required to carry out the works in accordance with the specifications.

In cases where the SMME is unable to provide all of the above then the Main Contractor is to provide plant, equipment, tools, material, and other items needed by the SMME in order to implement his work and such Contracts will be regarded as labour only Subcontracts. Any such arrangement is to be first approved by the Committee.

Alternatively, The Contractor may make arrangement to hire, advance resources to the Subcontractors and deduct from their interim payment certificates subject to the approval of the committee.

The Main Contractor shall provide full supervision and manage the SMME work at all times in order to ensure compliance with the specifications and drawings.

Measurement of SMME works for work packages must be reviewed by the SMME Manager and approved by the Employer's Agent after approval by the Construction Manager. SMMEs will be permitted to invoice bi-monthly. All invoices from SMMEs must be submitted together with the Contractor's Payment Certificates with a summary to show percentage targets reached.

In cases where it is suspected that an SMME have been paid by the Contractor and have not made payments that are due to their personnel (such as salaries), the SMME Committee will investigate. If it is found that there are outstanding payments and that the result thereof poses a risk to the project, the Contractor may be instructed by the SMME Committee to:

- Withhold the approval of further interim payment certificates to the SMME, until all due payments are settled,
- or make the due payments on behalf of the SMME and recover the costs thereof in the next interim payment certificate or from the retention monies if the final payment certificate has been issued.

The Main Contractor must pay SMMEs within two working days after receiving payment from the Employer. The Main Contractor will not be permitted to charge SMMEs handling costs i.e., bank charges, early payment discounts etc. These costs must be included in the **mark-up tendered by the Main Contractor** on the value of works carried out by SMMEs.

11 Measurement and Payment for Fulfilling the Requirements of this Specification

11.1 Provisional Sum for SMME Work Packages .....Prov Sum

Provisional Sum has been allowed for the payment of works completed by SMME Subcontractors in accordance with this specification.

11.2 Mark-up on the Value of Work Carried out by SMMEs..... %

Provision has been made for tenderers to tender a percentage mark-up on the value of SMME Works to be undertaken under this Contract. The percentage tendered must cover all costs as indicated in **Sections 1 to 9 above** of this specification, other than the cost for the SMME Manager for all SMMEs works packages, identified as provisional sums. This must also cover lost earnings or commercial opportunities arising out meeting the requirements of this specification.

In addition, should SMMEs carry out any works measured under provisional sums where the Contractor has had the opportunity to tender a mark-up on these provisional sums, the Contractor will not be eligible to claim the mark-up on the provisional/prime cost sum. The Contractor will, however, be entitled to the mark-up tendered for works carried out by SMMEs.

11.3 SMME Contract Manager..... Sum

The monthly fee shall include full compensation (cost to company, accommodation, travelling, administration, communication, allowances, profit, risk, any other overhead). Amount will be paid as per PSA 8.2.2 (time-related items).

11.4 Provide on-site, guidance, mentoring & supervision of all activities to ensure SMMEs meet their production and quality targets ..... Sum

The monthly fee shall include full compensation for all guidance, mentoring, non-accredited training, supervision, setting out, and monitoring activities that may be deemed necessary to ensure the Works carried out by SMMEs are in accordance with all aspects of the Contract Document and within the agreed timeframes and to the required quality as per the relevant sub-contractor agreement as stipulated in this specification. Amount will be paid as per PSA 8.2.2 (time-related items).

11.5 Any other costs related to the Management and administration of SMMEs ..... Sum

The Contractor is to allow for any other monthly cost he may incur and what has not been allowed for elsewhere in the document. Amount will be paid as per PSA 8.2.2 (time-related items).

11.6 Provisional Sum for SMME competency training .....Prov Sum

A Provisional Sum has been allowed for payment of competency training for appointed SMME's.

11.7 Mark-up on the value of training costs ..... %

The Contractor shall allow a markup for the arranging the training and enforcing quality deliverables.

C3.5: Labour and Community Specifications

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C.3.5: LABOUR AND COMMUNITY SPECIFICATIONS

Contents

ISD 1 FEATURES REQUIRING SPECIAL ATTENTION 2
ISD 2 UTILISATION OF LOCAL LABOUR 3
ISD 3 TRAINING 3
ISD 4 COMMUNITY PARTICIPATION 3
ISD 5 MEASUREMENT AND PAYMENT 6

ISD 1 FEATURES REQUIRING SPECIAL ATTENTION

ISD 1.1 Site Establishment

The contractor shall negotiate the site office space through the Stakeholders and leadership of the area via the ISD facilitator.

The contractor shall negotiate payment terms if any payment has to be made for use of space for site office via the assistance of the ISD facilitator.

ISD 1.2 Project Steering Committee Representatives (PSC)

All communication to the community members of the project areas will be done through the PSC.

The contractor will reimburse the PSC a seating allowance for every meeting the PSC shall attend.

ISD Facilitator shall submit the attendance registers for all meetings attended.

ISD 1.3 Appointment of a Community Liaison Officer (CLO)

The contractor shall appoint a community liaison officer that will assist with the appointment of local labour

The contractor shall provide details of skills requirements for the person to be appointed as a CLO, and the PSC will submit at least three names of people to choose from.

The contractor, ISD Facilitator, chairperson of the PSC and the Ward Councillor where applicable, may interview the candidates to get the preferred candidate from the three names provided by the PSC representatives.

The contractor shall be responsible for remunerating the CLO for services provided.

The payment periods and amount shall be agreed upon beforehand.

ISD 1.4 Lines of Communication –Regarding Community Related Activities of the Project

The contractor may not at any given moment communicate directly with the community members on project related matters.

The PSC members are the link between the community members and the project team members.

The job seekers list will be channelled through the PSC via the CLO to the contractor.

ISD 1.5 Sourcing of Labour for the Project

All labour to be used for the project will be sourced through the CLO and the PSC representatives of the project.

All labour used in the project will be sourced from a job seekers list approved by the PSC and their respective communities.

No other jobseekers list shall be used or received by the contractor except the one residing with the CLO of the project.

The contractor shall consider all the social demographics appointing local labour. (Including women and people with disabilities and youth)

Contractor shall explain in detail how payment of local labour shall be made i.e., per day/per task and when will labour be paid (weekly, fortnightly or monthly)

The contractor shall pay labourers using the rate of pay within the area as per department of labour prescribed rates.

Social Facilitator will facilitate that all those employed as local labour will open a bank account so that the contractor may not run the risk of carrying cash on site.

The contractor will have to bear the consequences for failure to adhere to arrangements and agreements made in relation to labour payments and related matters.

ISD 1.6 Conflict Management

The contractor should immediately report any conflict that may arise in the project to the ISD Facilitator or PSC members.

In the event that the contractor is in need of local material – local authorities should be consulted prior the use of such material. (e.g., sand or sabunga)

ISD 2 UTILISATION OF LOCAL LABOUR

ISD 2.1 Employment of labour from the local community

The Contractor's own site staff shall be limited to key personnel only.

It is a prerequisite of this Contract that the Contractor employs members of the local community in the execution of the Works. The Contractor shall recruit all his non-skilled labour from the local community.

Local community defined as persons who normally reside within the project area.

Monthly labour returns shall indicate the numbers and details (i.e., age, gender, etc.) of the local labour employed including the nature of the work undertaken by each labourer.

The Contractor is advised to enter into a written employment contract with the local labour employed.

ISD 2.2 Identification of labour

The identification and selection of suitable labour will be undertaken in consultation with the Project Steering Committee, Community leadership, the Employer's Agent, the Community Facilitator and the Contractor.

The Contractor shall train labour to undertake the tasks for which they have been employed to perform.

Should the employment of a labourer or labourers prove unsatisfactory at any stage, the Contractor shall consult with the Employer's Agent's Representative, the Community Facilitator, Ward Councillor and the Project Steering Committee in this regard. This action will in no way relieve the Contractor of his obligation to complete the Works.

All costs incurred by the Contractor in complying with this clause shall be deemed to be included in the rates tendered in the Bill of Quantities.

ISD 3 TRAINING

ISD 3.1 General

An aspect of the aim of this Contract is to provide training for the local labour employees.

ISD 3.2 Practical training of local labour

All local labour employed on this Contract shall receive practical training.

ISD 4 COMMUNITY PARTICIPATION

The Contractor shall make allowance for the employment of a CLO in accordance with the following terms of reference (TOR).

ISD 4.1 Terms of Reference of CLO

The Contractor shall in his dealings with the communities affected by the project, work with the Project Steering Committee (PSC) which has been elected by the community. The PSC acts as a communication structure between the project and the community. The process of appointing the Community Liaison Officer (CLO) is also facilitated by the Social Facilitator together with the PSC. The CLO acts as a link between the Contractor and the labourers and the PSC and attends to all labour related issues. The CLO facilitates labour recruitment through the PSC. The CLO and the Executive structure of the PSC (Chairperson, Vice-Chairperson and the Secretary) attend monthly project progress report meetings (site) besides the PSC meetings attended by the full PSC. The Contractor must include in his rates the costs of attending an average of one meeting every two weeks. The CLO is appointed for the period of physical construction, plus a period of 14 days prior to this period. The Contractor will provide office and stationery to the CLO to be able to perform his or her duties.

The ISD Consultant shall prepare and facilitate the signing of the Contract between the CLO and the Contractor. Remuneration of the CLO shall be R 8,000 per month for the period of employment and will change in accordance with change in rates from the Department of Labour.

A CLO who fails in the responsibilities he/she is given will be replaced following the procedures as stipulated in his/her Contract with the Contractor. The CLO will be expected to perform the following duties/activities:

- Organise and assist the contractor in explaining to all workers the labour-based construction model.
- Ensure labourers understand their task and the principles behind task work.
- Ensure labourers are informed of their conditions of temporal employment.
- Attend all site meetings and briefing for work procedures.
- Keep written record of community liaison and consultation which should be summarised and included in the monthly progress reports.
- Collect monthly welfare reports and submit to social facilitators.
- Ensure that contractor's workers are paid what is due to them and in time.
- Assist in the recruitment of labour.
- Promote and maintain sound relations with community stakeholders and other role players in the project.
- Screen the supplied labour by the community through Project Steering Committees to ensure compliance with the agreed upon recruitment policy and the government's labour employment targets.
- Inform local labour about their conditions of temporary employment, to ensure their timeous availability and inform them timeously when they would be relieved, where the rotation of labour is applicable.
- Keep the register of labour and manage records for local labourers in order to be able to provide reports on employment statistics.
- Consult on all decisions regarding local problems and any matters of importance that, in any way will be of relevance to the Contract.
- To be on site on a daily basis.
- To register concerns / perceptions form the labour or contractor and raise them in the PSC meetings.
- Attend PSC meetings to present monthly report on the local community labour involvement and site matters.
- Identify possible labour dispute and any disciplinary matter and advise the site agent / foreman and assist in the resolution, where necessary must call for the assistance of the Social Consultant for the resolution of the conflicts.
- Assist the contractor in preparing records of project employees.
- Assist the contractor in making task measurements and the records thereof.
- Monitor the production of individual task workers and arrange replacement of those workers who fail to produce a reasonable task output.
- Attend disciplinary proceedings to ensure that hearings are fair and reasonable.
- Communicate daily with the contractor to determine additional labour requirements with regard to numbers and skills and pass this to the PSC.
- Attend weekly meetings with the contractor and make a weekly written report which shall be a prerequisite to being paid.

The residents of each village being served by the project are represented by a PSC. All liaisons with the community and the committees are the responsibility of the Social

Facilitator in conjunction with the Implementing Agent, the Ward Councillor (where applicable), and the Project Manager. The Contractor will be required to liaise through them for any matters to do with the community.

ISD 4.2 Conditions of Temporary Employment

The following conditions will apply to the employment of local labour, whether employed directly or through a Subcontractor:

- Transport to site will not be provided
- There will be no payment for leave, sick leave, holidays or rain days
- Notice period for termination of employment shall be 2 days and there shall be no severance pay.

The Contractor shall however give, at the earliest possible opportunity, notice of the termination of the project and/or an employee's participation in the project:

- Workmen's Compensation Act (WCA) benefits shall apply
- The Occupational Health and Safety Act will be adhered to
- An employee shall not be required or permitted to work continuously for more than five hours without given a meal interval of not less than half an hour.

An employee shall, upon termination of his services, be entitled to a certificate of service showing the full names of his employer (i.e., the Contractor) and the employee, the type of work done by the employee, the date of commencement, a record of training received and the date of termination of his services.

ISD 4.3 TASK RATES

The following Department of Public Works task units are to be used by the Contractor:

Site Clearing and Setting Out

	Activity	Unit	Task Rate	Remarks
1.1	Setting out alignment and needed setting out of all activities	m/wd	15	
1.2	Bush clearing including disposal of cuttings out clearing width			
	• In thick bush	m²/wd	150	
	• In light bush	m²/wd	350	
1.3	Grass cutting	m²/wd	750	
1.4	Grubbing including disposal of grubbed material out of clearing width			
	• Depth up to 2 cm thick	m²/wd	200	
	• Depth more than 2c m up to 5 cm think	m²/wd	100	
1.5	Tree and stump removal including disposal of cutting out of clearing width	m²/wd	200	
1.6	Boulder removal including disposal of clearing width	m³/wd	2.00	For estimating purpose only. Use daywork
1.7	Sand and silt removal including disposal out of cleared width	m³/wd	3.50	In-situ measurement
1.8	Establishment of access to quarry	m/wd	25	Involves different activities
1.9	Excavation of overburden at quarry	m³/wd	2.50	In-situ measurement

Excavation

	Activity	Unit	Task Rate	Remarks
2.1	Trench excavation (± 0.5m wide and up to 1.0 deep)	m/wd	7-10	
2.2	Trench excavation (± 0.5m wide and up to 1.25 deep)	m/wd	5~7	
2.3	Trench excavation	m³/wd	3~6	
2.4	Backfilling of trenches	m³/wd	4~8	

Pipe Laying Works

	Activity	Unit	Task Rate	Remarks
3.1	Laying of water pipes 100~150 mm Ø	m/wd	14~19	
3.2	Laying of sewer pipes 100~150 mm Ø	m/wd	19~24	
3.3	Laying of HDPE pipes 100~150 mm Ø	m/wd	125	

ISD 5 MEASUREMENT AND PAYMENT

ISD 5.1 Fixed-Charge Items

a) Allowance for Contractor's initial obligations in respect of the ISD — Sum

b) Allowance for Submission of the ISD Plan — Sum

c) Allow for Community Liaison Officer — Psum

d) Allow for remuneration of 5 PSC Members R500 p/p, per month — Psum

e) Allow for training of PSC Members — Psum

ISD 5.2 Time-related Items

a) Allowance for Contractor's time related obligations in respect of ISD — Sum

b) Allowance for provision of part time ISD — Sum

C3.6: Health and Safety Specifications

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C3.6.1: Occupational Health and Safety Specification

Issued in terms of the Occupational Health and Safety Act, 1993 Construction regulations 2014

Contents

1 SCOPE....2
2 DEFINITIONS....4
3 INTERPRETATION....5
4 THE OCCUPATIONAL HEALTH AND SAFETY FILE....5
5 GENERAL REQUIREMENTS....6
6 TRAINING, AWARENESS AND COMPETENCY....7
7 OCCUPATIONAL HEALTH & SAFETY MANAGEMENT....8
8 GENERAL RISK MANAGEMENT....11
9 COMMUNICATION ON SITE....13
10 CARE OF WORKERS ON SITE (WELFARE)....13
11 DISCIPLINE, ALCOHOL AND SUBSTANCE ABUSE....13
12 WORKING AT HEIGHTS....13
13 EXCAVATIONS....14
14 TEMPORARY WORKS....14
15 CRANES AND LIFTING OPERATIONS....14
16 ELECTRICAL AND MECHANICAL INSTALLATIONS....14
17 DELIVERY OF MATERIALS TO SITE....15
18 NUCLEAR DENSITY GAGE....15
19 CONTRACTOR MANAGEMENT....15
20 NON-CONFORMANCES....15
21 PROJECT CLOSE OUT REQUIREMENTS....15
22 ANNEXURE A: INCIDENT RECORDING....17
23 ANNEXURE B: MANDATORY DOCUMENTS....19
24 ANNEXURE C: MEDICAL CERTIFICATE....23
25 ANNEXURE D: NON-CONFORMANCES AND PENALTIES....24
26 ANNEXURE E: BASELINE RISK ASSESSMENT....25

1 SCOPE

1.1 Project Introduction

The extended project Works involve the refurbishment and expansion of the Bathurst wastewater treatment works, construction of new sewer ponds for reticulation networks, and connection of all Nolukhanyo and Freestone households to a sustainable bulk sewer system.

1.2 Project Information

A portion of the Works shall be executed by SMMEs, who shall be supervised and assisted under the direction of a full-time SMME Construction Manager (refer to Part C3.4: SMME Specification). Training and upskilling will form a large part of the project delivery criteria, and the contractor will be responsible, pursuant to the provisions of the contract, without in any way limiting the contractors' obligations there under, provide for the health and safety (PSA 5.7) for the works.

The principal will appoint competent contractors as per the tender scope of works documents, which will include engineering, mechanical, electrical, telemetry and other competencies.

The project has a variety of risks, which if not managed, may have a real negative impact on the project. The appointed contractor must ensure that risk control is part of the construction program and planning.

1.2.1 Project Location

Bathurst Nolukhanyo is a township located near Bathurst, within the Ndlambe Local Municipality in the Eastern Cape Province. The Implementing Agent is Ndlambe Local Municipality.

1.2.2 Project duration

50 Weeks (11,5 months).

1.3 Scope of Application

This health and safety specification shall apply to this project as follows:

- Provides the overarching framework within which the Principal Contractor is required to demonstrate compliance with certain requirements for occupational health and safety established by the Occupational Health and Safety Act 85 of 1993 during construction work;
- Sets a high standard in directing the way the Principal Contractor is to manage risk reduction on all health and safety aspects, specifically those where loss incident can be suffered, during construction; and
- Establishes the way the Client's Health and Safety Agent will interact with the Principal Contractor.

This specification establishes general requirements to enable the Principal Contractor to satisfy aspects of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and the Construction Regulations, 2014. The Principal Contractor is required to develop, implement, and maintain a site-specific health and safety plan. The Client is required to provide certain site-specific information to the Principal Contractor or a health and safety specification for the works to enable such a plan to be formulated. Accordingly, this specification on its own cannot ensure compliance with the requirements of the Act.

The Construction Regulations, 2014, requires the contractor, the client and the designers to stop any contractor from executing construction work which is not in accordance with the contractor's health and safety plan and specification for the site or where construction poses a threat to the health and safety of persons.

1.4 Scope of Works

Refer to parts C3.1 and C3.2 of the tender document; however herewith a summary of the works, where the works comprises:

1.4.1 Scope Development

In summary, the scope has been confirmed as per the table hereunder:

Scope of Work – Upgrade of WWTW (1 050 kℓ Capacity)	
Scope Components	**Description**
Site	Site establishment and site clearance.

Earthworks	Bulk excavation for platform and structures. Restricted excavation for minor structures.
Inlet alterations	Partial demolition, construction of new canals, and mechanical installations.
Anaerobic Ponds	Construct new ponds and ancillaries (pipework, subsoil drainage, sumps, etc.)
Aerobic pond	Construct new pond and ancillaries (HDPE liners, pipework, subsoil drainage, etc..)
Settling pond	Construct new pond and ancillaries (pipework, subsoil drainage, sumps, etc.)
Drying beds	Construct new drying beds and ancillaries (HDPE liners, pipework, sumps, etc..)
Refurbish existing ponds	Emptying existing ponds, removing sludge, and repairing as needed.
New building (pump, chlorination, guard, office, and lab)	Construct new building and install ancillaries (plumbing, furniture, pipework, mechanical, and electrical.)
Pipelines	Install pipelines, ancillary structures, and fittings for potable water, sewer, de-sludging, aeration, chlorination, recycling, and recovery.
Access and internal roads	Upgrade the existing access road and construct internal roads.
Fencing	Demolition, refurbishment, supply and erection of perimeter fencing and gates.
Canals	Construction of required canals.
Mechanical works	Supply, installation, and commissioning of mechanical works.
Electrical works	Supply, installation, and commissioning of Electrical works.
ESKOM connection	Construct a new medium voltage overhead line and step-down transformer to connect WWTW.

1.4.2 Deliverables

As a summary of the background presented above, the main deliverables of the Upgrade of Bathurst Bulk Sewer: Wastewater Treatment Works are as follows:

- Upgrade of WWTW to handle current and future demand, with a 1 050 kℓ capacity.
- Construction of new ponds and structures.
- Installation of mechanical and electrical infrastructure.
- ESKOM connection.
- Road upgrade and construction of new internal roads.
- Refurbishment and construction of new fencing.

1.4.3 Temporary Works

The Contractor is responsible for the design, construction/erection, inspection, and maintenance of all Temporary Works.

No major Temporary Works is expected for the completion of the Works. Minor Temporary Works (scaffold and formwork) may be required.

1.5 Site Establishment

The contractor will be required to ensure:

- Provision of a site office, stores, meeting rooms, lay-down areas, employers agents offices.
- Employee ablutions, undercover eating areas, waste management and requirements according to the FR and section 8 of the contract data.
- Fenced, secure, supplied with electrical needs, water for construction and human use.
- Latrines to conform with the local authorities standard. No pit toilets are illegal. Ablutions must be clean and supplied with toilet paper, hand wash systems at all times. With the site works over a distance, this will need planning and controls.
- The permit number must be clearly displayed on the site name boards or OHS entry signage. The permit document must be on file.
- Under no circumstance may water be abstracted form the existing reservoir or pipe lines.
- EMP must include control of all worker generated waste across the works and ensure that environmental aspects, protection of Fauna and Flora, minimizing of waste through recycling, reduction and strict stock controls, are implemented. Waste must be managed as per municipal requirements and strict housekeeping practices on all construction activities will be enforced across the site camp and site works areas. No fires without prior authorization from the client site agent. Plant may not be washed, repaired or allowed to contaminate any area across the works: this must be planned for and permission noted in writing.
- The contractor shall ensure that construction activities do not encroach on, interfere with, tress pass, damage adjoining lands, buildings properties, road structures, pipe lines (Specifically the asbestos pipe in operation during the works) or any other services: under or overhead. Care must be taken to protect existing services. Where crossings of roads or access to properties are a problem, the contractor must be providing safe suitable crossings and will be responsible for any damages and rehabilitation. Night traffic must never be impacted upon due to any arrangements made for access during the day.
- Traffic accommodation must be catered for as required.
- Flammable stores, fuel stores, HAZCHEM substance management must be arranged for as per MSDS and local authority advisories.
- Housing of staff must be arranged by the contractor

2 DEFINITIONS

As per the Occupational Health and Safety Act (85 of 1993) and the relevant regulations and applicable standards.

2.1 List of Abbreviations

CC	Compensation Commissioner
CHSA	Construction Health and Safety Agent
CHSO	Construction Health and Safety Officer
CR	Construction Regulations (Gazette 10113 of 07/02/2014)
DoL	Department of Labour
GAR	General Administration Regulations
GSR	General Safety Regulations
HCSR	Hazardous Chemical Substances Regulations
HIRA	Hazard Identification Risk Assessment
H&S	Health and Safety
OHSA	Occupational Health and Safety Act No. 85 of 1993 (as amended)
OHSS	Occupational Health and Safety Specification
PA	Principal Agent
PSHSS	Project Specific Health and Safety Specification
PC	Principal Contractor
PPE	Personal Protective Equipment
SANS	South African National Standards (Authority)
MSDS	Material Safety Data Sheet
SWP	Safe Work Procedure
POPIA	Protection of Information Act
ER	Ergonomic Regulations

ExR Explosive Regulations

2.2 Key References

- Occupational Health and Safety Act, No. 85 of 1993 and Regulations (as amended)
- Construction Regulations 2014;
- Compensation for Occupational Injuries and Diseases Act, No. 130 of 1993 (as amended);
- Consolidated Directions on OH&S Measures in Certain Workplaces, 2020;
- SANS Standards; and
- Codes of Practice (COPs).

3 INTERPRETATION

The Occupational Health and Safety Act 85 of 1993, herein after referred to as "the Act" and its associated regulations, particularly the Construction Regulations 2014, shall have precedence in the interpretation of any ambiguity or inconsistency between it and this specification.

3.1 Purpose of the Project Specific Health and Safety Specification (PSHSS)

The PSHSS is a performance specification to ensure that the Client and any organization that enter into formal agreements with the Client / Agents, Professional Service Consultants (Engineers, Quantity Surveyors and Architects), Principal Contractors and Contractors achieve an acceptable level of OHS performance on the project.

No advice, approval of any document required by the PSHSS, such as hazard identification and risk assessments, or any other form of communication from the Client shall be construed as acceptance by the Client of any obligation that absolves the Principal Contractor from achieving the required level of performance and compliance with legal requirements. Furthermore, there is no acceptance of liability by the Client, which may result from the Principal Contractor failing to comply with the PSHSS, i.e., the Principal Contractor remains responsible for achieving the required performance levels.

A Mandatary Agreement in terms of Section 37.2 of the OHSA will be signed between parties prior to any works commencing. The PSHSS highlights the aspects to be implemented over and above the minimum requirements of current legislation. Requirements may be changed should new risks or issues be identified that which could not have been foreseen during the design phase of the project, or during the construction phase. Any new legislation or standards (legislated or determined by the Client) that are promulgated or accepted during the contract will automatically be applied.

It should be well noted that in no way does this PSHSS relieves the Contractor of any of his responsibilities set out in the Act and Regulations.

4 THE OCCUPATIONAL HEALTH AND SAFETY FILE

As required by Construction Regulation 7, the Principal Contractor shall keep and maintain a Site Health and Safety File where all relevant health & safety records will be kept, including the Site-Specific Health & Safety Plan, COVID-19 Plan and the relevant construction risk assessments as stated above. Other relevant information includes but not limited to:

As required by Construction Regulation 7, the Principal Contractor shall keep and maintain a Site Health and Safety File where all relevant health & safety records will be kept, including the Site-Specific Health & Safety Plan, COVID-19 Plan and the relevant construction risk assessments as referred to above. Other relevant information includes but not limited to:

a) Client Site Specific specification and HIRA
b) PC appointment letter
c) OHS Act 37(2)
d) PC approved OHS Plan and approval letter
e) OHS Administrative statuary documents:
    - Valid Letter of Good Standing with the Workmen's Compensation Commissioner
    - UIF
    - SARS clearance certificates
    - Permit from DOEL in the file with project number clearly displayed at site access.
f) OHS Policies and procedures signed by the CEO, dated with a review provision. Ensure Smoking Policy is in the file. Include Environmental Management Policy, Substance Abuse Policy, HIV Policy, POPI Act Policy
g) Organogram with appointments, competencies and current statutory registrations.

h) HIRA for proposed site activities and works, Covid 19
i) Safe work procedures / Methodologies/ Plans: inclusive of *but not limited to*:
   - Demolition planning for each structural area, and general Dust and Waste control processes for minor works
   - Blasting Method statement should the contractor need, decide to blast.
   - Noise reduction plan
   - Hoarding and lock out controls
   - Prevention of water ingress to works
   - Facility management and planning for safe access to the works areas.
   - FPP done by a competent person specific to works.
   - Covid 19 mitigation and transmission control plan.
   - Fire prevention plan
   - Emergency Plan
   - Air monitoring plan for work in the dam tower
   - Excavation and trenching method statements that ensure only 400 m trenches in open areas are done daily and closed, and closer to towns, 150 m trenching is done. Barricade, warnings and all trench and excavation controls to be noted
j) Induction program that must include work in water environments
k) Training and toolbox talks. Upliftment of competency requirements as required for this works
l) Inspection registers with appropriate policies and procedures
m) Emergency management, contact numbers and coordinated emergency plan for the specific areas of work along the construction works route.
n) Police clearances for all before allows access to site, and filed for verification
o) Hazardous Chemical Management System
p) Construction environmental management system
q) Laws and Regulations
r) Communications
s) OHS Committee
t) Sub-Contractor Management
u) Employee medical monitoring with formal permission in writing with regard to the POPIA Act and BCE:
   - OHS Medicals fit for work: Repetitive movement, Weather exposures, Water Environments to be noted on assessment
   - Employee ID's
   - Covid daily access monitoring
   - Assessment for work at heights during work that has potential of falling into, off, onto
   - Ergonomic surveys
   - Proof of UIF payments

v) Incident Management:
   - Procedures
   - General incident management register (Monthly)
   - Annexure 1
   - COIDA forms
   - Covid Reporting COIDA forms.

u) Audits
   - Internal
   - Subbie Audits
   - CHSA Audits and Inspections

5 GENERAL REQUIREMENTS

5.1 General Risk Management

The Principal Contractor must provide a detailed risk assessment for the entire works on site. Certain construction activities, equipment, substances etc. represent significantly higher safety risk s than others. The risk assessment is required to define systems and safe working procedures that will be implemented on site in an endeavour to complete the activity safely. The set of risk assessments required to be submitted to the Client must include the assessment of health risks such as those that are associated with COVID-19, and other health risks which may result from lack of personal hygiene, ergonomic hazards, etc.

The contractor is required to:

- Identify health and safety hazards and risks to which persons may be exposed;

- Analyse and evaluate the identified hazards and risks;
- Document a plan which will highlight safe working procedures to mitigate, reduce or control the identified risks; and
- Develop a Monitoring and Review Plan of the hazards and risks.

The client baseline risk assessment provided with this specification aims to provide the framework within which the risks must be assessed for the construction phase of the project, and to highlight any reasonably foreseeable risks which may be inherent to the project based on its current scope of works. The BRA is therefore not the replacement of the contractor's risk assessment but rather to point the contractor towards some risks he might not be aware of during tendering stage and while conducting his formal risk assessment. The baseline risk assessment, which is attached as an Annexure to this specification must be used as a guide in conducting the construction phase risk assessments.

A baseline risk assessment is to be determined by the H&S Agent and provided as an addendum to this H&S Specification. The PC is required to determine their own project specific risk assessment as mandated by the Construction regulations, noting procedural methodologies of choice to achieve the project deliverables. The contractor is a technical specialist and was appointed for that specific knowledge base. The OHS system must be aligned, with the purpose of reducing risk at task level, whilst construction occurs.

Technical work method statements are required by the clients' agents. These are to be developed in order to ensure that particular work is conducted in a manner as safe as reasonably practicable and according to design, engineering specifications or similar technical specifications.

Safe work procedures must be developed by the PC in response to identified significant site-specific risks.

Near miss incidence must be noted, investigated and used to update the PC HIRA and works procedures.

Anticipated high risks summary (Not limited to:):

Work in water environments Dam and other areas.	Work in adverse weather conditions	Community risk: Unrest, strikes,
Work at heights: Varies per construction task: FPP must note them individually	Excavations: Note controls that are not negotiable. Deepest depth anticipated 4M	Public liability: blocking access to private property or damaging existing structures
Temporary works: Form work and scaffold use	Use of tractor and trailer Plant and machinery	If blasting is used: all associated risk
Fires	Ergonomic hazards	Site over large areas: Emergency and facility needs
Snakes, spider bites, dog bites (Rabies)	Electrocution	Flooding
Noise, dust, vibration	Covid 19	Waterborne diseases

6 TRAINING, AWARENESS AND COMPETENCY

6.1.1 Health & Safety Training

The Principal Contractor must ensure that all his / her staff is adequately trained to perform the tasks allocated to them and that there is the requisite amount of supervision at all times to maintain safe work practices and standards, particularly where semi-skilled and unskilled personnel are involved. The contractor shall conduct a training needs analysis to ascertain what health and safety training and re-training is required. No employees shall be allowed on site unless there is proof of induction training and some form of identification.

6.1.2 Induction

The contractor shall conduct a site-specific health & safety induction for all the employees, contractors and visitors to the site.

Copies of the attendance registers signed by the attendees as acknowledgement of attendance are to be kept on site in the health & safety file for verification during inspections and Client Audits.

The onsite induction training must also include precautionary measures to be taken on site to prevent the spread of COVID-19. Such measures shall include inter alia the importance of disclosure of any

COVID-19 related symptoms, good personal hygiene, observing and maintaining safe social distancing, use of suitable PPE such as face masks, etc.

6.1.3 Awareness

The Principal Contractor shall conduct on-site periodic toolbox talks, preferably weekly or before commencing a hazardous work (activity). The talks shall cover the relevant activity and an attendance register and the contents of the topics discussed must be kept on site in the health & safety file.

Safety notices and symbolic signs, including health and safety awareness posters must be displayed at the site entrance and at strategic positions on the site to create health and safety awareness.

COVID-19 awareness signs, notices and posters must also be displayed at strategic positions.

6.1.4 Competency

The Principal Contractor shall send relevant persons to appropriate courses as required by the Act, relevant Regulations, and applicable safety standards. The type of training to be conducted will be determined after conducting a Hazard Identification and Risk Assessment (HIRA). Copies of training certificates must be kept on site in the health & safety file.

The training to be conducted is, but not limited to:

- Health & Safety Representative Course;
- First Aid Training;
- Fall Protection Planner (SAQA US 229994);
- Working at Heights (SAQA US 229998);
- Scaffolding Erectors and Inspectors, designers;
- Incident investigation;
- Hazard Identification & Risk Assessment Course; and
- Covid 19 training course.

6.2 Specified Hazardous Chemical Substances

The PC is to supply the products required as per the bill of quantities-, materials data sheets (MSDSs) for each of the product envisaged to be utilized on site. The South African MSDS to be provided.

Multiple chemical substances will be in use: Index and ensure relevant controls are in place and that the site F.A is aware of requirements.

6.3 Blasting

Should the PC decide to blast it is critical that a competent contractor does the work, and that all the required documents, planning, blast zone controls, rock fly zones, access controls, traffic planning, warning signals and so on is presented 2 weeks prior to blasting dates for assessment and approval. The community must be fully informed, and all employees educated on the associated risks. A HIRA must guide the controls required.

7 OCCUPATIONAL HEALTH & SAFETY MANAGEMENT

7.1 Notification via Permit of Construction Work

The Client or appointed CHSA to submit a permit application to the Department of Labour as per CR 3, ensuring compliance with CR 5 and 6.

DOL acknowledgement letter shall be kept on file, and the Permit number must be displayed clearly at the site entrance/ site camp.

This must take place before any work commences and post SHE Plan and implementing file approval; the contractor is to ensure this specification guides the documentation presented for approval. The required competency standards must be presented and be evidence based. This process must not be delayed by the appointed contractor who is aware of the requirements at tender phase.

It should be noted that **in no way** does this PSHSS relieves the Contractor of any of his responsibilities set out in the Act and Regulations.

7.2 Appointment of Competent Site Personnel

The CEO (OHSA S16.1) of the PC will take overall responsibility for the appointment of competent site staff for the duration of the project. Should the CEO not be personally involved in the project, the H&S responsibilities are to be delegated to the Acting CEO (OHSA 16.2/ 8.1).

Knowledge and training in H&S are required, and certificates indicating H&S training as well as experience to be included in CVs. The designated Construction Manager (CR 8.1) is empowered to appoint personnel on the site as part of his / her duty to ensure health and safety compliance. The 8.1 must sign off on (Not limited to:)

- FPP
- Temporary works designs
- Method Statements
- CHSA Audits

The signature to the above documents indicates that the responsible person, the 8.1, approves and is informed with the content of the information given.

All other legal appointments are to be made with relevance to the type of work to be performed, all appointees are specific to this site and this contract. Each appointed person must understand their role and legal liability in accepting the appointment.

7.3 Construction Manager (CR 8.1) and for in his absence, the CR. 8.1. alternate is accountable. This is a specific legal appointment under Sec 8.

The 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 this single site, including the duty of ensuring occupational health and safety compliance. In the absence of the designated Construction Manager, an alternate must be appointed and the appointed shall have training and/or experience in the area of responsibility.

7.4 Assistant Construction Managers (8.2)

The Principal Contactor must, after considering the size of the project, in writing appoint one or more assistant manager for different sections of the works; these appointments do not relieve the 8.1 of any personal accountabilities for failure in managerial duties.

7.5 Construction Work Supervisor (CR 8.7)

The Construction Manager must in writing appoint construction work supervisor/s responsible for construction activities and ensuring occupational health and safety compliance on the construction site.

7.6 Construction Health and Safety Officer (CR 8.5)

The Principal Contractor must appoint a suitably competent Construction Health & Safety Officer (CHSO) to co-ordinate his or her organization's health & safety efforts on the site.

The CV for the proposed CHSO must be submitted to the Client appointed CHSA for approval. The appointed CHSO must be full time and readily available on site during working hours. The CHSO must conduct monthly internal audits and random site safety and equipment checks, including overall compliance with the site-specific construction health and safety plan and procedures, and compile a monthly CHSO report to be tabled at each site progress meeting.

The minimum qualification for the CHSO must be a matric certificate, SAMTRAC qualification with at least two years and more experience on civil engineering and/or building projects.

The CHSO that the Principal Contractor intends to appoint must be registered as a CHSO with the SACPCMP and shall provide a valid registration certificate with the Council.

7.7 Construction Supervisor Assistants

A contractor must consider the size of the project, appoint in writing one or more competent employees to provide full time supervision for a specified area of the works, thus does not absolve the 8.7 form personal accountability in assuring adequate supervision is given for construction works.

7.8 Health & Safety Representative / H&S Committee Member (OHS Act 17 & 19)

Irrespective of the number of employees employed on the site, the PC and contractors must each appoint a full-time health and safety representative, who at least has completed the necessary health and safety representative course. The election or appointment of health & safety representatives must be in writing.

Regular inspections are to be carried out by health & safety representatives; records must be kept on site in the health & safety file. Deviations must be rectified by the responsible person immediately.

The H&S representative will liaise and report to the health and safety officer.

In cases where there are more than two health & safety representatives elected, a health & safety committee must be established. Health and safety committee meetings must be held at least monthly to discuss relevant health & safety topics.

7.9 First Aider / First Aid Attendant

The Principal Contractor must appoint at least two Level 2 First Aid Attendant for the project and where practicable, one First Aid Attendant for each work team or section of the works. The appointed First Aid Attendants must be suitably qualified and have valid training certificates.

The Principal Contractor together with the responsible First Aid Attendant must ensure that the first aid boxes(s) are fully stocked.

The contractor is to note that work may occur over a widespread area and for this multiple FA may be required: also note the risk and ensure adequate FA box provisioning.

7.10 Risk Assessor

The Principal Contractor is required to appoint a competent risk assessor and must understand the process of identifying hazards and assessing risks emanating from the identified hazards.

This appointed person can be an already designated health & safety officer because the task of assessing risks is an ongoing process and therefore risk review process must be done regularly.

This will also mean that that person will be responsible to put together a risk profile, rate the risks, and ensure that there are appropriate corrective action plans.

Further to that, there must be a direct link to the personal protective equipment / clothing and training to be conducted throughout the contract.

7.11 Other Appointments are stated below but not limited to:

- Drivers / Operators of Construction Vehicles and Plant;
- Electrical Installation & Equipment Inspector;
- Excavations Supervisor;
- Emergency / Security / Fire Co-Ordinator;
- Fire Equipment Inspector;
- Temporary Works Supervisor and Inspector;
- Scaffolding Erector/s and Inspector;
- Fall Protection Planner
- Stacking and Storage Supervisor;
- Hand Tools Inspector;
- Ladder Inspector;
- COVID19 Compliance Officer and Covid Compliance Manager;
- All other relevant Appointments for the Project;
- Blaster; and
- CLO.

The Principal Contractor shall, when appointing Contractors, shall do so in terms of the Construction Regulations 2014, and in terms of the requirements of Section 37(2) of the Occupational Health and Safety Act, 85 of 1993 (As amended).

The appointments shall be in writing and the responsibilities clearly stated together with the period for which the appointment / designation is valid. This information shall be communicated and agreed with the appointees as well as all the mandataries.

The Principal Contractor must provide a project specific health and safety organogram of all appointed / designated personnel and a list of contractors appointed on the project and shall always keep an up-to-date copy of each on site. The site organogram and list of contractors shall also be displayed on the site notice board.

The Principal Contractor is to ensure that each Contractor's H&S documentation is evaluated and approved in accordance with the Occupational Health and Safety Act 85 of 1993 (As amended) and CR 7. A copy of the Contractor's H&S Plan Approval is to be sent through to the appointed H&S Agent.

The Principal Contractor must ensure that an audit is conducted on each Contractor on a monthly basis before the arranged site progress meeting. This audit is to be conducted by the Principal Contractor's appointed CHSO and a report is to be given on each Contractors H&S performance for the past month.

Herewith a site register:

Contractor & Contact details	COIDA date	SHE Plan Approved	Appointment Date/duration.	37.2	Scope	Audit score	Non compliance	Date

8 GENERAL RISK MANAGEMENT

8.1 Health Risks and Medical Surveillance

The appropriate MSDSs are to be obtained for all products and used to develop the H&S documentation as they relate to the works. The PC is to ensure and supervise safe use of products / chemicals, and their inclusion into risk assessments.

All employees on the site, including contractors, must be in possession of valid medical certificates of fitness to work, issued by an Occupational Health Medical Practitioner in the form of Annexure 3. These medical certificates shall be in the categories of pre-employment, annual and exit medical evaluation.

Furthermore, the medical surveillance program shall include initial screening of COVID-19 symptoms based on the professional advice of the OHMP / OHNP. Good personal hygiene must be promoted on the site and the sanitary and hand washing facilities with soap and running water must be provided.

Additional monitoring in house must be done for work at heights.

Where air monitoring in the dam tower indicates risk: the employees must be monitored.

New legislation may impact on monitoring needs.

General hygiene and wellness, inclusive of mental health impacts should from part of the project training programs.

8.2 Emergency Procedures

An emergency plan and procedure that is appropriate to the risks is required prior to commencement on site. It is advised that the system should be simple and easy for any worker to follow. The plan / procedure must include COVID-19 related emergencies such as responding to COVID-19 case/s on the site. Assembly point / area to be large enough to allow for social distancing during roll call.

The emergency plan is to ensure the inclusion of local service providers where possible, including nearest COVID-19 testing station. Such arrangements should be made with the service providers prior to the commencement of the project. An isolation area for COVID-19 suspected persons must be made available on site, preferably an enclosed area or room.

Local emergency telephone numbers must be displayed and made part of the emergency procedure. COVID-19 Emergency Contact numbers must also be included on the list

The general principals of emergency management are to be applied as it applies to the hierarchy of control and management. The distances between works site, the works environments must be noted in the emergency risk analysis and response planning:

Potential emergencies (Not limited to:)

- Employee incidence inclusive of Covid 19 transmission, injuries, falls
- Community unrest
- Fire
- Snake, spider and dog bites (Rabies is currently a huge concern)
- Flood
- Drowning
- Collapse of structures
- Water borne disease spread or illness due to weather exposures: heat

8.3 Security and Access Control

The Principal Contractor shall establish site access rules, implement, and maintain these throughout the construction period.

Access control procedure shall ensure that non-employees do not proceed on to work areas unaccompanied by a senior site responsible person. All workers and visitors to site must be screened for COVID-19 symptoms before they can be allowed on site. Should a person exhibit any of the COVID-

19 symptoms, that person shall not be allowed to site and must either be transported home or to the nearest testing centre.

8.4 Fires and Emergency Management

Attention to emergency planning and procedures is very important. Requirement in terms of identified risks:

- Fire;
- Public Safety;
- Working near water;
- Falls from heights;
- Electricity;
- Riots; and
- Vehicle accidents.

The emergency plan is to ensure the inclusion of local service providers where possible. Such arrangements should be made with these persons prior to the commencement of the project; the emergency plan is to include the risks of fire on site and related to any specific activities.

Fire extinguishers will be appropriate for the risk and in sufficient numbers to deal with the type of fires that could occur.

8.5 Incident Management and Compensation Claims

All incidents and accidents are to be investigated using a form similar to Annexure 1 hereto attached. All serious incidents requiring medical attention or involving any form of disabling or lost time injury or fatality are to be reported to the Client /CHS Agent immediately. This shall be confirmed in writing following the incident.

8.6 Personal Protective Equipment (PPE) and Clothing

The PC is to provide PPE to all employees free of charge, based on the risk assessments and the type of work to be performed.

The wearing of the identified SANS approved PPE at all times is non-negotiable.

- Hard hats;
- Protective footwear;
- Overalls that ensure worker visibility, and shows for whom employee works;
- Eye protection (if required);
- Hearing protection: Muffs and earplugs, noting that ear plugs only reduce news by 5dB;
- Reflective jackets (No bibs);
- Respiratory Protection (minimum of FFP2) for activities where a more effective mask other than a cloth mask is required;
- Safety Harnesses with Big Hooks; and
- Any other necessary PPE identified from MSDS's and/or risk assessments.

All employees and visitors to the site must always wear face masks over their mouth and nose to prevent the spread of COVID-19 both at the workplaces and within the surrounding communities. Also note requirements set out in the Covid specification.

8.7 Occupational Health and Safety Signage

As mentioned earlier on this document, on-site H&S awareness signage is required. Signage shall be posted up at fixed or temporary working areas, or other potential risk areas/operations. These signs shall be in accordance with the requirements of the General Safety Regulations or SANS requirements as amended. Signage is to be noted on the site layout drawing indicating where fixed/temporary signage is required.

The signage to be displayed shall be in respect of the following:

- No Un-authorized entry – Report to Site Office;
- Permit number on Project boards;
- COVID-19 Awareness Signage / Rules / Notices (i.e., Symptoms; Wearing of Masks; Personal Hygiene; Social Distancing; Isolation Area / Room, etc.);
- 'Hard hat area' or other PPE requirements;
- First aid box positions (including vehicles);

- Fire extinguishers;
- Assembly Area;
- Scaffold Signage;
- Deep Excavations;
- Blasting control signage; and
- Traffic safety signs as applicable to the works risks.

Signs shall be posted at areas of work on site indicating that a construction site is being entered and that persons should take note of H&S requirements. Signage must be clean and in good repair.

8.8 Induction of Employees and Visitors, General H&S Training

A simple, formal induction program is to be prepared which is site specific. Inductions must be carried out for all workers and visitors (including Client) to the site.

DSTI training is required to ensure workers are familiar with the risks and H&S measures of the work or tasks to be done.

9 COMMUNICATION ON SITE

All OH&S communication during the project between the CHS Agent and the PC will be done in writing, including the issues and responses to non-conformances and H&S audit results.

10 CARE OF WORKERS ON SITE (WELFARE)

The provision of toilets at reasonable distances within the work areas is required in terms of the National Building Regulations and Construction Regulation 30. Clean drinking water is to be available to all employees at all times. Hand washing stations and / or 70% alcohol-based hand sanitizer must be provided. Hand washing soap must also be provided. Also note set out under Scope.

At any one time, no employee's belongings are to be found on the active construction area, the Principal Contractor is to ensure that adequate storage facilities are available for employee's belongings.

At least one toilet for each sex and for every 30 workers and must be maintained in a hygienic manner and disinfected regularly to reduce the spread of COVID-19.

Sheltered eating area to be provided for the workers on site. All facilities to be COVID-19 compliant. An isolation room / area for suspected COVID-19 cases must also be provided on site.

11 DISCIPLINE, ALCOHOL AND SUBSTANCE ABUSE

All employees (management included) are to follow instructions given in the interest of H&S. Disciplinary action is to be imposed on those who do not follow such instructions or company rules or policies.

No person shall be allowed to work or access the site if under the influence of alcohol or other substances that could impact on their own or others safety. Random alcohol testing shall be conducted on site. Care should be taken not encourage the spread of COVID-19. Single-use disposable alcohol test units to utilized and appropriately disposed of. Fires must be prevented at all cost.

12 WORKING AT HEIGHTS

A practical site-specific fall protection plan as per the requirements of CR 10 needs to be compiled by a competent person as per unit standard 229994. The Fall Protection Plan must be submitted to the client appointed CHSA for evaluation and approval.

It is envisaged that scaffolding as well as ladders may be utilized to gain access to heights during construction work.

Scaffold erector/s and the scaffold inspector with relevant competencies must be appointed in writing for the purpose of erecting and inspecting scaffolding on the site. A scaffold supervisor must also be appointed to supervise all scaffolding operations on site.

All employees who will be required to work at heights must be declared medically fit to work at heights by an occupational health medical practitioner and the medical certificates must be made available prior to work at heights. All employees working at height shall be in possession of working at heights certificates in line with US 229998.

When working at heights, the effects of wind forces must be considered, and the work must be stopped where significant wind forces are experienced.

13 EXCAVATIONS

The Principal Contractor is to provide a method statement for excavations, and this will be approved by the H&S Agent and the Engineer/Architect.

The Principal Contractor must ensure that all excavations are safe to enter prior to any work commencing.

Area being worked at needs to be properly barricaded or fenced off. Barricading must be done in such a manner that prevents people and animals from falling into open excavations.

All deep excavations deeper than 1m must be sloped or shored to make the work environment for employees safe to work in.

All excavations deeper than 2m must be shored, and shoring must be signed off by the Construction Manager before any work can take place in such excavations.

All excavations on site where employees are performing work, must have a ladder for safe access and egress. The ladder must be long enough to protrude 900mm above the edge of an excavation and must be positioned at every 6m within the excavation length.

Excavations should preferably not be opened beyond what can be worked in daily. The Contract data state clearly: Maximum length of a trench is 400M and closer to communities 150M. This makes the risks manageable. No trenching is allowed within 2 of existing infra structure telemetry, electrical poles or stays: unless instructed and noted on a drawing.

Danger tape or candy tape is not permitted to be used on site as a means of barricading!

Suitable material such as hard-plastic mesh (long durability) adequately supported and being able to withstand a normal person's weight and the elements (wind, rain) must be utilized as barricading.

All open excavations shall be kept clean (dewatered) of stagnating water.

14 TEMPORARY WORKS

The Principal Contractor must appoint a competent person as a Temporary Works Designer to design, inspect and approve the erected temporary works on site before use. The appropriate competent persons are to be appointed to manage and monitor such works to the satisfaction of the Engineer and CHS Agent. Records of temporary works inspections and approvals are to be properly completed by the relevant competent persons and kept in the H&S file.

All temporary works must comply with the requirements of Regulations 6 and 12 of the Construction Regulations 2014. Workers who shall be required to erect, move, or dismantle temporary works structures must be provided with adequate training and instruction to perform those operations safely. If temporary works are to be erected by a Contractor, this must be notified to the Architect / Engineer / CHS Agent. All necessary calculations and drawings of temporary works must be kept on site and available to the PA and CHSA.

15 CRANES AND LIFTING OPERATIONS

Should any form of lifting device or crane (fixed or mobile) be used during the project for deliveries, moving of supplies or equipment, the appropriate documentation must be made available. Valid load test certificates for cranes and lifting tackle must be made available before use on site.

Method statements, risk assessments, safe work procedures and training records are to be available prior to work commencing. A procedure for managing loads and lifting operations on the site must be made available as an addendum to the Construction H&S Plan.

16 ELECTRICAL AND MECHANICAL INSTALLATIONS

All electrical and mechanical installations must comply with the requirements of the Health and Safety Act, the Construction Regulation 2014, other relevant regulations and applicable safety standards and industry best practice. This type of work may be done by specialist contractors, in which case, the requirements of Regulation 7 of the Construction Regulations 2014 must be complied with in respect of appointing such contractors. Relevant safe work procedures and technical method statements must be submitted for approval by the PC. Proof of pneumatic and silencing of noise on tools must be provided.

The work must be conducted by appropriately registered contractors and on completion of such installations, certificates of compliance issued by competent persons will be required.

17 DELIVERY OF MATERIALS TO SITE

The PC must reasonably manage all deliveries of material to site. Stacking and storage of materials to be properly coordinated by a person designated for that purpose.

PC to ensure all construction materials and articles are safely stacked in areas designated for that purpose and demarcated accordingly as material laydown areas.

18 NUCLEAR DENSITY GAGE

The correct appointments, proof of department of Health appointees, storage, method statements and controls must be available for Audit.

19 CONTRACTOR MANAGEMENT

The Principal Contractor shall remain responsible for all the contractors appointed by him or her, including nominated and selected contractors and shall ensure that they also comply with requirements of this specification and legislated requirements.

All contractors shall be appointed in terms of the requirements of Regulation 7 of the Construction Regulations 2014 and shall enter into a written agreement with the Principal Contractor as stipulated in Section 37(2) of the Occupational Health and Safety Act, 85 of 1993.

Contractors must be appointed in writing by the Principal Contractor and they must submit health and safety plans which shall be evaluated and approved in writing by the Principal Contractor.

Each Contractor must be registered and in good standing with a licensed Compensation Insurer or Compensation Commissioner and a valid letter of good standing must be submitted to the PC.

The PC must audit all the contractors at least monthly and follow up on non-compliances and ensure such are attended to within reasonable time periods as agreed between the Principal Contractor and each Contractor. Audit reports to be made available for verification.

20 NON-CONFORMANCES

The Principal Contractor may be penalized for critical and / or repeat non-conformances with the requirements of this specification, the Principal Contractor's health and safety plan and current health and safety legislation. Penalties shall be in the form of monetary value or work stoppage or both. Penalties of monetary value shall be at the discretion of the CHSA, after consultation with the Client / Consulting Engineer or Architect, ranging between R100.00 to R5000.00 per count, depending on the nature and seriousness of the offence in question.

Refer to **Annexure E** for further details pertaining to the penalties applicable.

Should, at any time, the works, or part of the works, be stopped due to unsafe acts or non-compliance with this specification, the PC's H&S Plan or any legislative requirements; the PC shall have no claim for extension of time or any other compensation.

21 PROJECT CLOSE OUT REQUIREMENTS

The documentation submitted and approved following the awarding of the contract will be used to form the H&S file. On completion of the project, a consolidated health and safety file consisting of the following documents but not limited to, shall be submitted to the client appointed CHSA:

- The H&S Plan and the approval by Client;
- PC Appointment Letter;
- Mandatory Agreement with Client;
- Notification of Construction work and Confirmation letter from DOL.
- Record of Competencies (CVs) and appointments;
- Training Records;
- Method statements;
- Risk assessments;
- Safe work procedures;
- Emergency and Injury Management (Accident Stats and Investigations);

- Medical surveillance records;
- Registers and Checklist;
- Internal H&S Audit Reports;
- Contractor H&S Audit Reports;
- Non-Conformance Reports; and
- Any other documents which may be required by the appointed CHSA.

The file must be submitted in an electronic copy stored on a flash drive and must be arranged chronologically in folders and subfolders where necessary.

22 ANNEXURE A: INCIDENT RECORDING

ANNEXURE 1

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993
(ACT NO 85 OF 1993)

REGULATION 9 OF THE GENERAL ADMINISTRATIVE REGULATIONS

RECORDING AND INVESTIGATION OF INCIDENTS

A. RECORDING OF INCIDENT

1. Name of employer ……..……...

2. Name of affected person..……..……..

3. Identity number of affected person…..…….

4. Date of incident .....

5. Time of incident.……..…….....…….

6. Part of body affected

Head or Neck	Eye	Trunk	Finger	Hand
Arm	Foot	Leg	Internal	Multiple

7. Effect on person

Sprains or strains	Contusion or wounds	Fractures	Burns	Amputation
Electric shock	Asphyxiation	Unconsciousness	Poisoning	Occupational Disease

8. Expected period of disablement

0-13 days	2-4 weeks	>4-16 weeks	>16-52 weeks	>52 weeks or permanent disablement	Killed

9. Description of occupational disease…….

10. Machine/process involved/type of work performed/exposure**...……..……

11. Was the incident reported to the Compensation Commissioner and Provincial Director?

Yes	No

12. Was the incident reported to the police? *

Yes	No

13. SAPS office and reference ……..……

*to be completed in case of a fatal incident.** in case of a hazardous chemical substance, indicate substance exposed to

---

B. INVESTIGATION OF THE ABOVE INCIDENT BY A PERSON DESIGNATED THERETO

1. Name of investigator .....

2. Date of investigation .....

3. Designation of Investigator ……..

4. Short description of incident
……
……
……
……

5. Suspected cause of incident
……
.....
.....
……

6. Recommended steps to prevent a recurrence
……
……
…….....
……
……

…… ……
Signature of Investigator Date

C. ACTION TAKEN BY EMPLOYER TO PREVENT THE RECURRENCE OF A SIMILAR INCIDENT

.....
……
.....
……..

…….. ……
Signature of employer Date

D. REMARKS BY HEALTH AND SAFETY COMMITTEE

Remarks
.....
.....
.....
……

…….. ……
Signature of Chairperson of Health and Safety Committee Date

23 ANNEXURE B: MANDATORY DOCUMENTS

OCCUPATIONAL HEALTH AND SAFETY ACT (85 OF 1993)
CONSTRUCTION REGULATIONS 2014

AGREEMENT WITH MANDATARY

In terms of Section 37(1) and (2)

WRITTEN AGREEMENT ENTERED INTO AND BETWEEN

_____

AND

_____

Agreement with Mandatary to be completed in black ink and each page and any change made to be initialled

OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993 AND CONSTRUCTION REGULATIONS 2014

REQUIREMENTS:

1. Your attention is drawn to "General Duties of Employers to their Employees" as required by Section 8 of the Act.
2. You are required to:
2.1. Sign a written "Agreement with Mandatary" as required by Sect 37(1)(2) of the Act before commencing any work on site.
2.2. Ensure that all your employees receive the necessary Induction Training and have proof thereof.
Note: You must ensure that all employees under your control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences.
2.3. Ensure the provision of Welfare Facilities for your employees as per Construction Regulation 28.
2.4. Provide the Client/Principal Contractor with your SHE Plan and Specifications
2.5. Ensure that Method Statements, Risk Assessments and Safe Work Procedures are done and available.
2.6. Provide the Client/Principal Contractor with written appointment of the person who is going to supervise the Construction Work per Construction Reg. 8
2.7. Provide the Client/Principal Contractor with written designation of your nominated Health and Safety Representative as per Section 17(1).
Note: Your Health and Safety Representative will be expected to attend the Client/Principal Contractor safety meetings.
2.8. If you employ more than five (5) persons, you are required to provide your own First Aid Box (GSR 3(2)).
2.9. If you employ more than ten (10) persons, you are required to provide your own qualified First Aider as per GSR 3(4)
Note: If you have difficulty in complying with items 2.7 and 2.8 above, you may arrange/come to an agreement with the Client/Principal Contractor to make use of his First Aid facilities in case of injury. You will be expected to communicate such an agreement to your employees.
2.10. When working with Hazardous Chemical Substances, comply with HCS Reg. 3
Note: Asbestos and Lead Regulations are separate.
2.11. When using a Materials Hoist, comply with the requirements of Construction Reg. 19.
2.12. When using Lifting Machines and Lifting Tackle, comply with DMR 19
Note: You may be required to appoint a Banksman to control Lifting/Slinging operations
2.13. When erecting/using Scaffolding comply with the requirements of SANS/0085 "Access Scaffolding"
2.14. When doing Demolition Work, comply with Construction Reg. 14
2.15. When doing blasting to comply with Explosives Regulations Chapter 10
2.16. When doing Excavation Work, comply with Construction Reg. 13
2.17. When doing Electrical Installations, comply with the requirements of Construction Reg. 24
Note: Electrician to provide copy of registration as per Elect. Install. Reg. 9(3)
2.18. When using Construction Vehicles, comply with Construction Reg. 23
2.19. When using/erecting Support/Form Work, comply with Construction Reg. 12
2.20. When working over or in close proximity to Water, comply with Construction Reg. 26
2.21. Ensure that good Housekeeping, Stacking and Storage principles are applied on this project as per Construction Reg. 27 and 28
2.22. Ensure that appropriate measures are taken to avoid the risk of Fire/Explosion and comply with requirements of Construction Reg. 29
2.23. If you are going to work at heights a Fall Protection Plan must be submitted (roof work included) as per requirements of Construction Reg. 8
2.24. When using Explosive Powered Tools, comply with GSR 19
2.25. When Welding, Flame Cutting/Soldering, comply with GSR 9
2.26. When working in Confined Spaces, comply with GSR 5
3. You are responsible for providing your own legal safety documents and registers to comply with the Act's requirements a copy of the OHS Act of 1993 and the Construction Regulations ;2003 will be available for perusal in the Principal Contractor's site office.
4. You are required to comply with General Safety Regulations 2(1) to (7) and provide your employees with: personal protective equipment which will allow them to carry out their work in a safe manner, e.g. hard hats, safety harnesses, gloves, safe footwear, eye protection, ear protection, waterproof clothing etc.
5. Reporting of Incidents of Occupational Diseases shall be done as per General Admin. Regulation 8 (Also see Sect 24 of the Act)
6. Compensation for Occupational Injuries and Diseases Act (No 130 of 1993) You are required to provide the Client/Principal Contractor with proof of registration with the Compensation Commissioner/Federated Employer(s) Mutual when signing this agreement. If you are not registered, the Client/Principal Contractor may deduct the necessary amounts from your progress payments and pay it over to the Commissioner to ensure that you are insured. See Section 80 and 89 of the COID Act.

_____	_____
Client Signature	**Principal Contractor Signature**
_____	_____
Date	**Date**

AGREEMENT WITH MANDATARY
IN TERMS OF SECTION 37(1) AND (2)

DEFINITION OF MANDATARY

- includes an agent, a contractor or sub-contractor for work, but without derogating from his status in his own right as an employer or user

SECTION 37(1)
Whenever an employee does or omits to do any act which it would be an offence in terms of this Act for the employer of such employee or a user to do or omit to do, then, unless it is provided that –

(a) in doing or omitting to do that act the employee was acting without the connivance of permission of the employer or any such user;
(b) it was not under any condition or in any circumstance within the scope of the authority of the employee to do or omit to do an act, whether lawful or unlawful, of the character of the act or omission charged; and
(c) all reasonable steps were taken by the employer or any such user to prevent any act or omission of the kind in question, the employer or any such user himself shall be presumed to have done or omitted to do that act, and shall be liable to be convicted and sentenced in respect thereof; and the fact that he issued instructions forbidding any act or omission of the kind in question shall not, in itself, be accepted as sufficient proof that he took all reasonable steps to prevent the act or omission.

SECTION 37(2)
The provisions of subsection (1) shall mutates mutandis apply in the case of a mandatary of any employer or user, except if the parties have agreed in writing to the arrangements and procedures between them to ensure compliance by the mandatary with the provisions of this Act.

ACCEPTANCE BY MANDATARY

In terms of the provisions of Section 37(2) of the Occupational Health and Safety Act 1993

I, _____acting for and on behalf of

**(Company/Close Corporation/Enterprise/
Owner/User)** undertake to ensure that the requirements and provisions of the Act and Regulations are complied with.

Signature: _____ Print Name:

Contractor:

Designation: _____ Date: _____

Mandatary-Workmen's Compensation/Federated Employers Mutual No: _____

Signature: _____

Client:

Designation: _____ Date: _____

OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993
CONSTRUCTION REGULATIONS 2014

PRINCIPAL CONTRACTOR APPOINTMENT

CONSTRUCTION REGULATION 5

5(1): A Client shall be responsible for the following:

k) to appoint every principal contractor in writing for the project or part thereof on the construction site

APPOINTMENT

Principal Contractor,_____(name)

of: _____(Company/Close Corporation/Enterprise/Owner/and Labour Only Contractor) is hereby appointed to perform construction work

at: **Bathurst Wastewater Treatment Works for Ndlambe Local Municipality**

Job/Safety specifications:

You are reminded that:

1. your documented Health and Safety plan based on the Clients Health and Safety Specifications, is provided to the Client before commencing work on site
2. the Client will discuss/negotiate with you regarding the contents of the Health and Safety Plan to approve it for implementation
3. a Health and Safety File, which shall include all documentation required in terms of the provisions of the Act and Regulations are kept available on site for inspection (Risk Assessments and Fall Protection Plan)
4. should you appoint a Contractor to perform or assist you with Construction Work, the responsibilities as required by the Construction Regulations shall apply to you as if you were the Client
5. you are to promptly provide the Client with any information which might affect the Health and Safety of any person at work carrying out Construction Work or 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
6. as per Regulation 5(1)(o) audits of your Health and Safety Plan will be undertaken on at least a monthly basis.
7. all your Employees must undergo Safety Induction before starting work

Signature: _____ Date: _____
(Client)

Designation: _____

ACCEPTANCE OF APPOINTMENT

I, _____ accept and understand the requirements of this appointment

Signature: _____ Date: _____
(Principal Contractor)

Designation: _____

24 ANNEXURE C: MEDICAL CERTIFICATE

OCCUPATIONAL HEALTH & SAFETY ACT 85 OF 1993
Construction Regulations 2014

MEDICAL CERTIFICATE OF FITNESS

Name of Employee: _____ ID Number _____ Co. Number _____

	* Possible Exposures e.g., Noise, heat, fall risk, confined space, etc.	* Job Specific Requirements Operating mobile crane, digging trenches, erecting formwork and support work, etc.	*Protective Equipment e.g. Dust respirator (light duty), welding gloves, etc.
*Occupation e.g. General worker, welder, bricklayer, Steel fixer, mobile crane operator, etc.			

***The Employer to complete the information in the spaces marked with an * before sending the Employee for a medical examination**

Declaration by the Medical Examiner:

I certify that I have, by examination and testing, using the above criteria specified by the employer, satisfied myself that the abovementioned employee is fit to perform the duties as described by the employer in the matrix above.

Occupational Medicine Practitioner / Occupational Health Nursing Practitioner: (Please print name)
_____

Signature _____ Practice Number: _____ Date: _____

Address:
_____

25 ANNEXURE D: NON-CONFORMANCES AND PENALTIES

Should, at any time, the works, or part of the works, be stopped due to unsafe acts or noncompliance with the Clients specifications or PCs H&S Plan; neither the Principal Subcontractor nor any other Subcontractor shall have a claim for extension of time or any other compensation.

The following constitute the types of non-conformances that will attract penalties:

Minor: **Fine: R100/count**	**Medium:** **Fine: R500/count and a non-conformance**	**Severe** **Fine: R5000/count, a non-conformance and/or activity stoppage**
Non-use of PPE supplied	Toilets not supplied or regularly serviced; lack of drinking water	Subcontractors working without Health and Safety Plan approval
Non completion of registers for plant and equipment on site	Subcontractors not audited	Workers transported in contravention of the OHS plan or legal requirements
Lack of H&S signage at work areas	Working without training or the appropriate H&S method statements	Invalid Letters of Good Standing
Tools and equipment identified in poor condition during inspections	Legal non-conformances identified during the previous audit and not addressed within the agreed time frame	Noncompliance with traffic accommodation requirements: layout or physical conditions
	No monthly OHS report at site meeting to report on	Fall protection harness not tied off/ not worn
	No certificates of fitness for workers as required	Any breach of legal requirements
	Working without approved method statements	Item not attended to as identified in the audit report – second transgression
	Item not attended to as identified in audit report – first transgression	

Failure or refusal on the part of the subcontractor to take the necessary steps to ensure the safety of workers and other person involved in accordance with these specifications, the OHS Act and the regulations shall be sufficient cause to apply the above penalties.

26 ANNEXURE E: BASELINE RISK ASSESSMENT

26.1 MATRIX

26.2 BASELINE RISK ASSESSMENT

Risk Assessment Matrix

Risk Prioritisation Number / Risk Rating = Severity x Likelihood

Severity Table

Pt	Severity level	Workplace Safety	Workplace Health	Loss / Damage	Downtime Incurred
5	Critical	Fatality, single or multiple	Acute Poisoning, Failure of Major Bodily Functions	More Than R10 million damages	More than 1 year for full re-instatement
		Permanent Body Injury or Loss of Use for more than 30 days	Infection with No Known Cure		
4	Very Serious	Injury requiring 30 days of hospitalisation and/or medical leave	Moderate exposure, Reversible injury to Bodily Functions on prolong recovery	More Than R1 million damages	More than 3 months for full re-instatement
		Temporary Body Injury or Loss of Use for more than 10 days but not exceeding 30 days	Infection with Known Cure but extensive treatment		
3	Serious	Injury requiring 10 days of hospitalisation and/or medical leave	Mild exposure, Reversible injury to Bodily Functions with less than 30 days recovery	More Than R100k damages	More than 1 month for full re-instatement
		Temporary Body Injury or Loss of Use for up to 10 days	Infection with Known Cure but extensive treatment		
2	Marginal	Injury requiring maximum of 3 days of medical leave only	Very Mild exposure, Reversible injury to Bodily Functions with less than 3 days recovery	More Than R10k damages	More than 5 days for full re-instatement
		Temporary Body Injury or Loss of Use for 3 days or less	Infection with Known Cure but treatment needed		
1	Negligible	First aid treatment only	Very Mild exposure, Reversible injury to Bodily Functions with less than 3 days recovery	Less than R5k damages	No significant downtime
		No or superficial injury	No Exposure		

Likelihood Table

Pt	Likelihood level	Likelihood of Occurrence / Exposure Criteria
5	Frequent	Likely to occur many times per year
4	Moderate	Likely to occur once per year
3	Occasional	Might occur once in three years
2	Remote	Might occur once in five years
1	Unlikely	Might occur once in ten years

Risk level Determination - 5 x 5 Matrix

		SEVERITY				
		Critical (5)	Very Serious (4)	Serious (3)	Marginal (2)	Negligible (1)
LIKELIHOOD	Frequent (5)	25 Operation not permissible	20 Operation not permissible	15 High priority	10 Review at appropriate time	5 Risk acceptable
	Moderate (4)	20 Operation not permissible	16 Operation not permissible	12 High priority	8 Review at appropriate time	4 Risk acceptable
	Occasional (3)	15 High priority	12 High priority	9 Review at appropriate time	6 Risk acceptable	3 Risk acceptable
	Remote (2)	10 Review at appropriate time	8 Review at appropriate time	6 Risk acceptable	4 Risk acceptable	2 Risk acceptable
	Unlikely (1)	5 Risk acceptable	4 Risk acceptable	3 Risk acceptable	2 Risk acceptable	1 Risk acceptable

Review the risk assessment records every year or whenever there are changes in processes, work activities or upon any incident occurrence, whichever is earlier.

Action Table

Colour	Score	Risks	Action
	16 - 25	High	Manage risk: Stop operation & review controls. If necessary abort experimentation.
	12 - 15	Warning	High priority remedial action: Proceed with extreme caution with supervision at all times. Implement additional (secondary) controls immediately. Review within 7 days. Emergency control measures shall be in place.
	8 -10	Medium	Take remedial action at appropriate time: Proceed with care. Additional control is advised. Review shall be implemented within 30 days.
	1 - 6	Warning	Risk acceptable: Residual risk If possible, risk reduction should be further considered, particularly severity. There are no imminent dangers. Frequent review shall be in place especially changes in procedures, materials or environment.

BASELINE HAZARD IDENTIFICATION AND RISK ASSESSMENT

Hazard & Risk Identification			Raw Risk Evaluation			Risk Control Measures
Work activity	**Hazard**	**Consequential Risk / Possible Accident / Ill health to persons, fire or property loss**	**Severity**	**Likelihood**	**RPN***	**Risk Control Measures**
1. General Site Access & Construction Environment						
Accessing construction site	Uncontrolled access, unauthorised entry	Injury to public, theft, vandalism	3	3	**9**	Secure perimeter fencing; controlled access; induction for all personnel; warning signage
Movement of vehicles and plant	Vehicle–pedestrian interaction	Serious injury or fatality	4	3	**12**	Traffic management plan; speed limits; trained operators; spotters
Site establishment	Poor housekeeping	Slips, trips, falls	3	3	**9**	Defined laydown areas; daily housekeeping; supervision
Site services (temporary power & water)	Electrical hazards	Shock, fire	4	3	**12**	Certified electrical installations; lock-out procedures; inspections
2. Earthworks & Excavations						
Bulk excavation	Collapse of excavation	Serious injury or fatality	5	3	**15**	Excavation permits; shoring/battering; daily inspections by competent person
Excavation near existing services	Damage to services (incl. asbestos pipe)	Health exposure, service interruption	4	3	**12**	Service detection; exclusion zones; asbestos awareness; no disturbance without approval
Working in trenches	Confined space conditions	Asphyxiation, injury	5	4	**20**	Confined space permit; gas testing; ventilation; standby person
Earthmoving plant operation	Plant–people interaction	Crush injuries	5	4	**20**	Segregated work zones; trained operators; spotters
3. Pond Construction & Refurbishment (Anaerobic, Aerobic, Settling, Drying Beds)						
Working near open ponds	Falls into excavations/water	Drowning, serious injury	5	3	**15**	Edge protection; barricading; controlled access; life-saving equipment
HDPE liner installation	Slips, trips	Injury	3	3	**9**	Good housekeeping; non-slip footwear; supervision
Sludge removal	Biological exposure	Illness, infection	4	3	**12**	PPE (gloves, masks); hygiene facilities; controlled disposal
Refurbishment of existing ponds	Structural instability	Collapse, injury	4	2	**8**	Engineering inspections; safe work procedures
4. Mechanical Works						
Installation of mechanical equipment	Lifting operations	Crush injuries	5	3	**15**	Approved lifting plans; certified lifting equipment; competent riggers
Working on rotating machinery	Entanglement	Serious injury	4	3	**12**	Lock-out procedures; guarding; training
Commissioning of equipment	Unexpected start-up	Injury	4	3	**12**	Permit-to-work; isolation procedures
5. Electrical Works & Eskom Connection						
Electrical installation works	Contact with live electricity	Electrocution, fatality	5	3	**15**	Qualified electricians; lock-out/tag-out; electrical permits
Eskom MV overhead line connection	High-voltage exposure	Fatality	5	4	**20**	Eskom-approved procedures; exclusion zones; specialist contractors

Hazard & Risk Identification			Raw Risk Evaluation			Risk Control Measures
Work activity	Hazard	Consequential Risk / Possible Accident / Ill health to persons, fire or property loss	Severity	Likelihood	RPN*	Risk Control Measures
6. Pipeline Construction						
Trenching for pipelines	Trench collapse	Serious injury	5	3	**15**	Shoring; safe access; inspections
Pipe laying	Manual handling	Musculoskeletal injuries	3	3	**9**	Mechanical lifting aids; team lifting
Pressure testing	Pipe failure	Injury, flooding	4	2	**8**	Controlled testing procedures; exclusion zones
7. Roads, Fencing & General Construction Activities						
Road construction	Traffic hazards	Vehicle collisions	4	3	**12**	Traffic accommodation plan; signage; flagmen
Fencing installation	Use of hand and power tools	Cuts, eye injuries	3	2	**6**	PPE; tool inspections; training
General construction activities	Poor housekeeping	Slips, trips, falls	3	3	**9**	Daily housekeeping; supervision
8. Concrete Works (Foundations, Slabs, Canals, Structures)						
Formwork erection	Collapse of formwork	Serious injury, fatality	5	4	**20**	Formwork designed and inspected by competent person; adequate bracing and propping
Reinforcement fixing	Sharp edges, protruding bars	Lacerations, impalement	4	3	**12**	Bar capping; gloves; good housekeeping
Working at height on formwork	Falls	Serious injury	5	4	**20**	Edge protection; fall arrest systems; supervision
Concrete pouring	Hose whip, splashing	Impact injuries, cement burns	4	3	**12**	Secure hoses; exclusion zones; PPE
Wet concrete handling	Cement burns	Skin and eye burns	4	3	**12**	Waterproof PPE; washing facilities
Concrete vibration	Hand–arm vibration	Long-term injury	3	2	**6**	Time limits; maintained equipment
Striking of formwork	Premature removal	Structural collapse	5	2	**10**	Engineer approval; curing compliance
Concrete cutting & drilling	Silica dust	Respiratory illness	4	3	**12**	Wet cutting; dust suppression; respirators
9. Building Works (Pump Stations, Chlorination, Guard House, Offices, Laboratory)						
Masonry & blockwork	Manual handling, falling objects	Strains, crush injuries	3	3	**9**	Team lifting; scaffolding; exclusion zones
Bricklaying at height	Falls	Serious injury	5	3	**15**	Compliant scaffolding; edge protection; inspections
Roofing works	Falls from height	Fatality	5	3	**15**	Fall arrest systems; roof edge protection; permit to work
Installation of doors & windows	Dropped objects, glass breakage	Cuts, serious injury	4	3	**12**	Gloves; controlled handling; exclusion zones
Internal finishing works	Slips, trips	Minor to serious injury	3	3	**9**	Housekeeping; material storage control
Carpentry works	Power tool use	Cuts, amputations	4	2	**8**	Trained operators; guards; PPE
Painting & coatings	VOC exposure	Headaches, irritation	3	2	**6**	Low-VOC products; ventilation; respirators
Plumbing installation	Pressurised systems	Water release, injury	3	2	**6**	Pressure testing procedures; isolation
Installation of laboratory fittings	Chemical exposure	Health effects	3	2	**6**	MSDS compliance; PPE; training
Building services installation	Electrical hazards	Shock, fire	5	3	**15**	Qualified electricians; lock-out/tag-out

C3.7: Environmental Specifications

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C3.7: ENVIRONMENTAL SPECIFICATIONS

Contents

CEMP 1 INTRODUCTION 3

CEMP 2 ORGANISATIONAL REQUIREMENTS 3

CEMP 2.1 Organisational Structure 3
CEMP 2.2 Roles and responsibilities 3

CEMP 3 GENERAL SITE PROCEDURES 4

CEMP 3.1 Demarcation of Environmentally Sensitive Areas (ESA's) 4
CEMP 3.2 Location of camp and depot 4
CEMP 3.3 Demarcation of the site 4
CEMP 3.4 Toilets 4
CEMP 3.5 Refuse 4
CEMP 3.6 Protection of flora and fauna 5
CEMP 3.7 Defacement of natural features 5
CEMP 3.8 Protection of archaeological and palaeontological sites 5
CEMP 3.9 Effluent and storm water management 5
CEMP 3.10 Contamination prevention 5
CEMP 3.11 Dust control 6
CEMP 3.12 Noise control 7
CEMP 3.13 Materials use, handling, storage and transport 7
CEMP 3.14 Emergency procedures 8
CEMP 3.15 Social issues 8

CEMP 4 SITE CLEARANCE 8

CEMP 4.1 Removal of endemic or endangered species 8
CEMP 4.2 Removal of topsoil 8
CEMP 4.3 Stabilisation of steep slopes 9
CEMP 4.4 Excavations 9
CEMP 4.4.1 Excavation of trenches 9
CEMP 4.5 Removal of alien vegetation 9

CEMP 5 SITE REHABILITATION 9

CEMP 5.1 Scope 9
CEMP 5.2 Preparation for rehabilitation 9
CEMP 5.3 Seeding 10

CEMP 6 MANAGEMENT AND MONITORING 10

CEMP 6.1 General inspection monitoring and reporting 10
CEMP 6.2 Environmental Awareness Training 10
CEMP 6.3 Documentation 10
CEMP 6.4 Penalties 11
CEMP 6.5 Dispute Resolution 12

CEMP 7 MEASUREMENT AND PAYMENT 12

CEMP 7.1 Refuse removal 12
CEMP 7.2 Environmental awareness training 12
CEMP 7.3 All requirements of the environmental management specification 12
CEMP 7.4 Fixed-Charge Items 12
CEMP 7.5 Time-related Items 12

CEMP 8 LEGISLATION APPLICABLE TO THIS SPECIFICATION 13

CEMP 9: ENVIRONMENTAL AWARENESS DO'S AND DON'TS 14

CEMP 9: METHOD STATEMENT SHEET - ENVIRONMENTAL METHOD STATEMENT 15

CEMP 1 INTRODUCTION

The CEMP has been prepared and is to be implemented as part of the Environmental Management System for the construction of the Upgrade of Bathurst Bulk Sewer: Wastewater Treatment Works.

The CEMP provides specifications that the Contractor, and any appointed subcontractors shall adhere to, in order to minimise adverse environmental impacts and optimise opportunities associated with construction activities.

The CEMP will be provided to any appointed subcontractors, so that all are aware of their environmental responsibilities prior to commencing work.

The aim of this CEMP is to ensure that environmental management of site activities is integrated into the management of quality, health and safety.

CEMP 2 ORGANISATIONAL REQUIREMENTS

CEMP 2.1 Organisational Structure

This section outlines the required management structure for the administration of the CEMP, in accordance with the Generic Specifications for Environmental Management (GSEM) of Civil Engineering Contracts applicable to this project, with particular emphasis on the roles and responsibilities of key individuals.

CEMP 2.2 Roles and responsibilities

CEMP 2.2.1 Environmental Manager

The key individual appointed by the Client has the title of Project Environmental Control Officer (PECO). The PECO is responsible for monitoring the implementation of the requirements of the GSEM by the relevant parties as specified in the GSEM.

The PECO shall:

a) Review and approve in writing valid method statements;

b) Review and approve in writing the CEMP provided by the contractor for the project;

c) Review and approve the Environmental Management File for the project;

d) Inspect the project site to check compliance with method statements and the requirements of the GSEM at least monthly and maintain inspection reports on file;

e) Meet with the Responsible Person for the contractor, whereby the Responsible Person reports on the implementation of the GSEM (at least monthly) and keep a record of minutes of the above meetings;

f) Report in writing any problems related to conformance with the GSEM which cannot first be resolved in co-operation with the relevant Responsible Person to:

- The Contractor(s); and
- the Client.

CEMP 2.2.2 Environmental Control Officer

The key individual appointed by the contractor will have the title of Environmental Control Officer (ECO) in accordance with the GSEM. The ECO is responsible for monitoring the implementation of the CEMP, and also monitoring compliance with the GSEM.

The contractor shall submit a CV of the ECO to the PECO for approval prior to commencement of work on site.

The ECO shall:

a) Use the CEMP as a tool to ensure that the GSEM is effectively implemented.

b) Audit this system so that he/she can demonstrate to the PECO that the CEMP is being effectively implemented.

c) Ensure that employees of the contractor, sub-contractors, suppliers etc. receive appropriate environmental awareness training prior to commencing work on the project and maintain records of training. It is anticipated, though not a requirement, that the ECO will deliver training sessions.

d) Ensure that responsible persons for sub-contractors are designated to carry out the requirements of the CEMP.

e) Submit method statements to the PECO for approval as specified in the GSEM and maintain approved method statements on file.

f) Record any transgressions of the method statements, that lead to environmental impacts in the site instruction book, and report these to the PECO as soon as possible.

g) Develop an Environmental Management File for record keeping purposes specifically for environmental related issues and documentation.

h) Attend Site meetings, and report on environmental matters on behalf of the contractor.

CEMP 3 GENERAL SITE PROCEDURES

CEMP 3.1 Demarcation of Environmentally Sensitive Areas (ESA's)

The PECO shall advise the contractor of any environmentally sensitive areas. It is assumed that the ESA's include the following:

- All indigenous bush; and
- All Wetlands and natural water courses (natural drainage lines).

In order to minimize adverse impacts to the ESA's during construction activities, the ESA's shall not be entered or used for any purpose unless in accordance with the written authority of the PECO.

The contractor(s) shall exercise special care when working close to the ESA's in order to avoid physical disturbance or pollution of these areas.

It is accepted that damage caused to ESA's by the contractor shall be rehabilitated to the written satisfaction of the PECO.

CEMP 3.2 Location of camp and depot

The location of the Site Camp must be approved by the PECO prior to establishment and must be located away from ESA's.

CEMP 3.3 Demarcation of the site

The importance of conducting activities within a limited area so as to facilitate control and to minimize the impact on the existing natural environment, surrounding agricultural lands, public thoroughfares and residences, is understood by the contractor.

The contractor shall demarcate the boundaries of the site, and shall be required to fence the boundaries of the site as establishment of the site. The location of the demarcated area must be approved by the PECO. The contractor shall ensure that all his plant, labour and materials are confined to the site camp when no construction activities are taking place.

CEMP 3.4 Toilets

Chemical toilets shall be provided within 400m of works areas, with a minimum of one toilet per 15 persons. Toilets will be easily accessible and shall be transportable. The toilets shall be secured to prevent them from blowing over, and shall be provided with an external closing mechanism to prevent toilet paper from being blown out. Toilet paper dispensers shall be provided in all toilets. Toilets shall be cleaned and serviced regularly by a registered service provider, and proof of service must be kept on file. Toilets shall be emptied before long weekends and builders' holidays.

The contractor shall ensure that chemicals and/or waste from toilet cleaning operations are not spilled on the ground at any time. It is accepted that if there should there be repeated spillage of chemicals and/or waste (i.e., more than three), the contractor shall be required to place the toilets on a solid base with a sump at own expense. Accumulations of chemicals and waste will have to be removed from the site and disposed at an approved waste disposal site or sewage plant.

Abluting anywhere other than in the toilets shall not be permitted, and all employees will be notified of this.

CEMP 3.5 Refuse

A Refuse Management Method Statement shall be submitted by the ECO to the PECO for written approval prior to the commencement of construction activities.

Refuse refers to all solid waste, including construction debris (wrapping materials, timber, cans etc.) waste and surplus food, food packaging etc.

The contractor shall institute an on-site waste management system that is acceptable to the PECO in order to prevent the spread of refuse within and beyond the site.

All waste shall be collected and contained immediately.

The contractor shall not dispose of any waste and/or construction debris by burning or burying. Waste bins with predator proof lids will be used. The contractor shall ensure that all waste is deposited by the employees in the waste bins for removal by the contractor. Bins shall not be used for any purposes other than waste collection and shall be emptied on a regular basis. All waste shall be disposed of off-site at approved landfill sites and proof of safe disposal must be kept on file.

Hazardous waste, including waste oil and other chemicals (e.g., paints, solvents) shall be stored in an enclosed area, and shall be clearly marked. If deemed necessary by the PECO, the contractor shall obtain the advice of a specialist waste expert with regard to the storage of hazardous waste. Such waste shall be disposed of off-site by a specialist waste contractor, at a licensed hazardous waste disposal site, and proof of safe disposal must be kept on file.

The PECO shall propose the method of storage and disposal of hazardous waste.

CEMP 3.6 Protection of flora and fauna

Indigenous flora is to be protected throughout the areas within and surrounding the project site.

Wild animals shall not be caught or killed by any means, including poisoning, trapping, shooting or setting of snares. The contractor accepts that offenders shall be prosecuted in terms of environmental legislation, and will also face expulsion from the project, and therefore all employees shall be warned thereof at the start of the contract.

CEMP 3.7 Defacement of natural features

Defacement of any features outside of the demarcated site shall not occur. The contractor accepts that any features defaced by them shall have to be restored.

CEMP 3.8 Protection of archaeological and palaeontological sites

If any possible palaeontological/archaeological material is found during excavations, the contractor shall stop work immediately and inform the PECO and the Resident Engineer (RE). The PECO will inform DEDEAT and the South African Heritage Resources Agency (SAHRA) and arrange for a palaeontologist/archaeologist to inspect, and if necessary, excavate, the material, subject to acquiring the requisite permits from SAHRA.

CEMP 3.9 Effluent and storm water management

An Effluent and Storm water Method Statement shall be submitted to the PECO by the ECO for written approval prior to the commencement of construction activities.

CEMP 3.10 Contamination prevention

CEMP 3.10.1 General

The contractor shall make every effort to ensure that pollution of the ground or surface water does not occur as a result of construction activities. Pollution could result from the release, accidental or otherwise, of contaminated runoff from construction a, discharge of contaminated construction water, chemicals, oils, fuels, sewage, run off from stockpiles, solid waste, litter, etc.

CEMP 3.10.2 Run off from construction camps

The contractor shall ensure that polluted runoff (excluding silt “pollution”), such as runoff from site camp where equipment is cleaned and/or serviced, fuel stores, workshops, etc. is not discharged overland. The contractor shall ensure that silt laden water is not discharged directly into any surface water courses (i.e. natural drainage channels, streams, rivers, etc.), and shall take suitable measures to discharge this into vegetated areas.

Natural run-off shall be diverted away from any camps towards the storm water drains where these are available. Special care will be taken in areas susceptible to erosion, e.g. steep slopes. The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter the storm water drain system, or any surface water course. The contractor shall take appropriate measures, e.g. the erection of silt traps, or drainage retention areas, to prevent silt and sand entering drainage or water courses.

Any partial or complete blockage of the storm water drainage system shall be cleared by the contractor at own expense.

CEMP 3.10.3 Discharge of construction water

Construction water refers to all water dirtied as a result of construction activities.

The contractor may discharge silt laden water overland and allow this water to filter into the ground. However, the contractor shall ensure that no erosion is caused as a result of any overland discharge.

The contractor may discharge limited quantities (less than 50 litres per day) of cement-laden water overland, i.e. washings from trowels, wheelbarrows and the like. The contractor shall ensure that all construction water is directed away from watercourses, and preferably into a temporary soak-pit.

Water from washing large concrete-mixing equipment (mixers and the like) shall not be discharged overland. Such water shall be collected and disposed of in a designated area approved by the PECO. The contractor may consider reusing such water for washing other concrete equipment, or for mixing to make concrete, to minimize the amount required to be removed off site.

Trucks delivering concrete shall not wash the trucks or the chutes on the site. All washing operations shall take place off site at a location where waste water can be disposed of in the correct manner.

CEMP 3.10.4 Servicing/fuelling of construction equipment

Servicing should preferably occur off site however there is a high probability that emergency servicing may be required on site due to breakdown. Fuelling will be done on site but only when required.

The contractor shall ensure that all emergency servicing of vehicles and equipment takes place in designated areas agreed upon by the PECO. All waste shall be collected and disposed of off-site at an appropriately licensed landfill site, and proof of safe disposal must be kept on file. All equipment that leaks onto the ground shall be repaired immediately or removed.

Similarly, no vehicles or machines shall be re-fuelled on site unless all the necessary spill prevention equipment is in place. The contractor shall not change oil or lubricants anywhere on site except at the site camp, except if there is a breakdown or an emergency repair. In such instances, the contractor shall ensure that Drizit pans (or equivalent) and/or drip trays are available to collect any oil, fluid, etc. Also, a Spill Kit shall be available wherever plant and machinery are operating so that there can be prompt response and spill control and clean–up in the case of a hydrocarbon spill.

CEMP 3.10.5 Fuels and chemicals

The contractor shall take all reasonable precautions to prevent the pollution of the ground and/or water resources by fuels and chemicals as a result of construction activities.

The contractor shall keep the necessary materials and equipment on site to deal with ground spills of any of the materials used or stored on site.

The contractor shall ensure that no oil, petrol, diesel, etc. is discharged onto the ground. Pumps and other machinery requiring oil, diesel, etc. which are to remain in one position for longer than two days shall be placed on drip trays. The drip trays shall be emptied regularly and the contaminated water disposed of off-site at a facility capable of handling such waste water. Drip trays shall be cleaned before any possible rain events that may result in the drip trays overflowing and before long week-ends and holidays.

The contractor shall also keep a Spill Kit wherever plant and machinery are operating so as to deal with spills promptly if these occur. The contractor shall also remove all oil-, petrol-, and diesel-soaked sand immediately and shall dispose of it as hazardous waste, and proof of safe disposal must be kept on file.

Should the PECO and/or the relevant authorities deem it necessary to institute a programme for the removal of contaminated ground resulting from the non-compliance of the controls detailed above, these costs will be for the contractor account. Remedial action shall be proposed by the PECO and approved by the relevant authorities, if appropriate.

CEMP 3.11 Dust control

The contractor shall be responsible for the continued control of dust arising from construction operations, through measures including, but not limited to, spraying of water on bare areas, rotovating straw bales and the scheduling of dust-generating activities. Overhead sprayers shall not be used in windy conditions, because too much water will be lost to evaporation. The use of water carts is preferred.

CEMP 3.12 Noise control

The contractor shall take all reasonable precautions to minimize noise generated on site as a result of construction operations.

CEMP 3.13 Materials use, handling, storage and transport

A Materials Handling Method Statement shall be submitted by the ECO to the PECO for written approval prior to the commencement of construction activities.

CEMP 3.13.1 General

The contractor is aware that the site is prone to occasional very strong winds. All material storage areas shall be designed so as to reduce the risk of spillage, dispersal or damage of or to materials as a result of strong winds. Methods of protection of stored materials shall be included in the method statement.

CEMP 3.13.2 Use of cement/concrete

The contractor is aware that cement and concrete are regarded as highly hazardous to the natural environment on account of the very high pH of the material, and the chemicals contained therein. Therefore, the contractor shall ensure that:

- Concrete is mixed on mortar boards, and not directly on the ground;
- Visible remains of concrete, either solid, or from washings, are physically removed immediately and disposed of as waste. Washing the visible signs into the ground is not acceptable; and
- All aggregate is also removed.

CEMP 3.13.3 Cement stabilisation

The contractor shall not undertake cement stabilisation during windy periods. Special care shall also be taken to avoid creating dust in the vicinity of the following areas:

- Public thoroughfares
- Public amenities
- Residential areas
- ESA's

CEMP 3.13.4 Fuel storage and use

Tanks containing fuels shall have lids and shall remain firmly shut. Only clean, empty tanks may be stored on the bare ground. Fuel stores shall be placed on a bunded sealed base - the bunds shall have a volume of 110% of the volume of the largest tank in the storage area. Any waste water or spilled fuel collected within the bund shall be disposed of as hazardous waste.

The contractor shall take all the necessary precautions to prevent fires or spills at the fuel stores. No smoking shall be allowed in the vicinity of the stores.

The contractor shall ensure that there is adequate fire-fighting equipment at any fuel stores.

CEMP 3.13.5 Hazardous materials

The contractor shall comply with all relevant national, regional and local legislation with regard to the transport, use and disposal of hazardous materials. If necessary, the contractor shall obtain the advice of the manufacturer with regard to the safe handling of hazardous materials.

The contractor shall provide the PECO with a list of all hazardous substances on site, together with storage procedures for these materials.

The contractor shall ensure that information on all hazardous substances is available to all personnel on site. The contractor shall furthermore be responsible for the training and education of all personnel on site who will be handling the material about its proper use, handling and disposal.

CEMP 3.13.6 Transport of materials outside the site

The contractor shall comply with all the applicable local, regional and national by-laws with regard to road safety and the transport of materials, especially hazardous and/or toxic materials. Any claims against the contractor shall be for own account.

The ECO shall provide the PECO with a schedule of proposed transportation of significant quantities of hazardous material onto the site, before commencing work on site.

CEMP 3.14 Emergency procedures

The contractor shall submit an Emergency Procedure Method Statement to the PECO prior to commencing activities on site.

CEMP 3.14.1 General

The contractor shall ensure that emergency procedures are set up prior to commencing work. Emergency procedures shall include, but are not limited to, fire, spills, contamination of the ground, accidents to employees, use of hazardous substances, etc. Emergency procedures, including responsible personnel, contact details of emergency services, etc. shall be made available to all the relevant personnel and shall be clearly demarcated at the relevant locations around the site.

The ECO shall advise the PECO of any emergencies on site, together with a record of action taken.

CEMP 3.14.2 Fire

The contractor shall take all the necessary precautions to ensure that fires are not started as a result of his activities on site, and shall also comply with the requirements of the Occupational Health and Safety Act 85 of 1993.

No open fires shall be permitted on or off site. The contractor is aware that sparks generated during welding, cutting of metal or gas cutting can cause fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion, such as fuel stores, stockpiles of plant material etc. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities.

The contractor shall be liable for any expenses incurred by any organizations called to assist with fighting fires, and for any costs relating to the rehabilitation of burnt areas.

CEMP 3.15 Social issues

CEMP 3.15.1 Third party or public complaints

The ECO shall be responsible for responding to queries and/or complaints and may request assistance from the PECO.

The ECO shall notify the PECO of any complaints lodged by a third party, and request appropriate information and measures to redress such complaints. The ECO shall be responsible for maintaining complaints register in which all complaints are recorded, as well as action taken. This register shall be available to the PECO.

CEMP 3.15.2 Use of local labour

It is advised that no personnel are to be recruited on site.

CEMP 4 SITE CLEARANCE

CEMP 4.1 Removal of endemic or endangered species

The PECO shall contact the DEDEAT at least three weeks before any site clearance to inform them whether or not rescue measures for endemic or endangered plant species should be implemented and also provide them with the opportunity to visit the site. The DEDEAT shall advise the PECO and the contractor within one week if it is necessary to provide the opportunity for a specialist to remove endemic or rare plant species prior to site clearance, and if rescue measures are required, the ECO shall submit a method statement for the rescue measures. If no response is received from DEDEAT within one week the contractor may proceed with the clearance of the site.

CEMP 4.2 Removal of topsoil

Following removal of vegetation from the site, all topsoil shall be removed (up to a maximum of 15cm depth) and stockpiled for re-use in subsequent rehabilitation activities. The stockpiles shall not be higher than 2 m in order to minimize composting and denaturing of the soil. The stockpiles of topsoil shall be located in an area agreed with the PECO and shall be covered should they need to be left for more than two weeks. This will prevent wind erosion and ensure that the soil retains its important biological processes.

During trench excavations topsoil shall be placed to one side of the trench and subsoil on the other side to prevent contamination of the topsoil, and after backfilling the topsoil must be applied over the backfill and rehabilitated.

CEMP 4.3 Stabilisation of steep slopes

The disturbance of steep slopes, for example by the removal of vegetation, may result in slope instability and erosion by rain and surface run off. The contractor shall ensure that slopes that are disturbed during construction are stabilized to prevent erosion occurring. Where re-vegetation of slopes is undertaken, this shall be in accordance with the specification provided in Paragraph 5 below.

Slopes that are susceptible to accidental damage during construction shall be protected to reduce the risk of disturbance.

Any erosion that does occur shall be reinstated at the contractor's cost.

CEMP 4.4 Excavations

Excavations for trenches will cause the biggest impact of this project, because the great length, variable depth, and different soils and even streams and rivers that it will pass through. Every effort will be made to minimize the impacts through correct construction practices.

CEMP 4.4.1 Excavation of trenches

The grass cover and other vegetation over the width of the trench shall be trimmed off and placed to one side of the trench. The topsoil shall be removed to a depth of 300mm and placed separately on the same side of the trench as the grass. The subsoil excavated from the trench shall be stored on the opposite side of the trench to the topsoil, to ensure that there is no mixing of topsoil and subsoil.

CEMP 4.4.2 Open trenches

Not more than 750m/team of trenching shall be left open at a time, and all open trenches shall be demarcated with danger tape. Trenches in wetland and streams shall be excavated and backfilled as soon as possible to minimize the chances of flooding the trench, and/or causing erosion, and the time taken from excavation to rehabilitation shall not exceed 14 days.

CEMP 4.4.3 Reinstatement of trenches

Backfilling shall be done with the subsoil and compacted in layers of 300mm. Once the backfilling and compaction has been completed, the topsoil layer shall be reinstated. The grass and vegetation that was initially removed shall be spread over the topsoil layer to offer protection against erosion while seed that is sown is allowed to germinate.

Care shall be taken to ensure that the finished level of the trench cover is slightly higher than the surrounding soil to allow for slump after being wet by rains.

CEMP 4.5 Removal of alien vegetation

The contractor shall remove all alien vegetation that establishes within the demarcated site after construction commences.

CEMP 5 SITE REHABILITATION

CEMP 5.1 Scope

The contractor shall be responsible for rehabilitating any areas cleared or disturbed for construction purposes. The contractor shall rehabilitate such areas in accordance with the specification provided below.

The contractor shall stabilize, by straw rotovation or other means, any areas that are cleared or disturbed for construction purposes.

All construction equipment and excess aggregate, gravel, stone, concrete, bricks, temporary fencing and the like shall be removed from the site upon completion of the work. No discarded materials of whatsoever nature shall be buried on the site or on any other land surrounding the proposed development site.

CEMP 5.2 Preparation for rehabilitation

Areas that require reshaping shall be cut, filled and compacted so as to follow the contours of the surrounding landscape. Topsoil removed from the area initially shall be replaced. Care must be taken not to mix the topsoil with the subsoil during shaping operations. Should a crust form on the soil before re-vegetation is commenced, the contractor shall, at own cost, loosen the crust by scarifying to a depth of 150 mm.

CEMP 5.3 Seeding

A commercial annual and perennial grass seed mix shall be used which has an annual to perennial ratio of greater than 1.5:1. Eragrostis tef is a suitable annual species, while perennial species should be comparable to those in the natural grassveld. Grass sown at high rates can prevent the establishment of natural species, therefore suitable sowing rates should be chosen, and these will be obtained from the PECO.

Irrigation will enhance the rehabilitation and should be considered if unusually dry conditions prevail.

The use of anti-erosion compounds shall be considered on steep slopes where there is a risk of erosion.

Control of the spread of alien species shall be managed by regular monitoring of the area and removal of these seedlings. Regular monitoring of the area will also allow for modifications to the rehabilitation programme, for example the need to irrigate, sow more seed or fertilize. The rehabilitation programme should be flexible allowing for these modifications.

CEMP 6 MANAGEMENT AND MONITORING

This section focuses on the systems and procedures required to ensure that the environmental specifications are effectively implemented.

CEMP 6.1 General inspection monitoring and reporting

The ECO shall ensure that the following is complied with:

- Inspect the site on a daily basis to ensure that the environmental specifications are adhered to.
- Provide the PECO with a monthly written report, detailing both compliance with the GSEM, and environmental performance.
- Maintain a record of major incidents (spills, impacts, complaints, legal transgressions etc) as well as corrective and preventive actions taken, for submission to the PECO at the scheduled monthly report back meetings.
- Conduct regular internal audits to ensure that the system for implementation of the EMP is operating effectively, in order to ensure compliance with the GSEM. The audit shall check that a procedure is in place to ensure that:
- The method statements and EMP being used are the up to date versions;
- Variations to the Method Statements and non-compliances and corrective action are documented;
- Appropriate environmental training of personnel is undertaken; and
- Emergency procedures are in place and effectively communicated to personnel.

CEMP 6.2 Environmental Awareness Training

The contractor shall be responsible for introducing the CEMP and GSEM to all employees on site, before any construction activities commence. Weekly toolbox talks shall also be used to remind the employees of their responsibilities in terms of environmental management, and any issues observed will be raised in these meetings. The Contractor shall ensure that all attendees sign an attendance register, and shall keep a copy of the attendance register on file.

The emphasis of the training shall be on potential environmental impacts relating to the construction or maintenance activities to be undertaken on site, and the related environmental precautions which need to be taken to avoid or mitigate these impacts. The contractual obligation to comply with the specifications in the CEMP shall also be emphasized.

If specific training is required, the ECO shall approach the PECO for assistance in providing the necessary training.

CEMP 6.2.1 Additional environmental awareness training

If there are persistent breaches of the specifications contained in this document, and / or if new environmental issues arise during the course of construction, the PM may require additional environmental training sessions be provided to all the Contractor's employees.

CEMP 6.3 Documentation

The ECO shall maintain records to demonstrate compliance with the CEMP and method statements. The ECO shall ensure that all records of spills, pollution incidents, spot fines, training details etc. are copied to the PECO and PM for his/her records. All documents shall be open for inspection by the Client, and made available to the public on request.

The ECO shall ensure that a register of public complaints and action taken thereon, plus the relevant documentation from the Contractor, is maintained.

CEMP 6.4 Penalties

Compliance with the CEMP is obligatory therefore contractors that are found to be non-compliant with the CEMP may be issued with a fine from the PECO or PM.

1) Spot Fines

Spot fines not exceeding R1,500.00 shall be recommended by the PECO and imposed by the PM on the Contractor if the Contractor is found to be infringing on this CEMP. The Contractor shall be advised in writing of the nature of the infringement and the amount of the spot fine. The Contractor shall determine how to recover the fine from the relevant employee and/or Sub-contractor and/or supplier. The Contractor shall also take the necessary steps (e.g. training) to prevent a recurrence of the infringement and shall advise the PM accordingly.

The Contractor is also advised that the imposition of spot fines does not replace any legal proceedings the Client, authorities, and/or members of the public may institute against the Contractor. The decision on how much to impose will be made by the PM and will be final. In addition to the spot fine, the Contractor shall be required to make good any damage caused as a result of the infringement at his own expense.

A preliminary list of infringements for which spot fines will be imposed is as follows:

- Moving outside the demarcated Site boundaries;
- Littering of the Site and surrounds;
- Burying waste on Site and surrounds without written approval;
- Smoking in the vicinity of fuel storage and filling areas and in any other areas where flammable materials are stored/used;
- Making fires outside designated areas;
- Defacement of natural features;
- Spillage onto the ground of oil, diesel, etc;
- Picking/damaging plant material;
- Damaging/killing wild animals; and

2) Procedure

Spot fines that are recommended by the PECO, will be issued as a 'Compliance Notice' to the Contractor, and the Compliance Notice shall present the activity that caused the non-compliance, and the amount to be paid. A copy of the Compliance Notice will also be submitted to the PM and financial manager for the project who will deduct the value of the fine from the Contractors payment claim.

A repeated contravention of a requirement of the CEMP shall be sufficient grounds to require the removal by the PM of the person responsible for the non-compliance on Site and the Contractor shall have no claim for such removal from Site.

3) Fines

More severe fines may be issued on the Contractor if there are repeated contraventions of the CEMP. The fines that are issued shall be in accordance with the severity of the incident, and these will be classified as minor-, medium-, or major environmental incidents.

4) Minor environmental incidents

This refers to an incident or sequel of incidents, whether immediate or delayed, that does not result in any negative impact on the environment after immediate intervention on the day of the occurrence, and does not result in pollution, and does not have a risk of danger to the public.

Minor environmental incidents may be cause for a fine not exceeding R5,000.00. The Contractor shall also be responsible for remediation of the incident, and be liable for the costs for the said remediation.

5) Medium environmental incidents

This refers to an incident or sequel of incidents, whether immediate or delayed, that results in widespread or localized short term, reversible significant negative impact on the environment, and/or risk of legal liability to the Client, and may entail risk of danger to the public.

Medium environmental incidents may be cause for a fine not exceeding R10,000.00. The Contractor shall also be responsible for remediation of the incident, and be liable for the costs for the said remediation, as well as responsible for legal liability if applicable.

6) Major environmental incidents

This refers to an incident or sequel of incidents, whether immediate or delayed, which results in widespread or localized long term, irreversible significant negative impact on the environment, and/or has a high risk of legal liability to the Client.

Major environmental incidents may be cause for a fine not exceeding R50,000.00. The Contractor shall also be responsible for remediation of the incident and be liable for the costs for the said remediation, as well as responsible for legal liability if applicable.

7) Procedure

Fines that are issued will be issued as a 'Compliance Notice' to the Contractor, and a copy given to the Client, and the Compliance Notice shall present the activity that caused the non-compliance, the severity of the incident, and the amount to be paid. A copy of the Compliance Notice will also be submitted to the financial manager for the project with an instruction to deduct the value of the fine from the Contractor.

A repeated contravention of a requirement of the CEMP shall be sufficient grounds to require the removal by the PM of the person responsible for the non-compliance on Site and the Contractor shall have no claim for such removal from Site.

A major environmental incident shall be grounds for the Client to claim a 'breach of contract' against the Contractor and shall have the right to terminate the contract.

CEMP 6.5 Dispute Resolution

The CEMP shall be part and parcel of contracts between any Contractor and the Client, and therefore any dispute must be dealt with according to the relevant dispute resolution clauses in the contract.

However, to gain a better understanding of compliance and offences, the Contractor is advised to study the national environmental legislation applicable to the type of project in which he/she is involved.

CEMP 7 Measurement and payment

CEMP 7.1 Refuse removal

The unit of measurement shall be a sum for dry and/or wet refuse to be removed by the Subcontractor. The tendered rate shall include full compensation for collecting the refuse, for providing and maintaining the refuse vehicles, refuse bins and special refuse enclosures, drivers and assistants, for all transport around and off-site, for loading and unloading all as specified.

CEMP 7.2 Environmental awareness training

The organisation and attendance of the education course will be measures as a sum. The tender shall cover the time cost of all personnel attending the course, the provision of the venue and for any other operation necessary to comply with the requirements of the environmental awareness courses to the satisfaction of the Employer's Agent.

CEMP 7.3 All requirements of the environmental management specification

All other work not measured elsewhere, associated with complying with any requirement of the environmental management specification shall be measured as a sum. The tendered rate shall cover any cost associated with complying with the environmental management specification and shall include for all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing.

The compilation and implementation of the Construction Environmental Management Plan shall meet the minimum requirements as set out in CEMP 1 – CEMP 3 as detailed on the next page.

CEMP 7.4 Fixed-Charge Items

a)	Compilation of an approved Environmental Management Plan	Sum
b)	Other fixed charges	Sum

CEMP 7.5 Time-related Items

a)	Compliance to the approved Environmental Management Plan and File	Sum

b) Training Sum

CEMP 8 LEGISLATION APPLICABLE TO THIS SPECIFICATION

The following is a brief summary of the relevant environmental legislation, which have implications for the project.

The National Constitution establishes the fundamental framework in terms of which the law is promulgated and applied, and confers rights on everyone to an environment that is not harmful to health and well-being, and which is protected, for the present and future generations, through reasonable legislative and other measures.

In terms of the constitution, environmental matters are delegated to the province, but not exclusively. National Acts of relevance to this environmental specification are:

- Conservation of Agricultural Resources Act, No 43 of 1983
- Environment Conservation Act, No 73 of 1989
- National Environmental Management Act, No 107 of 1998 (NEMA) – EIA regulations as amended
- National Environmental Management: Biodiversity Act of 2004
- National Environmental Management: Waste Act of 2008
- National Forests Act, No 84 of 1998
- National Heritage Resources Act, No 25 of 1999 (NHRA)
- National Veld and Forest Fires Act, No 101 of 1998
- National Water Act, No 36 of 1998 (NWA)

For implementation on small or low impact developments approved under the Environment Conservation Act (Act 73 of 1989).

CEMP 9: ENVIRONMENTAL AWARENESS DO'S AND DON'TS

BASIC RULES OF CONDUCT

The following list represents the basic Do's and Don'ts towards environmental awareness, which all participants in this project must consider whilst carrying out their tasks. These are not exhaustive and serve as a quick reference aid.

NOTE: **ALL new site personnel must** attend an environmental awareness presentation. Please inform your foreman or manager if you have not attended such a presentation or contact the ESA.

DO:

- Use the toilet facilities provided – report dirty or full facilities.
- Clear your work areas of litter and building rubbish at the end of each day – use the waste bins provided and ensure that litter will not blow away.
- Report all fuel or oil spills immediately & stop the spill continuing.
- Dispose of cigarettes and matches carefully. (Littering is an offence.)
- Confine work and storage of equipment to within the immediate work area.
- Use all safety equipment and comply with all safety procedures.
- Prevent contamination or pollution of streams and water channels.
- Ensure a working fire extinguisher is immediately at hand if any "hot work" is undertaken e.g. Welding, grinding, gas cutting etc.
- Report any injury of an animal.
- Drive on designated routes only.
- Prevent excessive dust and noise.

DO NOT:

- Remove or damage vegetation without direct instruction.
- Make any fires.
- Injure, trap, feed or harm any animals – this includes birds, frogs, snakes, lizards etc.
- Enter any fenced off or marked area.
- Allow cement or cement bags to blow around.
- Speed or drive recklessly.
- Allow waste, litter, oils, or foreign materials into the stream.
- Swim in the dam.
- Litter or leave food laying around.

Notes:

1. Should any animals such as tortoises, chameleons or snakes be encountered then do not harm them. The ESSO or RE should be contacted to remove these safely. The harming of any animal will result in disciplinary action.
2. Construction and heavy machine operators must be particularly sensitive to staying within access routes and prevention of unnecessary damage. Dust and noise are also of particular concern. Ensure that vehicles and machinery do not leak fuel or oils. Refuelling or maintenance must be done within the maintenance camp area only.
3. Alien plant clearing, and control work teams must be closely supervised.

CEMP 9: METHOD STATEMENT SHEET - ENVIRONMENTAL METHOD STATEMENT

WHAT:	**Subject of M/Statement**				
WHO:	**Site Foreman/contact person:**				
	Submitted to (e.g. ESA):		**Approved by:**		
	Date Submitted on:		**Date Approved:**		
WHEN:	**Date works start**		**Date works complete**		
	Rehabilitation period:		**Programme restrictions (critical path, season restrictions etc.)**		
	Split work Phasing:	**Item**		**start date**	**end date**
	Phase 1				
	Phase 2				
WHERE	**Area of works – submit plan or sketch if appropriate – stockpile, detention ponds, boundaries / restriction of works, special features or mitigation works landscape specials etc:**				
HOW:	**Route/site layout pegged:**	**Date available to inspect**		**Inspection persons required:**	
	Landscape concerns: (Specify items not covered in EMP. Refer to EMP items if required.)				
	Existing features & services affected (e.g. paths, curbing, irrigation etc.)				
	Trees (protection or removal methods).				
	Special vegetation				
	Reinstatement methods				
	Maintenance				
	Restricted areas				
	Access:				
	Machinery:				
	Earthworks & dust control:				
	Concrete works:				
	Storm-water control:				
	Stockpiles:				
	Refuse/rubble:				
	Water quality – pumping, source & discharge points, settlement, filtration, duration etc:				
	Hydrocarbon control measures:				
	I&AP notifications:				
	Fire/emergency contingencies:				
	Special conditions / mitigation measures (e.g. stream crossings, live sewer proximity etc):				
	Comments:				

C3.8: Labour Intensive Construction Specifications

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C3.8: LABOUR INTENSIVE CONSTRUCTION SPECIFICATIONS

Contents

LIC 1 LABOUR INTENSIVE WORK 2

LIC 1.1 USE OF LABOUR INTENSIVE CONSTRUCTION METHODS 2
LIC 1.2 COMPETENCIES OF SUPERVISORY AND MANAGEMENT 2
LIC 1.3 GENERIC LABOUR-INTENSIVE SPECIFICATION 3

LIC 1 LABOUR INTENSIVE WORK

LIC 1.1 Use of Labour Intensive Construction Methods

It is a requirement of this Contract that local labour is employed wherever possible. However, the Contractor shall limit the use of non-local employees to work that requires higher training or skills, and to key personnel only.

Written Contracts shall be Entered into with Local Labour.

The Contractor shall make use of labour intensive construction methods in the completion of the Works. Hand-held tools shall be used wherever possible. The use of mechanical plant shall be restricted to:

a) Compressors;
b) jack-hammers;
c) excavator for excavation in rock and bulk pipelines (only with prior permission of the Employer's Agent) as scheduled in the Bill of Quantities;
d) plant for transportation of materials;
e) plant for the mixing, pumping and compaction of concrete; and
f) minor hand-held tools, e.g. drills, circular saws, etc.,

Any other mechanical plant that the Contractor may require, may only be brought onto site with the prior permission of the Employer's Agent.

LIC 1.2 Competencies of Supervisory and Management

Established contractors shall only engage supervisory and management staff in labour-intensive works who have either completed, or are registered for training towards, the skills programme outlined in Table 1.

Emerging contractors shall have personally completed or be registered on a skills programme for the NQF level 2 unit standard. All other site supervisory staff in the employ of emerging contractors must have completed, or be registered on a skills programme for, the NQF level 2 unit standards or NQF level 4 unit standards.

Table 1: Skills programme for supervisory and management staff

Personnel	NQF level	Unit standard titles	Skills programme description
Team leader / Supervisor	2	Apply Labour-Intensive Construction Systems and Techniques to Work Activities	This unit standard must be completed, and
		Use Labour-Intensive Construction Methods to Construct and Maintain Roads and Stormwater Drainage	} Any one of these three unit standards
		Use Labour-Intensive Construction Methods to Construct and Maintain Water and Sanitation Services	
		Use Labour-Intensive Construction Methods to Construct, Repair and Maintain Structures	

Personnel	NQF level	Unit standard titles	Skills programme description
Foreman/ Supervisor	4	Implement Labour-Intensive Construction Systems and Techniques	This unit standard must be completed, and
		Use Labour-Intensive Construction Methods to Construct and Maintain	} Any one of these three unit standards
		Roads and Stormwater Drainage Use Labour-Intensive Construction Methods to Construct and Maintain	
		Water and Sanitation Services Use Labour-Intensive Construction Methods to Construct, Repair and Maintain Structures	
Site Agent/ Manager (i.e. the Contractor's most senior representative that is resident on the site)	5	Manage Labour-Intensive against this Construction Processes	Skills Programme against this single unit standard
Details of these skills programmes may be obtained from the CETA.			

LIC 1.3 Generic labour-intensive specification

LIC 1.3.1 Scope

This Specification establishes general requirements for activities which are to be executed by hand involving the following:

a) trenches having a depth of less than 1.5 metres

b) stormwater drainage

c) low-volume roads and sidewalks

LIC 1.3.2 Precedence

Where this Specification is in conflict with any other standard or specification referred to in this Contract, the requirements of this Specification shall prevail.

LIC 1.3.3 Hand excavatable material

Hand excavatable material is material:

a) Granular materials:

i) whose consistency when profiled may in terms of table 1 be classified as very loose, loose, medium dense, or dense; or

ii) where the material is a gravel having a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than 15 blows of a dynamic cone penetrometer is required to penetrate 100 mm;

b) Cohesive materials:

i) whose consistency when profiled may in terms of table 1 be classified as very soft, soft, firm, stiff and stiff / very stiff; or

ii) where the material is a gravel having a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than

8 blows of a dynamic cone penetrometer is required to penetrate 100 mm;

Note:

1) A boulder, a cobble and gravel is material with a particle size greater than 200 mm, between 60 and 200 mm, and between 2 mm and 60 mm respectively.

2) A dynamic cone penetrometer is an instrument used to measure the in-situ shear resistance of a soil comprising a drop weight of approximately 10 kg which falls through a height of 400 mm and drives a cone having a maximum diameter of 20 mm (cone angle of 60° with respect to the horizontal) into the material being used.

Table 2: Consistency of materials when profiled

GRANULAR MATERIALS		COHESIVE MATERIALS	
Consistency	**Description**	**Consistency**	**Description**
Very loose	Crumbles very easily when scraped with a geological pick	Very soft	Geological pick head can easily be pushed in as far as the shaft of the handle
Loose	Small resistance to penetration by sharp end of a geological pick	Soft	Easily dented by thumb; sharp end of a geological pick can be pushed in 30-40 mm; can be moulded by fingers with some pressure
Medium dense	Considerable resistance to penetration by sharp end of a geological pick	Firm	Indented by thumb with effort; sharp end of geological pick can be pushed in up to 10 mm; very difficult to mould with fingers; can just be penetrated with an ordinary hand spade
Dense	Very high resistance to penetration by the sharp end of geological pick; required many blows for excavation	Stiff	Can be indented by thumb-nail; slight indentation produced by pushing geological pick point into soil; cannot be moulded by fingers.
Very dense	High resistance to repeated blows of a geological pick	Very stiff	Indented by thumb-nail with difficulty; slight indentation produced by blow of a geological pick point.

LIC 1.3.4 Trench excavation

Hand excavatable material has to have a consistency of:

a) Granular Materials – Very loose or Loose

b) Cohesive Materials – Very soft or Soft

c) All other consistencies are regarded machine excavatable materials.

d) Hand excavation only for trenches having a depth of less than 1,5 metres, all other trenches to be done by machine.

LIC 1.3.5 Compaction of backfilling to trenches (areas not subject to traffic)

Backfilling to trenches shall be placed in layers of thickness (before compaction) not exceeding 100 mm. Each layer shall be compacted using hand stampers

a) to 90% Proctor density;

b) such that in excess of 5 blows of a dynamic come penetrometer (DCP) is required to penetrate 100 mm of the backfill, provided that backfill does not comprise more than 10% gravel of size less than 10 mm and contains no isolated boulders, or

c) such that the density of the compacted trench backfill is not less than that of the surrounding undisturbed soil when tested comparatively with a DCP.

LIC 1.3.6 Excavation

All excavation, as listed under PD9-3.4 classified as hand excavatable shall be excavated by hand. The excavation of any material which presents the possibility of danger or injury to workers shall not be excavated by hand.

LIC 1.3.7 Clearing and grubbing

Grass and small bushes shall be cleared by hand.

LIC 1.3.8 Shaping

All shaping shall be undertaken by hand.

LIC 1.3.9 Spreading

All material shall be spread by hand.

LIC 1.3.10 Compaction

Small areas may be compacted by hand provided that the specified compaction is achieved.

LIC 1.3.11 Grassing

All grassing shall be undertaking by sprigging, sodding, or seeding by hand.

LIC 1.3.12 Stone pitching and rubble concrete masonry

All stone required for stone pitching and rubble concrete masonry, whether grouted or dry, shall be collected, loaded, off loaded and placed by hand.

Sand and stone shall be hauled to its point of placement by means of wheelbarrows where the haul distance is not greater than 150 m.

Grout shall be mixed and placed by hand.

LIC 1.3.13 Manufactured elements

Elements manufactured or designed by the Contractor, such as manhole rings and cover slabs, precast concrete planks and pipes, masonry units and edge beams shall not individually, have a mass of more than 320kg. In addition, the items shall be large enough so that four workers can conveniently and simultaneously acquire a proper handhold on them.

C3.9 Training Specifications

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C3.9: TRAINING SPECIFICATIONS

GENERAL NOTICES • ALGEMENE KENNISGEWINGS

DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE

GENERAL NOTICE 1779 OF 2023

Construction Industry Development Board

Standard for Developing Skills through Infrastructure Contracts

31 MARCH 2023

In terms of sections 5(2) of the Construction Industry Development Board Act, 2000 (Act no. 38 of 2000) (the Act), the Construction Industry Development Board is empowered to promote best practice Standards. This best practice Standard for developing skills through infrastructure contracts, establishes the minimum contract skills development goals to be achieved in the performance of such contracts relating to the provision of workplace opportunities, linked to or leading to:

a) a part- or full occupational qualification registered on the National Qualification Framework;

b) a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012);

c) a national diploma registered on the National Qualification Framework; and

d) registration in a professional category by one of the professional bodies listed in the standard.

Mr Khulile Nzo
Chairperson: Construction Industry Development Board

Construction Industry Development Board

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

higher education & training
Department:
Higher Education and Training
REBUBLIC OF SOUTH AFRICA

economic development
Economic Development Department
REPUBLIC OF SOUTH AFRICA

Standard for developing skills through infrastructure contracts

(31 MARCH 2023)

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Introduction 1

1 Scope 2

2 Terms and definitions 2

3 Requirements 6

3.1 Contract skills development goal (CSDG) 6
3.2 Achieving the contract skills development goal (CSDG) 7
3.3 Contract skills development goal credits 8
3.4 Denial of credits 10

4 Compliance with requirements 10

4.1 General 10
4.2 Structured workplace learning opportunities for learners 11
4.3 Structured workplace learning for candidates 12

5 Records 13

6 Sanctions 13

Annex A: Incorporating this standard in a procurement document 14

A1 General 14
A2 Sanctions 14

Annex B: Role and Function of Skills Development Agency 15

B1 Career Management and Compliance Reporting 15
B2 Employment Intermediary 15

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Introduction

Procurement may be defined as the process which creates, manages and fulfils contracts. Procurement accordingly commences once a need for goods, services or works has been identified and it ends when the goods are received, or the services or construction works are completed. Public procurement can have a significant impact on social and economic development, if it is used to leverage social and development objectives.

The South African government requires that its considerable expenditure on the delivery, maintenance and operation of infrastructure (fixed assets that are constructed or result from construction operations) contribute to an increase in the number of people who have part or full occupational qualifications registered on the NQF or professional designations awarded by professional bodies or statutory councils. This standard has been prepared to leverage contributions towards the increase of the pool of qualified skilled people, and where required professionally registered, through training on professional services, design and build or engineering and construction works contracts associated with such expenditure. This Standard for developing skills through infrastructure contracts, establishes the minimum contract skills development goals to be achieved in the performance of such contracts relating to the provision of workplace opportunities, linked to or leading to:

a) a part- or full occupational qualification registered on the National Qualification Framework.

b) a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012);

c) a national diploma registered on the National Qualification Framework; and

d) registration in a professional category by one of the professional bodies listed in Table 1 of this standard.

Contractors are responsible for achieving the contract skills development goals and are provided with a number of methods for measuring their achievements. They may, if need be, devolve their obligations onto subcontractors.

This standard should be applied to;

A contract or an order issued in terms of a framework agreement that has a duration of 12 months or more, and:

a) a contract of R5 million or more, in the case of a professional service or service contract or an order issued in terms of such a contract; or

b) a cidb grading designation of grade 7 or higher, in case of an engineering and construction works, or design and build contract or an order issued in terms of such a contract.

This Standard will be subject to review every five years, or sooner if required.

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Standard for developing skills through infrastructure contracts

1 Scope

This standard establishes a key performance indicator;

a) in the form of a contract skills development goal (CSDG) relating to the structured workplace learning of occupational or professional learning, which enables learners to make measurable progress towards the attainment of:

   (i) a part- or full occupational qualification registered on the National Qualification Framework; or

   (ii) a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012); or

   (iii) a national diploma registered on the National Qualification Framework; or

   (iv) registration in a professional category by a statutory council listed in Table 1.

b) in the delivery, maintenance and operation of infrastructure through the performance of professional service, engineering and construction works, or design and build contracts or an order associated with such a contract and

c) sets out the methods by which the key performance indicator is established, measured, quantified and verified in the performance of the contract or the execution of an order.

NOTE 1: Guidance on the manner in which this standard should be incorporated into procurement documents is provided in Annex A.

NOTE 2: This standard can be applied to contracts or to orders (call-offs) issued in terms of framework agreements. Framework agreements are well suited to situations in which long term relationships are entered into. They offer flexibility in attaining contract skills development goals as requirements can be adjusted from one order to another, thus allowing key performance indicators to be improved upon over time.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

allowance
amount provided for in the contract or an order by the employer relating to one or more of the following:

a) the performance by the contractor of work or services that are foreseen but cannot be accurately specified at the time that the contract was entered into or the order issued;

b) work or services to be performed, or goods provided, by a subcontractor who is either nominated by the employer or is selected by the employer in consultation with the contractor after the award of the contract or the issuing of an order;

c) provision for price adjustment for inflation; or

d) other budgetary provisions intended to cover the employer's contractual risks

artisan
a person who has been certified as competent to perform a listed trade in accordance with Section 26B of the Skills Development Act of 1998 (Act No. 97 of 1998)

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black people mean Africans, Coloureds and Indians, who - (a) are citizens of the Republic of South Africa by birth or descent; or (b) became citizens of the Republic of South Africa by naturalisation - (i) before 27 April 1994; or (ii) on or after 27 April 1994 and who would have been entitled to acquire citizenship by naturalisation prior to that date

candidate
a person who is registered in a category of registration which ultimately leads to registration in a professional category by one of the statutory councils listed in Table 1

cidb
Construction Industry Development Board, established in terms of the Construction Industry Development Board Act of 2000 (Act 38 of 2000)

class of construction works
the class of construction works referred to in Schedule 3 of the Construction Industry Development Regulations 2004, as amended from time to time

contract amount
financial value of the contract at the time of the award of the contract or an order at the time of issue, including value added tax but excluding all allowances and expenses

contract skills development credits
the number of learners employed by the contractor and placed for continuous training opportunities in a three-month period

contract skills development goal (CSDG)
the number of hours or head count of skills development opportunities that a contractor contracts to provide in relation to work directly related to the contract or order, up to:

a) completion, in the case of a professional service contract;
b) the end of the service period, in the case of a service contract; and
c) practical completion, in the case of an engineering and construction works contract

contractor
person or organization that contracts to provide professional services, goods and related services, or engineering and construction works

design and build contract
engineering and construction works contract where both the design and the construction are the responsibilities of the same contractor

employed learner
a learner who was in the employment of an employer prior to the commencement of the contract or execution of the order. Learners deployed from the public sector, other organisations, or other contractors for the purposes of gaining structured workplace learning shall also be considered to be an employed learner, albeit their employer remaining unchanged.

employer
person or organization entering into a contract with the contractor for the provision of professional services, goods and related services, engineering and construction works (commonly referred to as the client)

employer's representative
person authorized to represent the employer in terms of the contract

engineering and construction works contract
contract for the provision of a combination of goods and services arranged for the manufacture, development, extension, refurbishment, rehabilitation or demolition of a fixed asset, including building and engineering infrastructure

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expenses
costs incurred by the contractor in the performance of the contract or order, which are in terms of the contract recoverable from the employer

framework agreement
agreement between an employer and one or more contractors, the purpose of which is to establish the terms of the governing orders to be awarded during a given period, with regard to price and, where appropriate, the quantity envisaged

mentor
a qualified and experienced person, in the case of professionals, registered person, designated to guide a learner or candidate through a structured work experience learning component of a learning programme required for the acquisition of a part or full qualification or professional designation

occupational qualification
occupational qualification registered on the National Qualifications Framework Act (Act No. 67 of 2008)

order
the instruction to carry out construction works, services or professional services under a framework agreement

part qualification
an assessed unit of learning that is registered on the National Qualifications Framework as part of an occupational qualification

practical completion
the state of completion at the end of construction required in terms of an engineering and construction works contract

NOTE: Practical completion is commonly understood to be a state of readiness for occupation of the whole works although some minor work may be outstanding. Practical completion in an engineering and construction works contract occurs when:

a) FIDIC Short Form of Contract: the date when the Employer considers that the Works have been completed in accordance with the Contract, except for minor outstanding work and defects which will not substantially affect the use of the Works for their intended purpose.
b) FIDIC Red, Silver and Yellow Book: the date when the Engineer determines that the Works have been completed in accordance with the contract except for minor outstanding works and defects which will not substantially affect the use of the works for their intended purpose.
c) GCC 2010: the date when the Engineer certifies that the whole or portion of the Works has reached a state of readiness, fit for the intended purpose, and occupation without danger or undue inconvenience to the Employer, although some work may be outstanding.
d) JBCC 2000 Principal Building Agreement and JBCC Minor Works Agreement: the date when the principal agent decides that the completion of the works has substantially been reached and can be used for the purpose intended.
e) NEC3 Engineering and Construction Contract: the date when the Project Manager decides that the Contractor has reached Completion as defined in the contract.
f) NEC3 Engineering and Construction Short Contract: the date when the Employer decides that the Contractor has completed the works in accordance with the Works Information except for correcting notified Defects which do not prevent the Employer from using the works and others from doing their work.

professional category
a category of registration identified in Table 1 or such other category recognised by the Employer in the application of this standard

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Table 1: Categories of registration

Profession	Category of registration	Act
Architectural	Architect, Senior Architectural Technologist, Architectural Technologist or Architectural Draughtsperson	Architectural Profession Act of 2000 (Act No. 44 of 2000)
Construction Health and Safety	Construction Health and Safety Agent, Construction Health and Safety Manager or Construction Health and Safety Officer	Project and Construction Management Professions Act of 2000 (Act No. 48 of 2000)
Construction Project Management	Construction Project Manager	
Construction Management	Construction Manager	
Engineering	Engineer, Engineering Technologist, Engineering Technician or Certificated Engineer	Engineering Profession Act of 2000 (Act No. 46 of 2000)
Landscape Architectural	Landscape Architect, Landscape Technologist, Landscape Technician or Landscape Assistant	Landscape Architectural Profession Act of 2000 (Act No. 45 of 2000)
Planning	Planner or Technical planner	Planning Profession Act, 2002. (Act No. 36 of 2002)
Quantity Surveying	Quantity Surveyor	Quantity Surveying Profession Act of 2000 (Act No. 49 of 2000)
Scientists	Natural Scientists	Natural Scientific Professions Act (Act No. 27 of 2003)
Surveying	Land Surveyor, Engineering Surveyor or Technician Engineering Surveyor	Professional and Technical Surveyors' Act (Act No. 40 of 1984)
Valuers	Valuer or Associate Valuer	Property Valuers Profession Act (Act No. 47 of 2000)

professional fees
financial value of a professional service contract at the time of the award of the contract or an order at the time of issue, excluding value added tax (VAT), allowances and expenses

professional service contract
contract for the provision of services with the skill and care normally delivered by professionals

Sector Education and Training Authority (SETA)
an institution established under section 9 of the Skills Development Act, Act 97 of 1998 and which has the responsibility under this Act to register learners on learning programmes

service contract
contract for the provision of labour or work, including knowledge-based expertise, carried out by hand or with the assistance of equipment and plant

site
means the land or place made available by the employer, for the purposes of the contract or order, on, under, over, in or through which the works or services are to be executed

skills development agency (SDA)
an agency which performs some or all the functions set out in section 4.1.5.

statutory council
a council established as follows:

a) South African Council for the Architectural Profession, established by the Architectural Profession Act of 2000 (Act No. 44 of 2000);
b) South African Council for the Project and Construction Management Professions, established by the Project and Construction Management Professions Act of 2000 (Act No. 48 of 2000);

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c) Engineering Council of South Africa, established by the Engineering Profession Act of 2000 (Act No. 46 of 2000);
d) South African Council for the Landscape Architectural Profession, established by the Landscape Architectural Profession Act of 2000 (Act No. 45 of 2000);
e) South African Council for the Quantity Surveying Profession, established by the Quantity Surveying Profession Act of 2000 (Act No. 49 of 2000);
f) South African Council for Professional and Technical Surveyors, established by the Professional and Technical Surveyors' of 2000 (Act No. 40 of 1984);
g) South African Council for Planners, established by the Planning Professions Act of 2002 (Act No. 32 of 2002);
h) South African Council for Natural Scientific Professions, established by the Natural Scientific Professions Act (Act No. 27 of 2003); or
i) South African Council for the Property Valuers Profession, established by the Property Valuers Profession Act (Act No. 47 of 2000)

structured mentorship
mentorship provided by a person who is registered in a suitable category of professional registration by a professional body or statutory council who leads and directs a candidate towards professional registration

structured workplace learning
component of learning in an occupational qualification or work placement for a trade or professional designation whereby a learner is mentored by a suitably qualified, and where required, registered mentor in the application and integration of the knowledge and practical skills learnt, under supervision, in the actual context of a workplace in accordance with the prescripts set by the relevant qualifying authority, professional body or statutory council

Sub-total
financial value of the all the items in the Bills of Quantities or Schedule of Rates or Pricing Schedule, excluding value added tax, allowances and expenses

supervisor
a supervisor is a person in the particular workplace charged with the responsibility of allocating workplace tasks to a learner that are aligned to the prescriptions of their learning programme and of overseeing and reporting on that learning using a formally agreed record keeping system

Tender sum
the overall pricing figure proposed by a tendering contractor in accordance with the tender pricing document

unemployed learner
a learner who was not in the full-time employment of the contractor prior to the commencement of the contract or execution of the order and is appointed by the contractor or SDA on a limited duration employment contract linked to the prescriptions of a structured workplace learning programme. Their conditions of employment shall not be less favourable than those set out for such learners on learnerships set out in section 18 (3) of the Skills Development Act (Act 97 of 1998)

work integrated learning
the workplace learning component required by learners completing a national diploma or bachelor degree at a University of Technology or Comprehensive University

3 Requirements

3.1 Contract skills development goal (CSDG)

3.1.1 The contractor shall attain or exceed the contract skills development goal in the performance of the contract or the execution of an order.

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3.1.2 The contract skills development goal shall be expressed as in 3.1.2.1 for engineering and construction works, design and build and services contracts, and as in 3.1.2.2 for professional services contracts.

3.1.2.1 In the case of engineering and construction works contracts, design and build contracts and services contracts the contract skills participation goals, expressed in Rand, shall be no less than the sub-total multiplied by a percentage (%) factor given in Table 2 for the applicable class of construction works used in the application of the Construction Industry Development Regulations, issued in terms of the Construction Industry Development Board Act of 2000.

Table 2: Contract skills development goals for different classes of engineering and construction works contracts

Class of construction works as identified in terms of Regulation 25(3) of the Construction Industry Regulations 2004		Construction skills development goal (CSDG) (%)
Designation	**Description**	
CE	Civil engineering	0.25
CE or GB	Civil engineering or General Building	0.375
EE	Electrical Engineering works (buildings)	0.25
EP	Electrical Engineering works (Infrastructure)	0.25
GB	General Building	0.50
ME	Mechanical Engineering works	0.25
SB	Specialist	0.25

Example 1: The sub-total of the tender sum for an engineering and construction works contract in the GB class of construction works is R65,7m. The contract skills development goal in Rands is R65,7m x 0.5% = R328 500.

3.1.2.2 In the case of professional services contracts the contract skills development goals, expressed in hours, shall be not less than the professional fees in millions of Rand multiplied by 150.

Example 2: The contract amount for a professional services contract is R5.6 m. The contract skills development goal in hours is R5.6m x 150 = 840 hours.

3.1.2.3 The number of hours for the contract skills development goal shall be revised as the need arises and be published in a Gazette notice.

3.1.3 Where required in terms of the contract or order, a specified proportion of the learners and candidates shall be selected from persons in the employ of the state who meet the relevant eligibility criteria for the relevant programme.

3.2 Achieving the contract skills development goal (CSDG)

3.2.1 The contractor shall achieve the measurable contract skills development goal by providing opportunities to learners requiring structured workplace learning using one or a combination of any of the following in relation to work directly related to the contract or order:

Method 1: structured workplace learning opportunities for learners towards the attainment of a part or a full occupational qualification;

Method 2: structured workplace learning opportunities for apprentices or other artisan learners towards the attainment of a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012) subject to at least 60% of the artisan learners being holders of public TVET college qualifications;

Method 3: work integrated learning opportunities for University of Technology or Comprehensive University students completing their national diplomas;

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Method 4: structured workplace learning opportunities for candidates towards registration in a professional category by a statutory council listed in Table 1 above.

3.2.2 Employed learners may not account for more than 33 percent of the contract skills development goal.

3.2.3 Not more than one method may be applied to any individual concurrently in the calculation of the contract skills development goal.

NOTE: The principle is that an individual can only be counted once towards the CSDG.

3.3 Contract skills development goal credits

3.3.1 Contract skills development credits will not be awarded for learners enrolled as beneficiaries of other funded or subsidised programmes.

3.3.2 In the case of engineering and construction works, design and build and services contracts:

a) The contract skills development goals shall be granted by multiplying the number of people employed by the contractors and placed for continuous training opportunities in a three-month period by the notional values contained in Table 3, or as revised in a Gazette notice.
b) The contractor may source beneficiaries of the contract skills development goal from the cidb Skills Development Agency (SDA).
c) All beneficiaries of the Standard must be registered with the cidb SDA.

NOTE: The role and function of a cidb SDA is outlined in Annex B

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Table 3: The notional cost of providing training opportunities per quarter

Type of Training Opportunity	Provision for stipends (Unemployed learners only)	Provisions for mentorship	Provisions for additional costs*	Total costs	
				Unemployed learners	Employed learners
Method 1					
Occupational qualification	R7 000	R0	R9 000	R16 000	R9 000
Method 2					
TVET College graduates	R14 000	R0	R9 000	R23 000	N/A
Apprenticeship	R14 000	R0	R12 000	R26 000	R12 000
Method 3					
P1 and P2 learners, or a 240 credits qualification	R24 000	R20 000	R4 500	R48 500	N/A
Method 4					
Candidates with a 360 credits qualification	R37 000	R20 000	R4 500	R61 500	R20 000
Candidates with 480 or more credits qualification	R47 000	R20 000	R4 500	R71 500	R20 000

*Additional provisions include provisions for personal protective equipment, insurance, medical assessments, course fees and trade tools (where applicable) assessment, moderation and monitoring of learners.

NOTE:
i) Where an unemployed learner is employed directly by the contractor, the contractor shall pay the stipend directly to the learner
ii) Where an unemployed learner is sourced through an SDA, training provider or skills development facilitator, the contractor may pay the stipend to the SDA, training provider or skills development facilitator who in turn will pay the learner
iii) The notional cost of providing training opportunities will be reviewed as and when required. The new, revised costs will be published as revised in a Gazette notice.

Example 3: Training Target Calculation for a R65,7m GB contract

Sub-total	R65 700 000
Contract duration	12 Months
CSDG	0,50%
Minimum CSDG target	0,5% x R65 700 000
	R328 500

Skills Types	Number of learners	Notional Cost / Learner / Quarter	Notional cost/learner/year	Total Notional Cost over 12 months Contract
Method 2: Workplace learning opportunities, with unemployed TVET graduates	1	R23 000	R92 000	R92 000
Method 4: Candidacy for an unemployed learner with a 3-year qualification	1	R61 500	R246 00	R246 00
Total	2			R338 000

3.3.3 Credits towards the contract skills development goal for professional services contracts shall be granted by summating the hours of structured workplace learning opportunities provided to P1 and P2 learners as well as professional candidates in accordance with this standard.

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3.3.3.1 No more than 45 hours may be claimed per week for any individual.

3.3.3.2 Contract skills development goal credits shall be reduced to the extent that they fail to comply with the requirements of this standard.

3.4 Denial of credits

Credits towards the contract skills development goal shall be denied, should:

a) the opportunities not be provided on site or the opportunities cannot be directly linked to the contract or order;

b) there be a failure to register all beneficiaries of the Standard with the cidb SDA;

c) there be a failure to submit a copy of the final contract compliance training report, within 30 days of practical completion;

d) the following not be provided:

1) the required contract compliance baseline plan, an interim contract compliance report or a final contract compliance report;

2) the required mentorship plan for a candidate;

3) the required training plan for learners;

4) the training reports covering a period;

5) the required records, specified documents and signatures;

6) the structured mentorship in accordance with the requirements of the applicable professional body, statutory council or qualifying authority;

7) the structured workplace learning, in accordance with the curriculum requirements of the part qualification or occupational qualification or prescription for professional registration for which the learner is registered;

e) conditions of employment and rates of allowances for learners not be in accordance with legislative provisions; and

f) the contractor not maintain the required training records, or an audit reveals that there is insufficient information to substantiate claims for credits.

g) the contractor claims credits for learners enrolled as beneficiaries on programme that is funded or subsidised from another source.

h) the contractor fails to provide sufficient evidence of disciplinary actions taken against a learner who fails to present their interim reports or credentials for assessment, when they have had sufficient structured work experience or structured mentorship to do so.

4 Compliance with requirements

4.1 General

4.1.1 The contractor shall:

a) within 30 days of the contract coming into effect or the issuing of an order, submit to the employer's representative a contract compliance baseline training plan, taking into account the skills mix and type of workers that are to be engaged;

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b) at intervals not exceeding three (3) months, submit to the employer's representative interim contract compliance training reports; and

c) shall within 30 days of reaching completion, end of the service, the delivery date for all work required or practical completion in the case of professional service, design and construct contracts, and engineering and construction works contracts, respectively, submit to the employer's representative a final contract compliance training report

4.1.2 The information contained in the final contract compliance training report shall include the contract skills development goal achieved (in Rands or in hours) in the performance of the contract and a breakdown of the goal achieved in respect of the following:

a) the name and contact details of the SDA, (where applicable)

b) the skills mix and skills types achieved on the contract; and

c) the names, Identity numbers and period of employment of each beneficiary.

4.1.3 The contractor shall keep records of the hours worked and registration particulars in compliance with this standard. The contractor shall allow the employer's representative to inspect or audit such training records at any time.

4.1.4 The employer's representative shall undertake suitable random audits on records to confirm compliance with requirements.

4.1.5 The learners shall be directly employed by the contractor or SDA and the contractor may enter into a contract agreement with the cidb SDAs, training provider or skills development facilitator of their choice, participating in the implementation of this standard, enabling such contractor to:

a) prepare training plans for registered learners, including details of the scope of experiential work to be covered and expected outcomes;

b) register learners with the appropriate Sector Education and Training Authority, established in terms of the Skills Development Act of 2008 (Act 37 of 2008);

c) manage learner registration with appropriate trade testing authorities as well as preparation for the trade test;

d) liaise with the supervisor to monitor onsite training progress of learners;

e) liaise with the supervisor to arrange for summative assessments at appropriate stages of the training; and

f) liaise with the supervisor to prepare reports for the employer or employer's representative.

4.2 Structured workplace learning opportunities for learners

4.2.1 Structured workplace learning opportunities shall be aligned to the curriculum requirements set for the part or full occupational qualification or professional designation for which the learner is registered.

4.2.2 A responsible supervisor will be appointed to allocate learning tasks, under the guidance of a competent person, to learners in line with their training plans.

4.2.3 Supervision associated with structured workplace learning for artisan learners shall be undertaken by an artisan in the applicable trade with a minimum of 3 years of trade specific experience.

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The number of artisan learners supervised by a single supervisor shall, unless otherwise permitted by the National Artisan Moderation Body, not exceed 4 at any one time.

4.2.4 Mentoring associated with structured workplace learning for learners leading to a part or full occupational qualification other than artisan learners shall be undertaken by a person qualified in the applicable discipline and having a minimum of 3 years of post-qualification experience.

4.2.5 The contractor shall, within one month of commencing work directly related to the contract or order and in respect of each learner, submit to the employer's representative,

a) a workplace training plan together with name of the learner's mentor and/or supervisor.

b) proof of registration as a learner with the relevant SETA where applicable;

c) a copy of the mentorship agreement entered into with the learner, or the company mentorship agreement entered into with the relevant qualified agency for method 3 and method 4; and

d) shall, within two weeks of updating and revising the workplace training plan, and at the end of the structured mentorship period, submit to the employer's representative;

(i) a quarterly progress report,

(ii) a final report (including a log of exposure and interactions with the mentor), signed off by the mentor, the supervisor and the learner, demonstrating compliance with requirements,

4.2.6 Learners shall, whenever a substantial activity or training period has been completed, be required by the supervisor to complete training reports required by the relevant qualifying authority.

4.2.7 The mentor and supervisor shall sign off all reports and logbooks to allow the learner to move to other projects or employment and continue the path towards qualification.

4.3 Structured workplace learning for candidates

4.3.1 Mentoring associated with structured workplace learning for candidates shall be in accordance with the prescripts of the relevant professional body or statutory council.

4.3.2 The contractor shall:

a) appoint a supervisor who is actively engaged in work directly associated with the contract to issue tasks, oversee their implementation and provide input to the candidate on an on-going basis;

b) identify a suitable mentor for the candidate. If the contractor does not have an in-house mentor, the contractor shall enter into a mentoring agreement with the candidate and with an external company as required by the professional body or statutory council; and

c) issue each candidate with a portfolio of evidence file which is to be kept up to date with all the documentation issued or prepared including the workplace training plan and all revisions thereof as well as copies of the logbook entries and training experience reports.

4.3.3 The mentor shall from time to time provide an updated workplace training plan for a candidate outlining the activities in which the candidate will be involved, including activities required by the relevant professional body or statutory council. The mentor shall require candidates to maintain a logbook issued by the relevant professional body or statutory council. The mentor shall sign off such logbook at quarterly presentations and progress review meetings.

NOTE: The mentor shall, where the duration of the contract or order exceeds the minimum time to register in a professional category of registration that candidates are exposed to the full range of activities and work towards

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assuming the full level of responsibility recommended by the relevant professional body or statutory council. This may require rotations and secondments.

4.3.4 The contractor shall, in respect of each candidate and within one month of commencing work directly related to the contract or order, submit to the employer's representative,:

a) a workplace training plan, together with name of the candidates' mentor and supervisor;

b) proof of registration, as a candidate, with the relevant professional body or statutory council;

c) a register of all beneficiaries of the Standard, enrolled with the cidb SDA;

d) a copy of the mentorship agreement entered into with the candidate, or the company mentorship agreement entered into with a professional body or statutory council and

e) shall, within two weeks of updating a workplace training plan and at the end of the structured mentorship period, submit to the employer's representative;

(i) quarterly progress reports,
(ii) a final report (including a log of exposure and interactions with the mentor), signed off by the mentor, the supervisor and the learner, demonstrating compliance with requirements,

4.3.5 Candidates shall be required by the mentor to complete training reports required by the relevant professional body or statutory council whenever a substantial activity or training period has been completed.

4.3.6 The mentor and supervisor shall, in the event of the contract ending, sign off all reports and logbooks to allow the candidate to move to other projects or employment.

5 Records

5.1 The contractor shall, in a timely manner and where a prescribed format is available, submit all the documentation required in terms of clause 4.

5.2 The employer's representative shall certify the value of the credits counted towards the contract skills development goal, if any, whenever a claim for payment is issued to the employer, and shall notify the contractor of this amount.

5.3 To satisfy the contract skills development goal, the contractor shall upon termination of the opportunities provided, certify the quantum and nature of the opportunity and shall submit the certificate, counter-certified, issued by the relevant individual to the employer's representative, for record-keeping purposes.

6 Sanctions

In the event that the contractor fails to provide a reasonable explanation to the employer for any failure to achieve the contract skills development goal, the sanctions as provided in the contract or order shall apply.

NOTE: The contract establishes the sanctions that apply. These are set out in a tender evaluation schedule, the scope of work or contract data. Sanctions where tender evaluation points are granted with respect to a tendered CSDG or where a minimum CSDG is specified are usually applied in the form of:

a) financial penalties (low performance damages), typically formulated on the difference between the contracted CSDG and the CSDG achieved in the performance of the contract; and

b) the issuing of completion certificates only after the certificates described in clause 5 are received.

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Annex A: Incorporating this standard in a procurement document

(Informative)

A1 General

A1.1 The following clause should be added to the scope of work of a contract or order to establish requirements:

Skills development requirements

The contractor shall achieve in the performance of the contract the contract skills development goal established in this Standard for developing skills through infrastructure contracts

NOTE: Depending on the context and the form of contract adopted, the term contractor may be changed to "consultant" or "professional service provider" or "supplier" and the term "performance of the contract" may, where the scope of work forms part of an order, be replaced with "execution of an order",.

A1.2 Where an employer requires that employees of the state be seconded to the contractor in order to be provided with structured workplace learning opportunities, in accordance with the provisions of this standard, the following clause should be included in the scope of work:

The specified number of employees of the state is . . . . . The employer must provide a list of persons for selection by the contractor as prescribed in the implementation guidelines. Persons selected by the contractor shall be seconded to the contractor under the terms and conditions prescribed in the implementation guidelines.

A2 Sanctions

In the event that the contractor fails to provide reasonable explanation to the employer for any failure to achieve the contract participation goal , the sanctions as agreed in the contract shall apply.

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Annex B: Role and Function of Skills Development Agency

(Informative)

The Skills Development Agency (SDA) will provide career management and compliance reporting functions for all learners for CSDG compliance in terms of this Standard. Where the contractors provides direct employment to unemployed learners, or enrols their own employees for CSDG compliance, the contractor shall register them with the cidb SDA.

The roles and functions of the Skills Development Agency (SDA) are summarised below.

B1 Career Management and Compliance Reporting

The contractor may enter into a contract agreement with the cidb SDA, training provider or skills development facilitator to manage their learners according to the provisions given below:

a) preparing training plans for registered learners, including details of the scope of experiential work to be covered and expected outcomes;
b) registering learners with the appropriate Sector Educational and Training Authority established in terms of the Skills Development Act of 2008 (Act 37 of 2008);
c) liaising with the supervisor to monitor onsite training progress of learners;
d) liaising with the supervisor to arrange for summative assessments at appropriate stages of the training; and
e) liaising with the supervisor to prepare reports for the employer's representative and cidb at practical completion of the contract.

The relevant training provider or skills development facilitator shall invoice the contractors for the provision of these services as per cost schedule in Table 3.

B2 Employment Intermediary

The cidb SDA may act as an employment intermediary for unemployed learners and may provide contractors with learners qualifying for participation in the CSDG, as well as managing their employment functions such as payment of stipends, workman's compensation, etc.

In such cases, the contractor shall contract directly with an SDA, training provider or skills development facilitator of their choice for the recruitment, placement and management of learners. The contractor shall pay the SDA, training provider or skills development facilitator in accordance with the notional costs provided for in this standard, or as amended by a Gazette.

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PART C4: SITE INFORMATION

C4.1: Site Report

mig | Municipal Infrastructure Grant	
FUNDER	**IMPLEMENTING AGENT & BENEFICIARY**

C4.1: PHOTOGRAPHIC REPORT

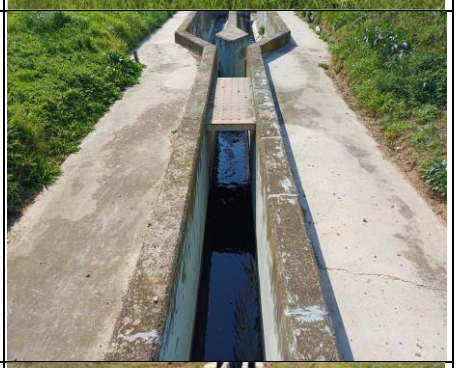
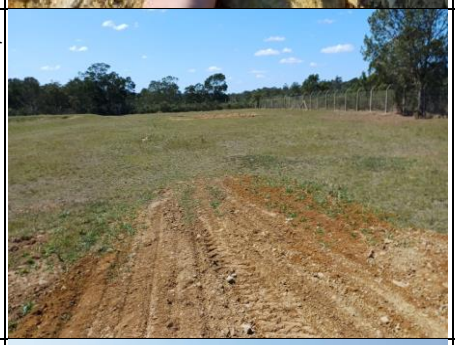
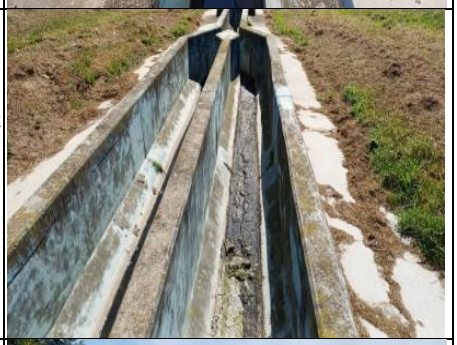
Summary

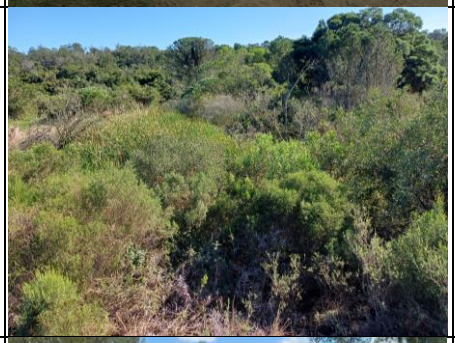
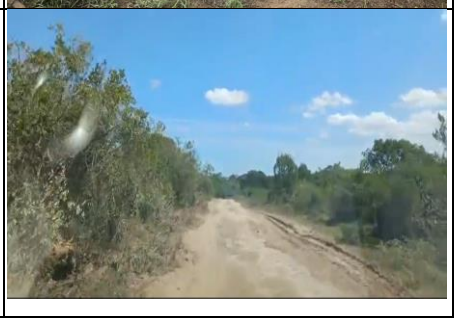
This report aims to provide contextual photographic information for the tender documents regarding Upgrade of Bathurst Wastewater Treatment work.

Each photo will contain a description as well as the actions relating to it according to the Specifications and/or Bill of Quantities.

It must be noted that some of the photographs contained in this report are outdated and are therefore not suitable to make accurate conclusions for tender purposes.

Description: Existing fence **Action:** Replace damaged existing fence to match existing. Take down and dispose damaged existing fence.		**Description:** Access to the WWTW that gets muddy when raining **Action:** Construct gravel road and install new access gate to match existing	
Description: Sewage Pond 1 that overflows to Pond 2 **Action:** Needs to be cleaned and maintenance work is needed. The side wall concrete joints need to be cleaned and sealed		**Description:** Discharge point connected to the inlet works **Action:** Construct gravel road to the side that gets muddy when it's raining	
Description: Sewage Pond 2 that overflows to Pond 3 **Action:** The pond needs to be cleaned, and minor maintenance needs to be done		**Description:** Sewage Pond 3 that has outflow point in the middle of the pond **Action:** Refurbish existing pond, emptying existing ponds, removing sludge, and repairing as needed.	

Description: Inlet canal to Anaerobic **Action:** Demolish apron and wall to construct new canal. Reinforcing and wet to dry concrete treatment must be done.		**Description:** Manhole connecting inlet works and existing ponds **Action:** Remove and dispose unnecessary manhole rings.	
Description: Soil conditions **Action:** Take note		**Description:** Inlet works **Action:** Minor maintenance work is required, and inlet pipe also require flow meter.	
Description: soil conditions **Action:** Some of the soil that is in good condition from excavation will be used for road construction.		**Description:** Emergency overflow canal **Action:** Demolish apron and wall to construct new canal	
Description: This is a proposed site for new Anaerobic and Aerobic Ponds **Action:** Where the major excavation for the ponds will take place		**Description:** Inlet canal **Action:** Minor maintainance work inside the canal.	
Description: New building (pump, chlorination, guard, office, and lab) **Action:** Construct new building and install ancillaries (plumbing, furniture, pipework, mechanical, and electrical.)		**Description:** This is a proposed site for drying beds. **Action:** Construct new drying beds and ancillaries (HDPE liners, pipework, sumps, etc..)	

Description: Fencing **Action:** Demolish, refurbishment, supply and erection of perimeter fencing and gates.		**Description:** Fencing **Action:** Demolish, refurbishment, supply and erection of perimeter fencing and gates.	
Description: Acess road and internal roads **Action:** Upgrade the existing access road and construct internal roads		**Description:** Acess road and internal roads **Action:** Upgrade the existing access road and construct internal roads	
Description: Thick bush below the 3rd existing pond which sewage is currently being disposed to **Action:** Bush to be cleared		**Description:** Manhole that connect the inlet works with dischage point **Action:** Remove and dispose of unnecessary manhole rings. Make good the remaining manhole ring, reconstruct benching. Replace cover, repair arsing damages	
Description: Existing gravel road **Action:** Selected material from excavations will be used to upgrade the gravel road		**Description:** Existing gravel road **Action:** Selected material from excavations will be used to upgrade the gravel road	

C4.2 Drawing Register

Drawings Register

Municipality	NDLAMBE LOCAL MUNICIPALITY	Project Name	UPGRADE OF BATHURST BULK SEWER: WWTW	Project Number	T11/2526

Issue Slip Number and Date Issued
1
2026/02/02

Method Code:
H - By Hard Copy
D - By Disc
E - By Email
DB - By Drop Box

Role	Organisation	For Attention
Contractor:	TBC	TBC
Funder:	COGTA	TBC
Implementing Agent:	Ndlambe Local Municipality	V. Tshangana
Municipality:	Ndlambe Local Municipality	V. Tshangana

Method of Distribution and Number of Copies
E1
E1
E1

Revision Code:
D - Design Drawing
T - Tender Drawing
I - Information Drawing
C - Construction Drawing
R - Record Drawing (As-Built)

Drawing Number	Drawing Name	Scale	Size	Revision Code	Rev	Last Issued
PC20013-CIV-2000	WWTW Combined Service Layout	1:500	A1	TO	TO	2026/02/02
PC20013-CIV-2001	WWTW SDP	1:500	A1	TO	TO	2026/02/02
PC20013-CIV-2101	Ponds Earthworks	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-2102	Drying Beds Earthworks	1:100	A1	TO	TO	2026/02/02
PC20013-CIV-2201	Pond Layout	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-2202	Drying Beds Layout	1:100	A1	TO	TO	2026/02/02
PC20013-CIV-2203	Pond Sections	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2301	Pipe Layout 1 of 2	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-2302	Pipe Layout 2 of 2	1:100	A1	TO	TO	2026/02/02
PC20013-CIV-2303	Pipe Long Sections 1 of 3	1:500	A1	TO	TO	2026/02/02
PC20013-CIV-2304	Pipe Long Sections 2 of 3	1:500	A1	TO	TO	2026/02/02
PC20013-CIV-2305	Pipe Long Sections 3 of 3	1:500	A1	TO	TO	2026/02/02
PC20013-CIV-2401	Anaerobic Pond Layout	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2402	Anaerobic Pond Construction Joints	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2403	Anaerobic Pond Details	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2501	Aerobic Pond layout and Details	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2502	Aerobic Pond Details	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2601	Settling Pond Layout and Details	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2701	Drying Beds Layout and Details	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2702	Drying Beds Details	As Shown	A1	TO	TO	2026/02/02
PC20013-CIV-2801	Internal Road Earthworks	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-2802	Road Details	1:20	A1	TO	TO	2026/02/02
PC20013-CIV-2901	Sewer Details	1:20	A1	TO	TO	2026/02/02
PC20013-CIV-2902	Pipe Details	1:20	A1	TO	TO	2026/02/02
PC20013-CIV-2903	Recycle Suction Pipe Details	1:20	A1	TO	TO	2026/02/02
PC20013-CIV-3201	Pump Room 1 of 4	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-3202	Pump Room 2 of 4	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-3203	Pump Room 3 of 4	1:200	A1	TO	TO	2026/02/02
PC20013-CIV-3204	Pump Room 4 of 4	1:200	A1	TO	TO	2026/02/02

Schedule Number	Schedule Name	Size	Revision Code	Rev	Last Issued

C4.3 Drawings

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

LEGEND:

- AEROBIC SYSTEM
- ANAEROBIC TO DRYING BEDS
- FIRST EXISTING POND TO ANAEROBIC AND AEROBIC PONDS
- FIRST EXISTING POND TO ANAEROBIC AND AEROBIC PONDS
- CHLORINATION SYSTEM
- SUBSOIL DRAIN
- DRYING BEDS TO ANAEROBIC AND AEROBIC
- PUMP ROOM DRAIN
- SEWER
- WATER PIPE
- MANHOLE

PROJECT NUMBER:
PC20013

PROJECT NAME:
UPGRADE OF BATHURST BULK SEWER

CLIENT:
NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
FAX: 086 520 6942
www.newground.co.za

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME:
COMBINED SERVICES LAYOUT

DRAWING NUMBER:
PC20013 / CIV / 2000

DRAWING ISSUED FOR: TENDER

SCALE	PAPER SIZE	REVISION:
1 : 500	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:

PROJECT NUMBER:
PC20013

PROJECT NAME:
UPGRADE OF BATHURST BULK SEWER

CLIENT:
NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

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www.newground.co.za

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 JANUARY 2026

DRAWING NAME:
SITE DEVELOPMENT PLAN

DRAWING NUMBER:
PC20013 / CIV / 2001

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
1 : 500	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:

CONCRETE APRON POINTS

POINT	Y	X	Z
AP01	-3 705 624.611	-14 383.370	226.132
AP02	-3 705 623.422	-14 382.066	226.112
AP03	-3 705 621.568	-14 380.059	226.033
AP04	-3 705 619.530	-14 377.842	225.946
AP05	-3 705 616.024	-14 374.023	225.795
AP06	-3 705 613.973	-14 371.790	225.707
AP07	-3 705 610.411	-14 367.913	225.555
AP08	-3 705 608.361	-14 365.681	225.467
AP09	-3 705 624.699	-14 380.889	226.130
AP10	-3 705 622.850	-14 378.874	226.050
AP11	-3 705 620.805	-14 376.659	225.963
AP12	-3 705 617.299	-14 372.846	225.813
AP13	-3 705 615.256	-14 370.627	225.725
AP14	-3 705 611.676	-14 366.744	225.572
AP15	-3 705 609.634	-14 364.515	225.484
AP16	-3 705 607.786	-14 362.495	225.405
AP17	-3 705 626.529	-14 382.423	224.661
AP18	-3 705 627.236	-14 381.636	226.026
AP19	-3 705 625.692	-14 380.008	226.027
AP20	-3 705 644.676	-14 365.782	225.791
AP21	-3 705 643.070	-14 364.035	225.791
AP22	-3 705 645.475	-14 365.086	225.780
AP23	-3 705 643.840	-14 363.326	225.780
AP24	-3 705 648.537	-14 366.526	225.769
AP25	-3 705 652.708	-14 360.049	225.720
AP26	-3 705 656.948	-14 353.570	225.672
AP27	-3 705 654.552	-14 353.479	225.655
AP28	-3 705 637.591	-14 335.077	224.983
AP29	-3 705 634.858	-14 337.554	225.405
AP30	-3 705 633.566	-14 336.150	225.386
AP31	-3 705 634.057	-14 338.299	225.405
AP32	-3 705 632.743	-14 336.871	225.385
AP33	-3 705 601.607	-14 358.364	225.397
AP34	-3 705 594.838	-14 351.009	225.401
AP35	-3 705 588.066	-14 343.647	225.404
AP36	-3 705 581.304	-14 336.286	225.389
AP37	-3 705 574.516	-14 328.932	225.371
AP38	-3 705 567.747	-14 321.576	225.360
AP39	-3 705 560.991	-14 314.198	225.356
AP40	-3 705 554.214	-14 306.855	225.351

CONCRETE APRON POINTS

POINT	Y	X	Z
AP41	-3 705 547.456	-14 299.484	225.347
AP42	-3 705 545.736	-14 297.626	225.346
AP43	-3 705 538.820	-14 303.988	225.519
AP44	-3 705 531.905	-14 310.329	225.742
AP45	-3 705 531.167	-14 311.023	224.569
AP46	-3 705 529.664	-14 312.394	225.338
AP47	-3 705 524.856	-14 307.163	225.333
AP48	-3 705 520.028	-14 301.924	225.323
AP49	-3 705 527.375	-14 295.163	225.323
AP50	-3 705 534.736	-14 288.388	225.323
AP51	-3 705 542.091	-14 281.619	225.323
AP52	-3 705 549.453	-14 274.846	225.323
AP53	-3 705 556.814	-14 268.079	225.323
AP54	-3 705 564.174	-14 261.358	225.324
AP55	-3 705 568.472	-14 257.386	225.323
AP56	-3 705 575.226	-14 264.740	225.405
AP57	-3 705 582.001	-14 272.099	225.405
AP58	-3 705 588.749	-14 279.455	225.405
AP59	-3 705 595.549	-14 286.792	225.405
AP60	-3 705 602.313	-14 294.150	225.405
AP61	-3 705 609.090	-14 301.508	225.405
AP62	-3 705 615.858	-14 308.869	225.405
AP63	-3 705 622.627	-14 316.227	225.405
AP64	-3 705 629.389	-14 323.589	225.405
AP65	-3 705 636.169	-14 330.952	225.405
AP66	-3 705 642.922	-14 338.317	225.465
AP67	-3 705 649.697	-14 345.702	225.565

AEROBIC POND POINTS

POINT	Y	X	Z
AE01	-3 705 606.615	-14 360.855	225.385
AE02	-3 705 538.915	-14 287.256	225.385
AE03	-3 705 566.792	-14 261.611	225.385
AE04	-3 705 569.789	-14 261.736	225.385
AE05	-3 705 636.052	-14 333.773	225.385
AE06	-3 705 607.027	-14 350.964	221.785
AE07	-3 705 548.806	-14 287.669	221.785
AE08	-3 705 558.831	-14 278.446	221.785
AE09	-3 705 576.316	-14 279.171	221.785
AE10	-3 705 626.163	-14 333.362	221.785

ANAEROBIC POND POINTS

POINT	Y	X	Z
AN01	-3 705 624.727	-14 380.541	222.220
AN02	-3 705 622.628	-14 378.259	221.985
AN03	-3 705 623.216	-14 377.719	221.935
AN04	-3 705 621.409	-14 376.934	221.935
AN05	-3 705 621.997	-14 376.394	221.935
AN06	-3 705 619.310	-14 374.653	222.220
AN07	-3 705 619.141	-14 374.469	222.220
AN08	-3 705 617.044	-14 372.186	221.935
AN09	-3 705 617.632	-14 371.645	221.935
AN10	-3 705 615.824	-14 370.863	221.935
AN11	-3 705 616.414	-14 370.320	221.935
AN12	-3 705 613.725	-14 368.581	222.220
AN13	-3 705 613.556	-14 368.397	222.220
AN14	-3 705 611.460	-14 366.115	221.935
AN15	-3 705 612.048	-14 365.574	221.935
AN16	-3 705 610.241	-14 364.790	221.935
AN17	-3 705 610.829	-14 364.249	221.935
AN18	-3 705 608.141	-14 362.511	222.220
AN19	-3 705 624.749	-14 375.764	221.160
AN20	-3 705 624.072	-14 375.028	221.160

ANAEROBIC POND POINTS

POINT	Y	X	Z
AN21	-3 705 619.163	-14 369.693	221.160
AN22	-3 705 618.486	-14 368.957	221.160
AN23	-3 705 613.578	-14 363.623	221.160
AN24	-3 705 612.901	-14 362.887	221.160
AN25	-3 705 649.401	-14 353.085	221.160
AN26	-3 705 648.724	-14 352.349	221.160
AN27	-3 705 643.815	-14 347.014	221.160
AN28	-3 705 643.138	-14 346.278	221.160
AN29	-3 705 638.230	-14 340.943	221.160
AN30	-3 705 637.554	-14 340.206	221.160
AN31	-3 705 654.163	-14 353.459	222.220
AN32	-3 705 648.747	-14 347.573	222.220
AN33	-3 705 648.577	-14 347.389	222.220
AN34	-3 705 643.160	-14 341.502	222.220
AN35	-3 705 642.991	-14 341.318	222.220
AN36	-3 705 637.575	-14 335.431	222.220
AN37	-3 705 621.576	-14 379.702	221.935
AN38	-3 705 622.681	-14 378.686	221.935
AN39	-3 705 619.884	-14 377.862	221.935
AN40	-3 705 620.988	-14 376.846	221.935

TOP STORMWATER CHANNEL

POINT	Y	X	Z
TC01	-3 705 665.746	-14 351.156	228.910
TC02	-3 705 666.464	-14 350.470	228.910
TC03	-3 705 658.862	-14 343.883	228.696
TC04	-3 705 659.571	-14 343.238	228.697
TC05	-3 705 651.992	-14 336.653	228.483
TC06	-3 705 652.685	-14 335.970	228.483
TC07	-3 705 645.100	-14 329.390	228.269
TC08	-3 705 645.815	-14 328.752	228.270
TC09	-3 705 638.244	-14 322.166	228.057
TC10	-3 705 638.929	-14 321.495	228.056
TC11	-3 705 631.303	-14 314.850	227.841
TC12	-3 705 632.053	-14 314.261	227.843
TC13	-3 705 624.469	-14 307.657	227.630
TC14	-3 705 625.168	-14 307.021	227.630
TC15	-3 705 617.564	-14 300.371	227.415

TOP STORMWATER CHANNEL

POINT	Y	X	Z
TC16	-3 705 618.268	-14 299.734	227.416
TC17	-3 705 610.703	-14 293.146	227.203
TC18	-3 705 611.371	-14 292.495	227.202
TC19	-3 705 603.809	-14 285.899	226.989
TC20	-3 705 604.505	-14 285.241	226.989
TC21	-3 705 596.957	-14 278.656	226.776
TC22	-3 705 597.603	-14 277.991	226.775
TC23	-3 705 590.011	-14 271.356	226.561
TC24	-3 705 590.741	-14 270.725	226.562
TC25	-3 705 583.149	-14 264.107	226.348
TC26	-3 705 583.810	-14 263.440	226.347
TC27	-3 705 576.272	-14 256.869	226.135
TC28	-3 705 576.946	-14 256.234	226.134
TC29	-3 705 572.892	-14 253.341	226.030
TC30	-3 705 573.617	-14 252.680	226.030

SETTLING POND POINTS

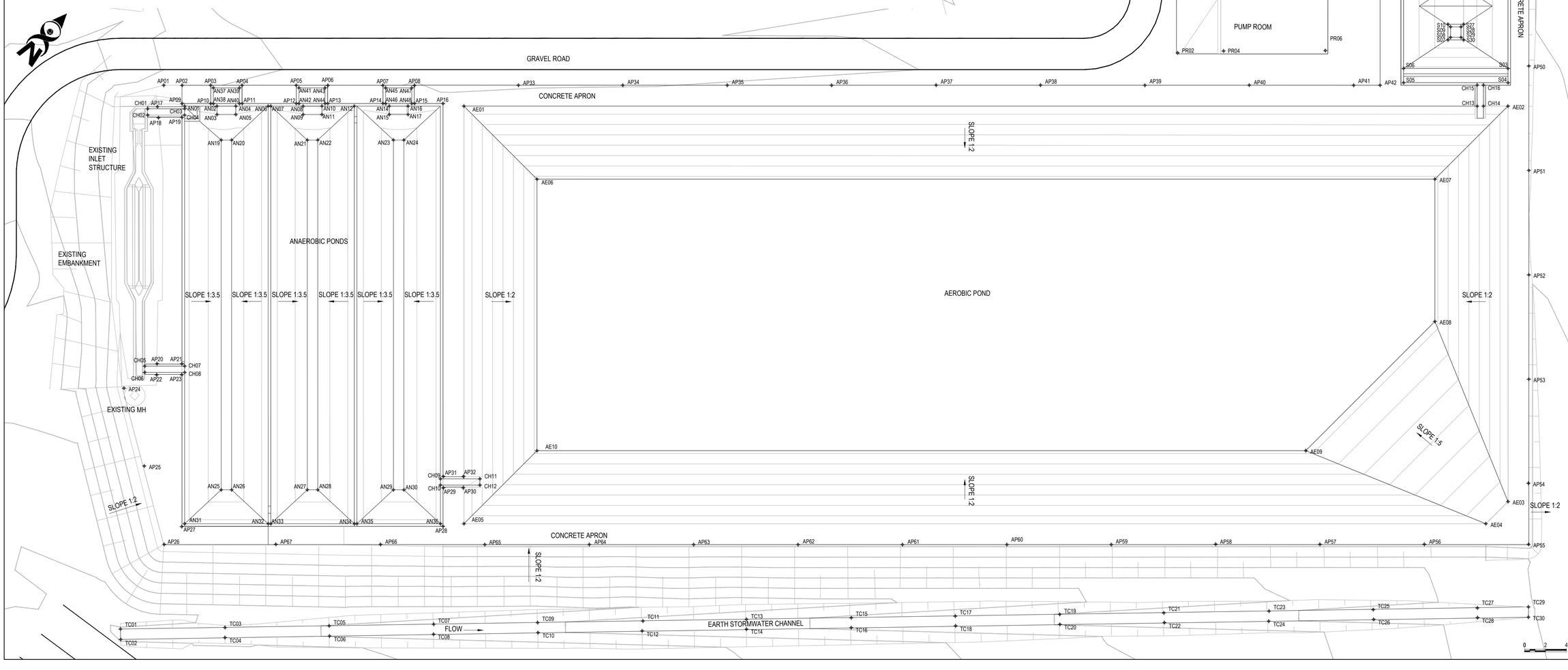
POINT	Y	X	Z
S01	-3 705 529.795	-14 309.232	222.650
S02	-3 705 523.025	-14 301.873	222.650
S03	-3 705 536.262	-14 289.697	222.580
S04	-3 705 537.259	-14 288.774	222.580
S05	-3 705 544.029	-14 296.139	222.580
S06	-3 705 543.032	-14 297.057	222.580
S07	-3 705 538.142	-14 295.780	221.170
S08	-3 705 537.788	-14 295.766	220.620
S09	-3 705 537.052	-14 296.443	220.620
S10	-3 705 537.038	-14 296.796	221.080
S11	-3 705 534.476	-14 299.152	221.080
S12	-3 705 534.123	-14 299.137	220.620
S13	-3 705 533.387	-14 299.814	220.620
S14	-3 705 533.372	-14 300.167	221.080
S15	-3 705 530.782	-14 302.550	221.080
S16	-3 705 530.429	-14 302.536	220.620
S17	-3 705 529.693	-14 303.213	220.620
S18	-3 705 529.678	-14 303.566	221.170
S19	-3 705 528.662	-14 302.461	221.170
S20	-3 705 529.016	-14 302.477	220.620
S21	-3 705 529.752	-14 301.800	220.620
S22	-3 705 529.766	-14 301.446	221.080
S23	-3 705 532.357	-14 299.063	221.080
S24	-3 705 532.710	-14 299.078	220.620
S25	-3 705 533.446	-14 298.401	220.620

SETTLING POND POINTS

POINT	Y	X	Z
S26	-3 705 533.461	-14 298.048	221.080
S27	-3 705 536.022	-14 295.692	221.080
S28	-3 705 536.375	-14 295.707	220.620
S29	-3 705 537.111	-14 295.030	220.620
S30	-3 705 537.126	-14 294.675	221.170

CHANNEL POINT TABLE

POINT	Y	X	Z
CH01	-3 705 627.307	-14 382.972	224.670
CH02	-3 705 627.749	-14 382.566	224.670
CH03	-3 705 624.915	-14 380.367	224.630
CH04	-3 705 625.356	-14 379.961	224.630
CH05	-3 705 645.635	-14 366.491	225.900
CH06	-3 705 646.076	-14 366.084	225.900
CH07	-3 705 643.051	-14 363.682	224.630
CH08	-3 705 643.492	-14 363.276	224.630
CH09	-3 705 634.413	-14 338.341	224.460
CH10	-3 705 634.853	-14 337.936	224.460
CH11	-3 705 631.854	-14 335.556	224.410
CH12	-3 705 632.294	-14 335.151	224.410
CH13	-3 705 540.912	-14 289.427	224.630
CH14	-3 705 540.506	-14 288.985	224.630
CH15	-3 705 539.436	-14 290.787	224.590
CH16	-3 705 539.030	-14 290.345	224.590
CH17	-3 705 530.405	-14 309.010	224.570
CH18	-3 705 529.964	-14 309.417	224.570
CH19	-3 705 559.399	-14 341.617	224.400
CH20	-3 705 559.843	-14 341.219	224.400



NOTES:

APPLICABLE STANDARDS:

- SANS 1200 DA - EARTHWORKS
- SANS 1200 DB - EARTHWORKS (PIPE TRENCHING)
- SANS 1200 L - MEDIUM-PRESSURE PIPELINES
- SANS 1200 LB - BEDDING (PIPES)
- SANS 1200 LD - SEWERS
- SANS 1200 LE- STORMWATER DRAINAGE
- SANS 1200 GA - CONCRETE
- SANS 1200 MK - KERBING AND CHANNELING

NOTES:

1. TENDER DRAWING TAKE PREFERENCE OVER INFORMATION DRAWING.
2. CONSTRUCTION DRAWINGS TO TAKE PREFERENCE OVER TENDER AND INFORMATION DRAWINGS.

GENERAL NOTES:

1. ALL CIVIL AND STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT.
2. ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
3. ALL SET OUT DIMENSIONS SHOWN ON THESE DRAWINGS TO BE VERIFIED BY THE CONTRACTOR ON SITE
4. DIMENSIONS MUST NOT BE SCALED OR MEASURED FROM DRAWING. IF ANY INFORMATION IS MISSING OR REQUIRED, PLEASE CONTACT THE ENGINEER.
5. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
6. FINAL POSITION OF SERVICES MUST BE DETERMINED ON SITE.
7. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT CURRENT SOUTH AFRICAN NATIONAL STANDARDS AND WITH THE SOUTH AFRICAN NATIONAL BUILDING REGULATIONS.
8. THE CONTRACTOR SHALL COMPLY WITH THE OCCUPATIONAL HEALTH & SAFETY ACT AT ALL TIMES.
9. CONTRACTOR TO CONDUCT HIS OWN QUALITY CONTROL BEFORE CALLING THE ENGINEER FOR INSPECTION.
10. CONTRACTOR TO CHECK ALL DIMENSIONS AND LEVELS ON SITE AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE CONSTRUCTION COMMENCES.
11. THE METHOD OF CONSTRUCTION AND THE MAINTENANCE OF SAFETY DURING CONSTRUCTION IS THE RESPONSIBILITY OF THE CONTRACTOR. IF ANY ELEMENT PRESENTS DIFFICULTY IN RESPECT OF BEING CONSTRUCTIBLE OR SAFE, THE MATTER SHALL BE REFERRED TO THE ENGINEER FOR RESOLUTION BEFORE PROCEEDING WITH THE WORK.
12. DURING CONSTRUCTION, THE STRUCTURE IS TO BE MAINTAINED IN A STABLE CONDITION AND NO PART IS TO BE OVERLOADED.
13. THE CONTRACTOR SHALL PROVIDE TEMPORARY BRACING, SHORING AND PROPPING IN ORDER TO KEEP THE BUILDING WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
14. THE CONTRACTOR IS RESPONSIBLE FOR THE ADEQUACY OF ALL TEMPORARY WORKS INCLUDING SHORING, PROPPING AND BRACING AND WHERE NECESSARY IS TO ENGAGE A STRUCTURAL ENGINEER TO DESIGN AND CERTIFY HIS TEMPORARY WORKS.
15. IF THERE IS A DISCREPANCY IN MEMBER SIZES FOR ANY COMPONENT, ASSUME FOR PRICING PURPOSES ONLY THAT THE LARGER OR MORE EXPENSIVE SIZE IS CORRECT. REFER TO THE ENGINEER FOR DECISION BEFORE DETAILING OR CONSTRUCTION.
16. THE CONTRACTOR IS REQUIRED TO NOTIFY AND ALLOW TIME FOR THE ENGINEER TO INSPECT AT THE FOLLOWING:
    - COMPLETED EXCAVATION, FORMWORK, REINFORCEMENT, MEMBRANES, EMBEDMENT AND CAST IN ITEMS PRIOR TO PLACING OF CONCRETE.
    - COMPLETED STRUCTURAL ELEMENTS PRIOR TO COVERING.
17. AT LEAST 48 HOURS NOTICE IS REQUIRED FOR INSPECTION. ALL WORK TO BE INSPECTED MUST BE COMPLETED PRIOR TO THE TIME OF INSPECTION.
18. SITE INSPECTIONS DO NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR THE COMPLETENESS AND CORRECTNESS OF HIS WORK.
19. THE CONTRACTOR IS TO ALLOW TIME AND PROVIDE SITE ACCESS FOR THE INSPECTION TO TAKE PLACE AND IS TO HAVE A RESPONSIBLE SITE FOREMAN AVAILABLE TO RECEIVE ANY COMMENT OR DIRECTION FROM THE ENGINEER.
20. INSPECTIONS SHALL BE PERIODIC AND REPRESENTATIVE AND WILL NOT NECESSARILY BE MADE OF ALL WORKS. ELECTION TO INSPECT. OR OTHERWISE WILL BE AT THE ENGINEER'S DISCRETION. THE CONTRACTOR IS TO ALLOW TIME AND PROVIDE SITE ACCESS FOR THE INSPECTION TO TAKE PLACE AND IS TO HAVE A RESPONSIBLE SITE FOREMAN AVAILABLE TO RECEIVE ANY COMMENT OR DIRECTION FROM THE ENGINEER.

PROJECT NUMBER:
PC20013

PROJECT NAME:
UPGRADE OF BATHURST BULK SEWER

CLIENT:
NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS:

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

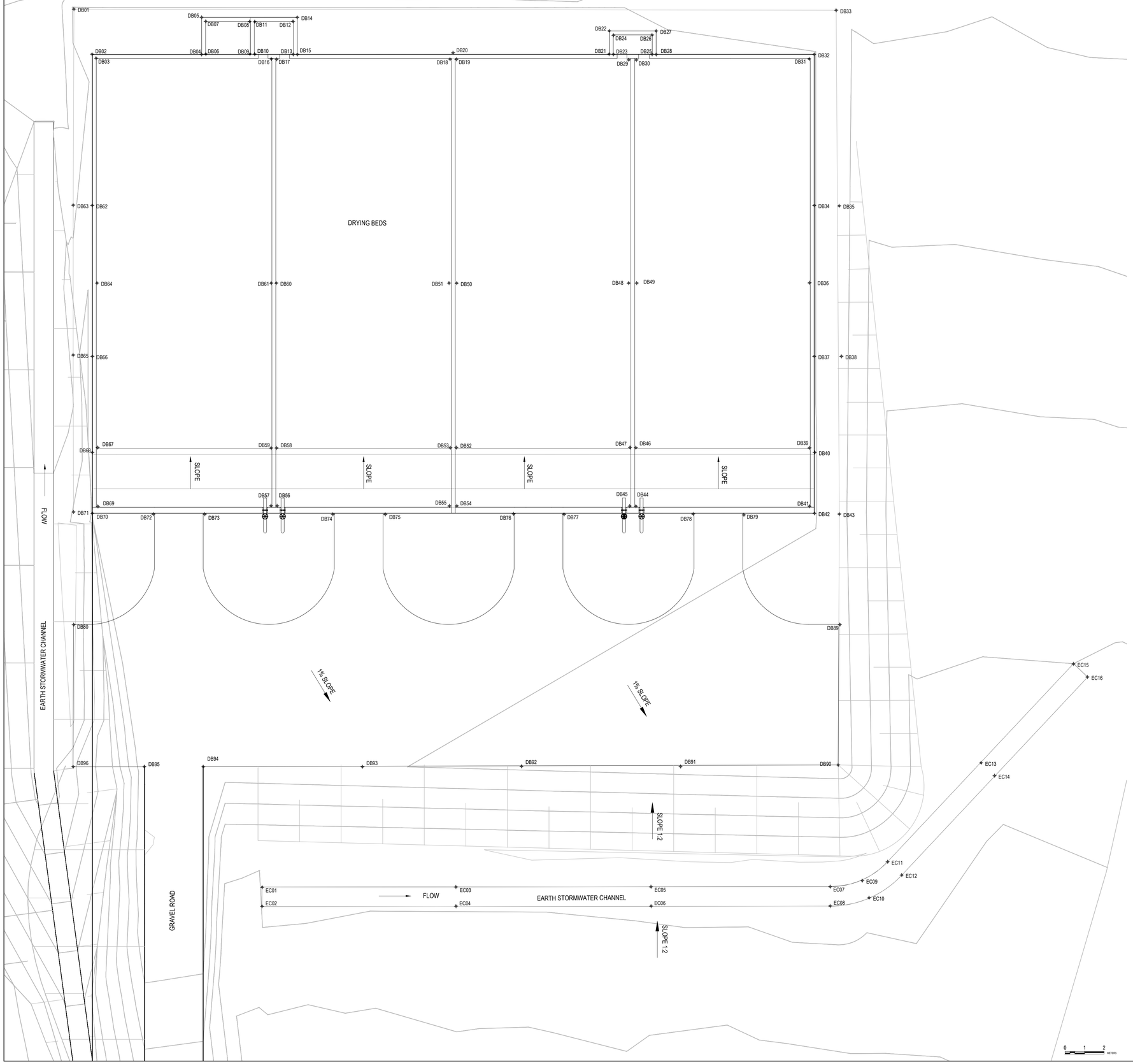
DRAWING NAME:
PONDS EARTHWORKS LAYOUT

DRAWING NUMBER:
PC20013 / CIV / 2101

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
1 : 200	A1	00

APPROVED BY ENGINEER:
SIGNATURE: DATE:



DRYING BEDS POINTS

POINT	Y	X	Z
DB01	14 396.594	3 705 478.749	220.520
DB02	14 394.346	3 705 479.818	220.520
DB03	14 394.053	3 705 479.831	219.470
DB04	14 390.208	3 705 476.025	220.520
DB05	14 391.489	3 705 474.628	220.520
DB06	14 390.060	3 705 475.865	219.320
DB07	14 391.193	3 705 474.635	219.320
DB08	14 389.527	3 705 473.119	219.320
DB09	14 388.395	3 705 474.333	219.320
DB10	14 388.212	3 705 474.173	217.460
DB11	14 389.333	3 705 472.949	217.460
DB12	14 387.896	3 705 471.611	217.460
DB13	14 386.752	3 705 472.843	217.460
DB14	14 387.882	3 705 471.309	220.520
DB15	14 386.594	3 705 472.701	220.520
DB16	14 387.418	3 705 473.777	219.470
DB17	14 387.207	3 705 473.607	219.470
DB18	14 380.666	3 705 467.581	219.470
DB19	14 380.418	3 705 467.366	219.470
DB20	14 380.775	3 705 467.238	220.520
DB21	14 374.842	3 705 461.872	220.520
DB22	14 375.639	3 705 460.991	220.520
DB23	14 374.674	3 705 461.729	218.774
DB24	14 375.333	3 705 461.008	218.658
DB25	14 373.214	3 705 460.385	218.644
DB26	14 373.883	3 705 459.660	218.644
DB27	14 373.866	3 705 459.366	220.520
DB28	14 373.054	3 705 460.250	220.520
DB29	14 373.902	3 705 461.408	219.470
DB30	14 373.612	3 705 461.148	219.470
DB31	14 367.124	3 705 455.108	219.470
DB32	14 367.093	3 705 454.763	220.519
DB33	14 367.795	3 705 452.337	220.214
DB34	14 361.851	3 705 460.452	220.518
DB35	14 360.896	3 705 459.609	220.251
DB36	14 359.345	3 705 463.539	219.470
DB37	14 356.617	3 705 466.146	220.519
DB38	14 355.594	3 705 465.206	220.287
DB39	14 353.624	3 705 469.767	219.470
DB40	14 353.269	3 705 469.753	220.516
DB41	14 351.597	3 705 471.965	220.260
DB42	14 351.163	3 705 472.060	220.518
DB43	14 350.202	3 705 471.224	220.328
DB44	14 358.147	3 705 477.988	220.259
DB45	14 358.389	3 705 478.200	220.257
DB46	14 360.182	3 705 475.784	219.470
DB47	14 360.408	3 705 475.976	219.470
DB48	14 366.161	3 705 469.829	219.470
DB49	14 365.860	3 705 469.548	219.470
DB50	14 372.646	3 705 475.798	219.470
DB51	14 372.940	3 705 476.061	219.470
DB52	14 366.960	3 705 482.010	219.470
DB53	14 367.181	3 705 482.221	219.470
DB54	14 364.915	3 705 484.193	220.255
DB55	14 365.194	3 705 484.449	220.254
DB56	14 371.698	3 705 490.427	220.253
DB57	14 371.930	3 705 490.636	220.252
DB58	14 373.730	3 705 488.265	219.470
DB59	14 373.930	3 705 488.452	219.470
DB60	14 379.458	3 705 482.055	219.470
DB61	14 379.648	3 705 482.233	219.470
DB62	14 389.094	3 705 485.514	220.518
DB63	14 389.821	3 705 486.163	220.436
DB64	14 386.220	3 705 488.277	219.470
DB65	14 384.626	3 705 491.816	220.373
DB66	14 383.853	3 705 491.203	220.519
DB67	14 380.494	3 705 494.455	219.470
DB68	14 380.523	3 705 494.826	220.519
DB69	14 378.440	3 705 496.666	220.261
DB70	14 378.409	3 705 497.122	220.519
DB71	14 379.167	3 705 497.722	220.328
DB72	14 376.077	3 705 495.033	220.520
DB73	14 374.139	3 705 493.252	220.520
DB74	14 369.301	3 705 488.807	220.520
DB75	14 367.322	3 705 486.993	220.520
DB76	14 362.496	3 705 482.522	220.520
DB77	14 360.576	3 705 480.787	220.520
DB78	14 355.716	3 705 476.292	220.520
DB79	14 353.777	3 705 474.570	220.520
DB80	14 375.251	3 705 501.965	220.384
DB81	14 372.234	3 705 499.245	220.520
DB82	14 370.298	3 705 497.523	220.520
DB83	14 365.485	3 705 493.088	220.520
DB84	14 363.452	3 705 491.298	220.520
DB85	14 358.669	3 705 486.810	220.520
DB86	14 356.738	3 705 484.976	220.518
DB87	14 351.937	3 705 480.583	220.449
DB88	14 349.831	3 705 478.705	220.418
DB89	14 346.350	3 705 475.372	220.268
DB90	14 341.543	3 705 480.724	220.197
DB91	14 347.436	3 705 486.253	220.276
DB92	14 353.441	3 705 491.766	220.357
DB93	14 359.433	3 705 497.302	220.438
DB94	14 365.434	3 705 502.826	220.520
DB95	14 367.660	3 705 504.869	220.395
DB96	14 370.348	3 705 507.340	220.243

EAST STORMWATER CHANNEL

POINT	Y	X	Z
EC01	-3 705 505.326	-14 359.035	222.260
EC02	-3 705 506.048	-14 358.377	222.260
EC03	-3 705 498.593	-14 351.734	222.192
EC04	-3 705 499.315	-14 351.065	222.192
EC05	-3 705 491.816	-14 344.379	222.123
EC06	-3 705 492.541	-14 343.705	222.123
EC07	-3 705 485.591	-14 337.622	222.060
EC08	-3 705 486.320	-14 336.952	222.060
EC09	-3 705 484.251	-14 336.624	222.060
EC10	-3 705 484.662	-14 335.771	222.060
EC11	-3 705 482.660	-14 336.319	222.060
EC12	-3 705 482.672	-14 335.328	222.060
EC13	-3 705 475.685	-14 336.225	222.030
EC14	-3 705 475.703	-14 335.271	222.030
EC15	-3 705 468.750	-14 336.170	222.000
EC16	-3 705 468.760	-14 335.189	222.000

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

EARTHWORK NOTES:

1. ALL CUT AND FILL SLOPES TO BE 1:3 UNLESS OTHERWISE INDICATED
2. ALL EARTHWORKS TO BE CARRIED OUT ACCORDING TO SANS 2001-BE1
3. FILL SHALL BE COMPACTED IN LAYERS OF NO MORE THAN 150mm AND TO A DENSITY OF NOT LESS THAN 93% MOD AASHTO, UNLESS OTHERWISE SPECIFIED.
4. COMPACTION TESTS TO BE CARRIED OUT ON EVERY COMPLETED LAYER. RESULTS TO BE SUBMITTED TO ENGINEER FOR APPROVAL. THE POSITIONS OF THE COMPACTION TESTS TO BE DETERMINED BY THE ENGINEER.
5. ALL LEVELS ARE FINAL LEVELS.
6. EARTHWORKS FOR RAMPS TO BE SHAPED AS REQUIRED DURING CONSTRUCTION TO MAINTAIN REQUIRED SLOPES.
7. RAMPS TO HAVE A MINIMUM SLOPE OF 1:12
8. IF REMOVED IN-SITU MATERIAL IS OF SUITABLE QUALITY SUCH AS COHESIONLESS SAND OR G7 MATERIAL OR BETTER, THE IN-SITU MATERIAL MAY BE USED AS FILL MATERIAL.
9. IF COHESIONLESS SAND IS USED, COMPACT TO 100% MOD AASHTO.
10. IF G7 MATERIAL IS USED, COMPACT TO 98% MOD AASHTO.
11. TEMPORARY BANK SLOPES ARE AS FOLLOWS:
    - CUT - 1 : 2
    - FILL - 1 : 2
12. MATERIAL FROM EXCAVATIONS MUST BE TESTED AND APPROVED BY THE ENGINEER BEFORE USING AS FILL.
13. DCP TESTS ARE TO BE CARRIED OUT AFTER THE TRENCH EXCAVATIONS AT ALL BEAM CORNERS AND JUNCTIONS. SOIL WITH PENETRATION RATES EXCEEDING 20mm/BLOW IS TO BE REMOVED AND REPLACED WITH G7 MATERIAL COMPACTED TO 95% MOD

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS:

DESIGNER: G TESELING
DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE
DATE: 2 FEBRUARY 2026

DRAWING NAME: DRYING BEDS EARTHWORKS

DRAWING NUMBER: PC20013 / CIV / 2102

DRAWING ISSUED FOR: TENDER

SCALE: 1 : 100
PAPER SIZE: A1
REVISION: 00

APPROVED BY ENGINEER:

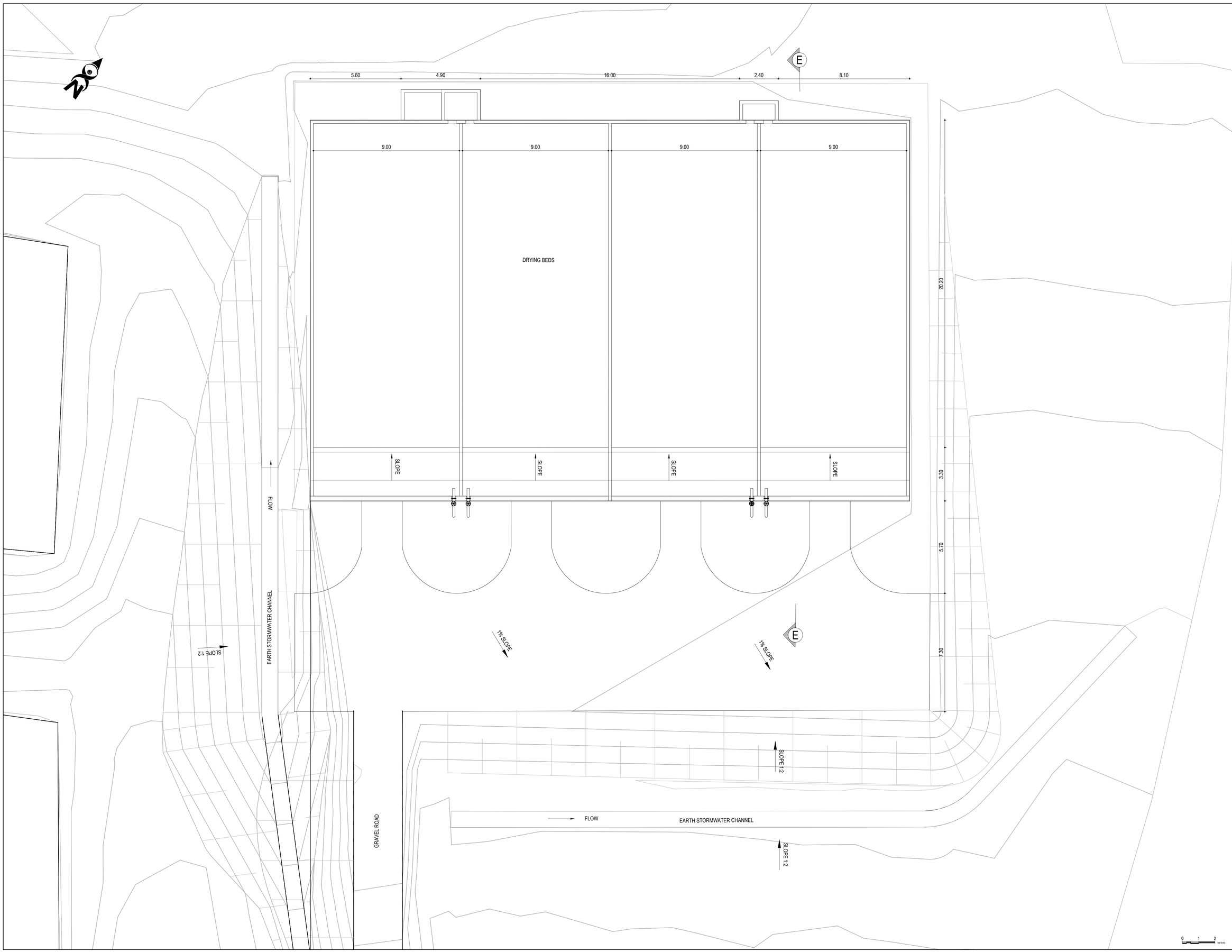
SIGNATURE:
DATE:

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

EXISTING POND
SLOPE 1%
GRAVEL ROAD
SLOPE 1:2
SLOPE 1:2
FLOW
NEW CHANNEL
SETTLING POND
SLOPE 1:2
14.25
2.00
10.50
1.75
2.00
1.00
1.05
CHLORINATION
PUMP ROOM
10.49
3.00
14.50
7.00
SLOPE 1:2
SLOPE 1:3
SLOPE 1:3
CONCRETE APRON
19.84
2.00
3.41
2.00
0.60
2.00
25.0
0.25 2.5 3.0 2.5 0.25 2.5 3.0 2.5 0.25 2.5 3.0 2.50 0.25
SLOPE
1.75
1.75
1.75
2.00
CONCRETE APRON
2.06
1.00
3.29
SLOPE 1:2
EXISTING INLET STRUCTURE
EXISTING EMBANKMENT
2.80
ANAEROBIC PONDS
86.00
AEROBIC POND
65.69
SLOPE 1:3.5
SLOPE 1:3.5
SLOPE 1:3.5
SLOPE 1:3.5
SLOPE 1:3.5
SLOPE 1:3.5
SLOPE 1:2
SLOPE 1:2
40.50
40.00
26.00
40.00
3.57
1.00
EXISTING MH
14.50
17.50
SLOPE 1:5
3.78
0.60
3.50
SLOPE 1:2
SLOPE 1:2
SLOPE 1:2
3.00
SLOPE
1.75
CONCRETE APRON
2.00
1.75
25.00
2.00
SLOPE 1:2
100.00
130.75
2.00
FLOW
EARTH STORMWATER CHANNEL
0 2 4 METRES

PROJECT NUMBER:	PC20013
PROJECT NAME:	UPGRADE OF BATHURST BULK SEWER
CLIENT:	NDLAMBE MUNICIPALITY
CIVIL & STRUCTURAL ENGINEER:	NEWGROUND PROJECTS 17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201 PO Box 19568, Tecoma, 5214 TEL: 043 722 5864 FAX: 086 520 6942 www.newground.co.za
REFERENCE DRAWINGS	
REVISIONS: REV / DATE / DESCRIPTION	
DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026
DRAWING NAME:	PONDS LAYOUT
DRAWING NUMBER:	PC20013 / CIV / 2201
DRAWING ISSUED FOR:	TENDER
SCALE: 1 : 200	PAPER SIZE: A1
REVISION:	00
APPROVED BY ENGINEER:	
SIGNATURE:	DATE:



NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

PROJECT NUMBER:
PC20013

PROJECT NAME:
UPGRADE OF BATHURST BULK SEWER

CLIENT:
NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
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PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
FAX: 086 520 6942
www.newground.co.za

PC0000/STR/3000 - DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION
01	26.06.2019	XXX

REVISIONS

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

DRAWING NAME:
DRYING BEDS LAYOUT

DRAWING NUMBER:
PC20013 / CIV / 2202

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
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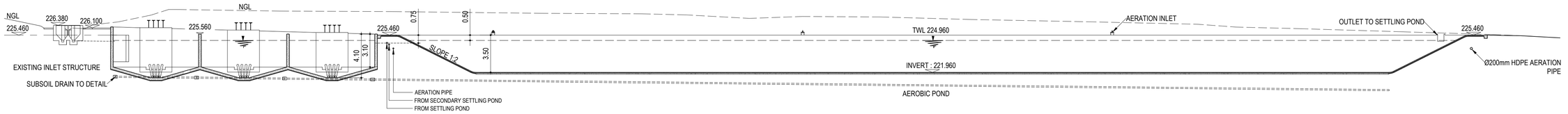
APPROVED BY ENGINEER:

SIGNATURE: DATE:



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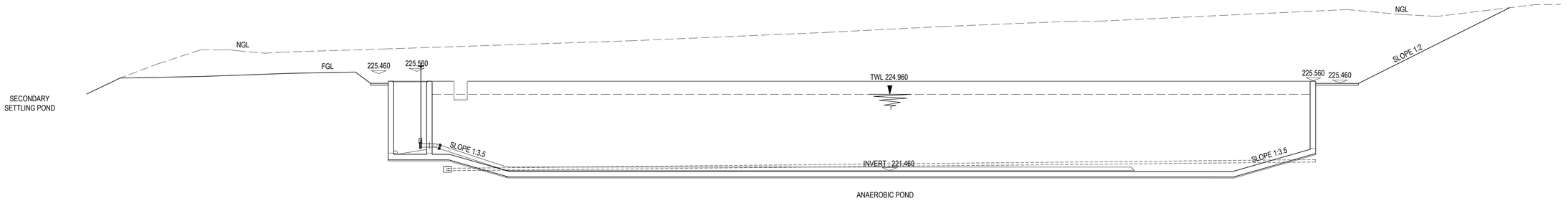
SCALE 1:200



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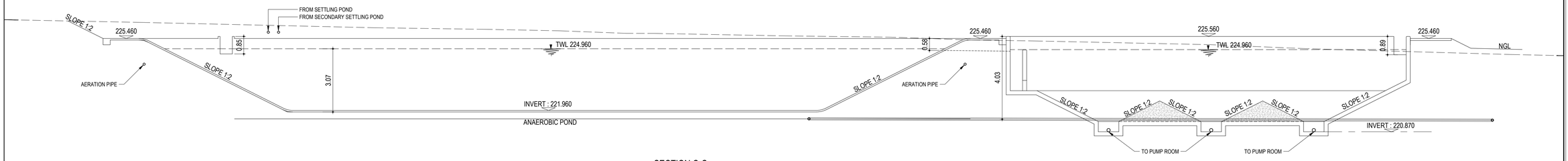
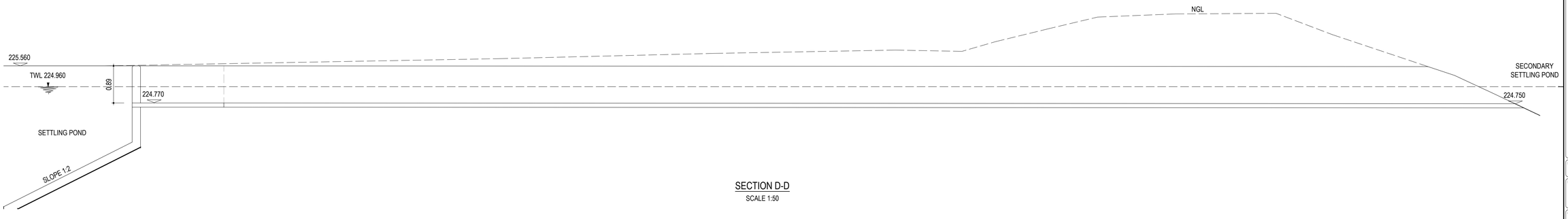
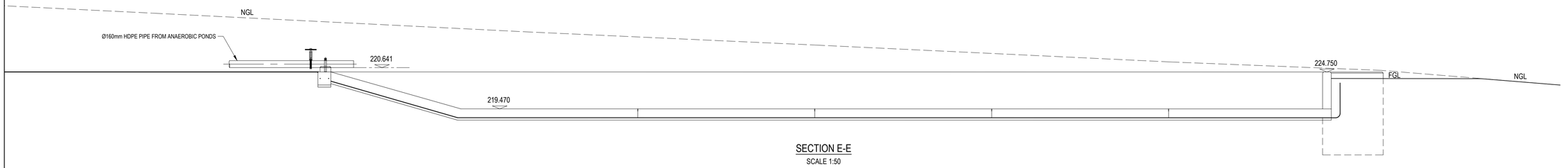
SCALE 1:100



SECTION C-C
SCALE 1:100



SECTION D-D
SCALE 1:50



SECTION E-E
SCALE 1:50

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
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PC0000/STR/0000 - DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION
01	26.06.2019	XXX

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 JANUARY 2026

DRAWING NAME: POND SECTIONS

DRAWING NUMBER: PC20013 / CIV / 2203

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
AS SHOWN	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:

FIRST EXISTING POND

Ø 50mm HDPE PN10

Ø 160mm HDPE PN10
Ø 110mm HDPE PN10
Ø 160mm HDPE PN10

GRAVEL ROAD

Ø 110 mm uPVC CLASS 6

MH08

Ø 110 mm uPVC CLASS 6

SETTLING POND

Ø 110 mm HDPC OPEN LATTICE

NEW CHANNEL

Ø 160mm HDPE PN10
Ø 50mm HDPE PN6
Ø 110mm HDPE PN10

MH04

MH03

MH07

Ø 110 mm uPVC CLASS 6

CHLORINATION

PUMP ROOM

Ø 160mm HDPE PN10
Ø 160mm HDPE PN10
Ø 160mm HDPE PN10
Ø 160mm HDPE PN10

MH01

MH02

Ø 110mm HDPE PN10
Ø 160mm HDPE PN10
Ø 160mm HDPE PN10
Ø 110mm HDPE PN10
Ø 110mm HDPE PN10
Ø 160mm HDPE PN10
Ø 110mm HDPE PN10
Ø 110mm HDPE PN10

GRAVEL ROAD

Ø 50mm HDPE PN10
Ø 110mm HDPE PN10
Ø 110mm HDPE PN10

Ø 110mm HDPE PN10

Ø 160mm HDPE PN10

Ø 200mm HDPE PN10

Ø 200mm HDPE PN10

Ø 110 mm HDPE OPEN LATTICE

Ø 110 mm HDPC OPEN LATTICE

EXISTING
INLET
STRUCTURE

Ø 110 mm HDPE OPEN LATTICE
Ø 160mm HDPE PN10
Ø 110 mm HDPE OPEN LATTICE
Ø 160mm HDPE PN10
Ø 110 mm HDPE OPEN LATTICE
Ø 160mm HDPE PN10
Ø 110 mm HDPE OPEN LATTICE
Ø 110mm HDPE PN10
Ø 110mm HDPE PN10

AEROBIC POND

Ø 200mm HDPE PN10

EXISTING MH

ANAEROBIC PONDS

Ø 110mm HDPE PN10
Ø 160mm HDPE PN10
Ø 200mm HDPE PN10

STORMWATER CHANNEL

0 2 4 METERS

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102

LEGEND:

- AEROBIC SYSTEM
- ANAEROBIC TO DRYING BEDS
- SETTLING POND TO ANAEROBIC AND AEROBIC PONDS
- FIRST EXISTING POND TO ANAEROBIC AND AEROBIC PONDS
- CHLORINATION SYSTEM
- SUBSOIL DRAIN
- DRYING BEDS TO ANAEROBIC AND AEROBIC
- PUMP ROOM DRAIN
- SEWER
- WATER PIPE
- MANHOLE

PIPELINE NOTES:

1. Ø REFERS TO THE NOMINAL DIAMETER OF THE PIPES.
2. PIPES WITH A GRADE STEEPER THAN 1:10 MUST HAVE ANCHOR BLOCKS.
3. ONLY REINFORCED CONCRETE PIPES WITH RUBBER RING SEALS ARE PERMITTED. INTERLOCKING JOINT (OGEE) PIPES SHALL NOT BE USED.
4. PRECAST CONCRETE PIPE UNITS TO COMPLY WITH SABS 677.
5. WHERE CUTTING OF PIPES ARE REQUIRED, THE PIPE MUST BE NEATLY CUT, WITH ANY EXPOSED REINFORCEMENT BEING ADEQUATELY TREATED AND PROTECTED AGAINST CORROSION.
6. EXCAVATION AND BACKFILLING OF TRENCHES TO COMPLY WITH SABS 1200 DB.
7. BEDDING OF PIPES TO COMPLY WITH SABS 1200 LB.
8. CLASS C BEDDING SHOULD BE PROVIDED FOR ALL STORMWATER PIPES.
9. BEDDING SHOULD BE TO A CLASS AS SPECIFIED BY THE ENGINEER. IN THE ABSENCE OF ENGINEERING INSTRUCTIONS, IT IS ADVISABLE TO USE A BEDDING CLASS FOR FLEXIBLE PIPES IN ACCORDANCE WITH SABS 1200 LB WHERE UNDER TRAFFIC LOAD AND A CLASS C BEDDING ELSEWHERE.
10. TRENCHES DEEPER THAN 1000mm IN CERTAIN TYPES OF MATERIAL MAY BE REQUIRED TO BE CHAMFERED TO PREVENT ACCIDENTAL INJURY FROM COLLAPSING SIDEWALLS.
11. TRENCH BOTTOMS TO BE FREE FROM STONES, PROJECTIONS, SOFT SPOTS, AND BE REASONABLY UNIFORM AND GRADED TO FALL.
12. BACKFILL TO BE DONE AS THE PIPE LAYING PROGRESSES AND A 300mm SECTION TO BE LEFT EXPOSED ON EITHER SIDE OF JOINTS FOR TESTING.
13. BACKFILL TO BE COMPACTED IN LAYERS NO MORE THAN 150mm TO 93% MOD AASHTO.
14. A MINIMUM COVER OF 600mm IS REQUIRED TO TOP OF ALL PIPES. THE ENGINEER TO BE NOTIFIED OF ANY SECTION OF PIPELINE WHERE THE COVER IS LESS THAN THE PRESCRIBED 600mm.
15. ALL HORIZONTAL AND VERTICAL BENDS TO HAVE THRUST BLOCKS.
16. SEWERS TO BE PROTECTED AT ROAD CROSSINGS AS SHOWN ON THE TYPICAL PLAN FOR PIPE BEDDING OR OTHERWISE AS INSTRUCTED BY THE ENGINEER.
17. uPVC PIPES TO BE BOUGHT IN LENGTHS OF 6 m, AND COMPLY WITH THE RELEVANT REQUIREMENTS OF SABS 791 AND HAVE SUITABLE FLEXIBLE JOINTS :
    - RUBBER JOINT RINGS SHALL COMPLY WITH THE RELEVANT REQUIREMENTS OF PART I OF SABS 974.
    - WHEN A FLEXIBLE JOINT IS TESTED IN ACCORDANCE WITH SUB-CLAUSE 4.4 OF SECTION LD OF PART 3 OF SABS 0120, THERE SHALL BE NO SIGN OF LEAKAGE IN ANY OF THE TESTS
    - THE INFLOW OF STORMWATER IS TO BE PROHIBITED.
16. TESTING TO BE DONE IN ACCORDANCE WITH SABS 1200 LD CLAUSE 7.
17. THE CONTRACTOR TO MAKE GOOD ANY DEFECTS THAT MAY BE FOUND WHILE THE PIPE IS UNDER TEST AND AFTER THAT THE TESTS SHALL BE REPEATED AT HIS EXPENSE UNTIL THE PIPE IS FOUND TO COMPLY WITH THE SPECIFICATION.
18. AFTER THE PIPES HAS PASSED THE TESTS ALL ACCESS LIDS SHALL BE PROPERLY SEALED WITH BITUMEN OR BY ANY OTHER APPROVED METHOD THAT WILL ENSURE THAT THEY ARE WATERTIGHT.

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

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PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
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www.newground.co.za

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: PIPE LAYOUT 1 OF 2

DRAWING NUMBER: PC20013 / CIV / 2301

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
1 : 200	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:

Ø 110mm HDPE PN10

DRYING BEDS

STORMWATER CHANNEL

FLOW

Ø 110mm HDPE PN10

SLOPE

SLOPE

SLOPE

SLOPE

Ø 160mm HDPE PN10

RE01

Ø 110 mm uPVC CLASS 6

Ø 50mm HDPE PN6

MH05

GRAVEL AREA

Ø 160mm HDPE PN10

GRAVEL ROAD

STORMWATER CHANNEL

FLOW

0 1 2 METERS

LEGEND:

- AEROBIC SYSTEM
- ANAEROBIC TO DRYING BEDS
- SETTLING POND TO ANAEROBIC AND AEROBIC PONDS
- FIRST EXISTING POND TO ANAEROBIC AND AEROBIC PONDS
- CHLORINATION SYSTEM
- SUBSOIL DRAIN
- DRYING BEDS TO ANAEROBIC AND AEROBIC
- PUMP ROOM DRAIN
- SEWER
- WATER PIPE
- MANHOLE

NOTES:

1. FOR GENERAL AND EARTHWORKS NOTES, REFER TO DRAWING PC20013/CIV/2101

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS:

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

DRAWING NAME: PIPE LAYOUT 2 OF 2

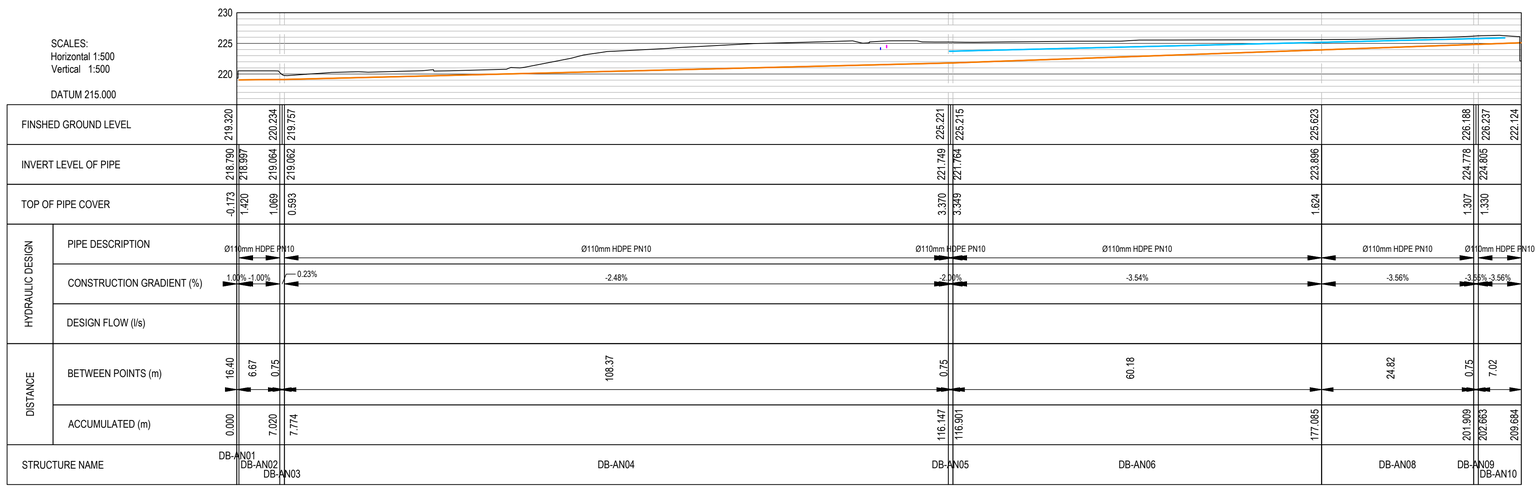
DRAWING NUMBER: PC20013 / CIV / 2302

DRAWING ISSUED FOR: TENDER

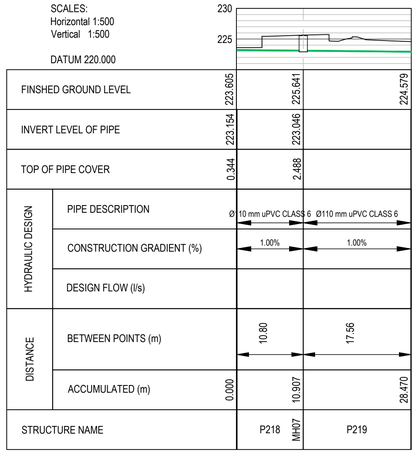
SCALE:	PAPER SIZE:	REVISION:
1 : 100	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:



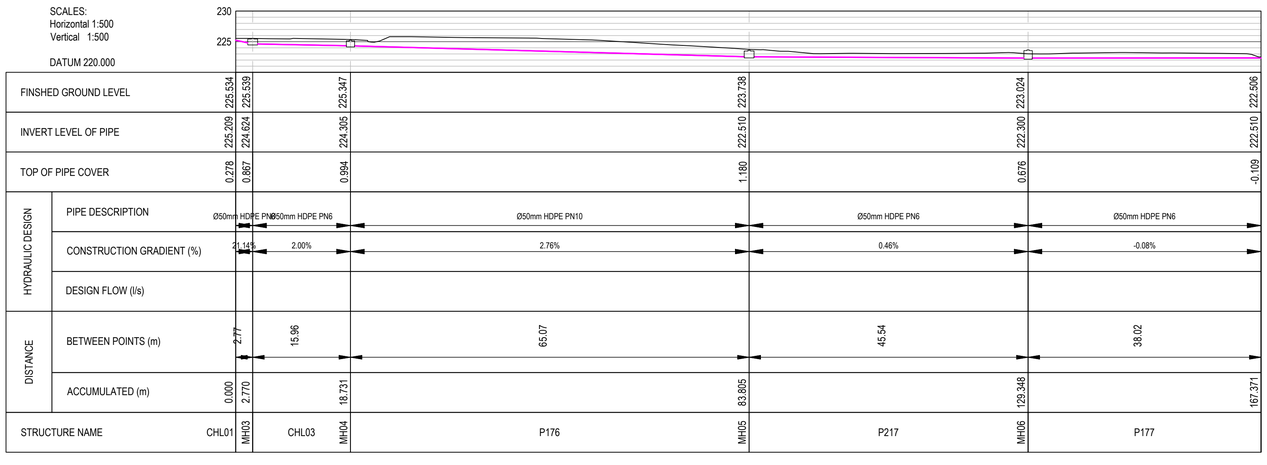
DRYING BED TO ANAEROBIC



PUMP ROOM DRAINAGE

ANAEROBIC TO DRYING BEDS

SECONDARY SETTLING TO PUMP ROOM



CHLORINATION TO EXISTING POND 3

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: PIPE LONG SECTIONS 1 OF 3

DRAWING NUMBER: PC20013 / CIV / 2303

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
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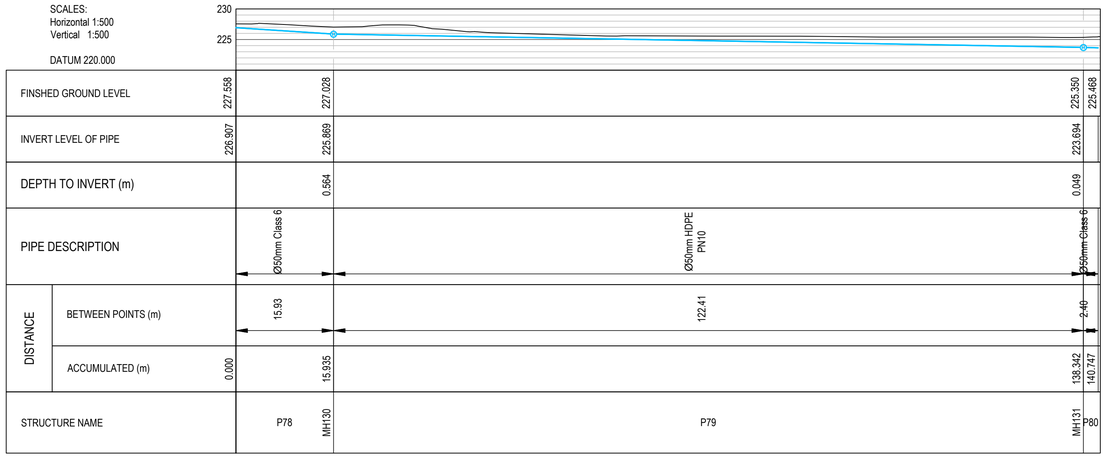
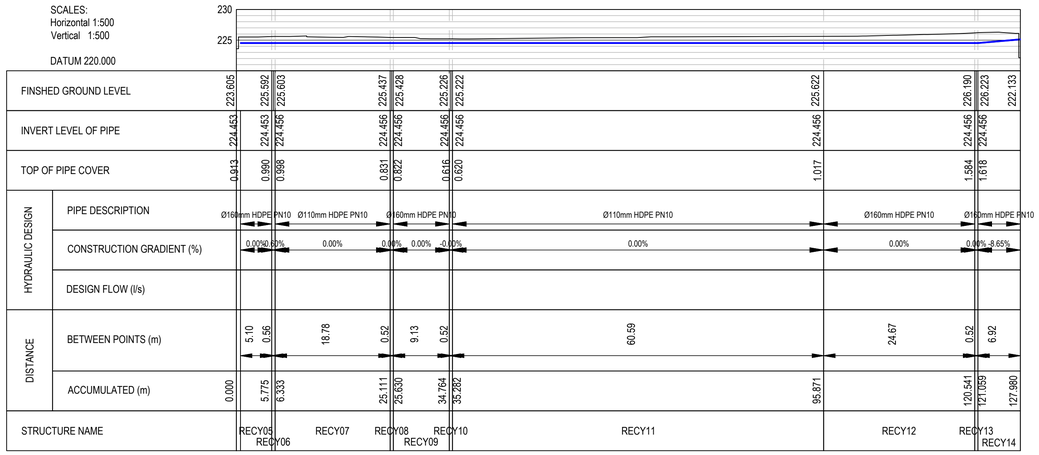
APPROVED BY ENGINEER:

SIGNATURE: DATE:



WATER PIPE



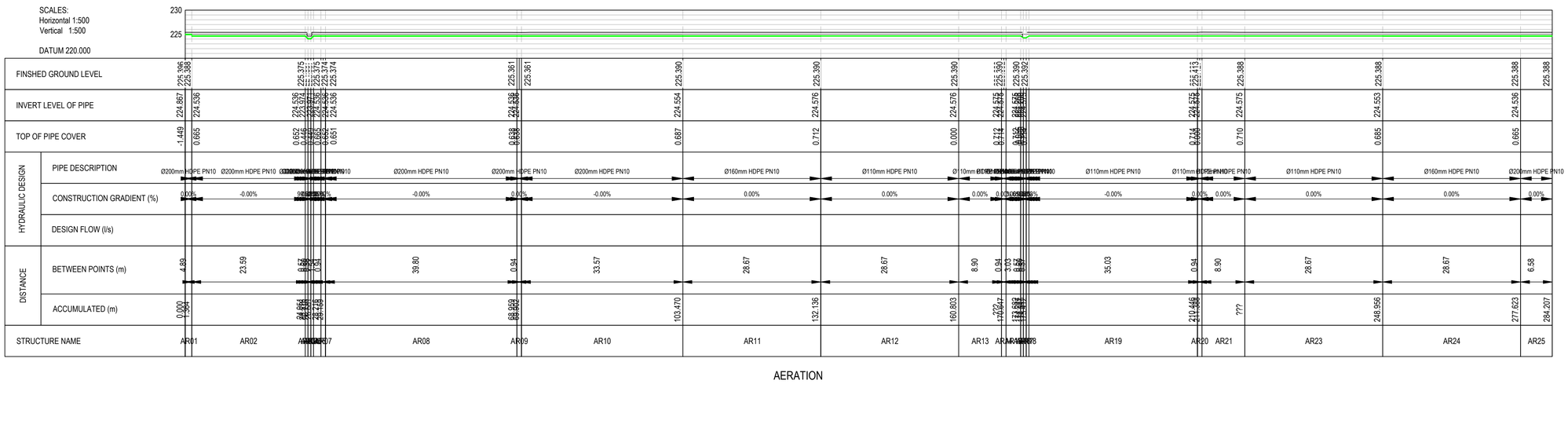
RECYCLING PUMP TO ANAEROBIC

SLUDGE PUMP TO ANAEROBIC

SETTLING TO SLUDGE PUMP 1

SETTLING TO SLUDGE PUMP 2

SETTLING TO SLUDGE PUMP 3



AERATION

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

DRAWING NAME: PIPE LONG SECTIONS 2 OF 3

DRAWING NUMBER: PC20013 / CIV / 2304

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
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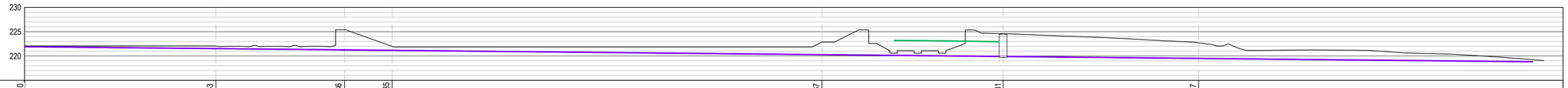
APPROVED BY ENGINEER:

SIGNATURE: DATE:

SCALES:
Horizontal 1:500
Vertical 1:500

DATUM 215.000



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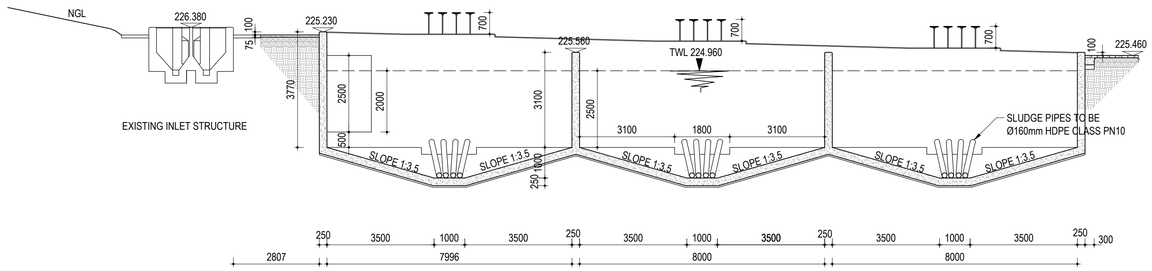

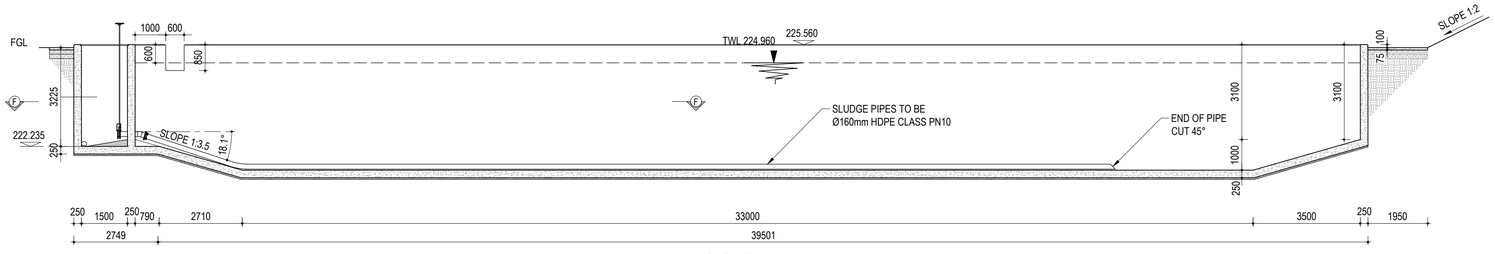

SECTION A-A
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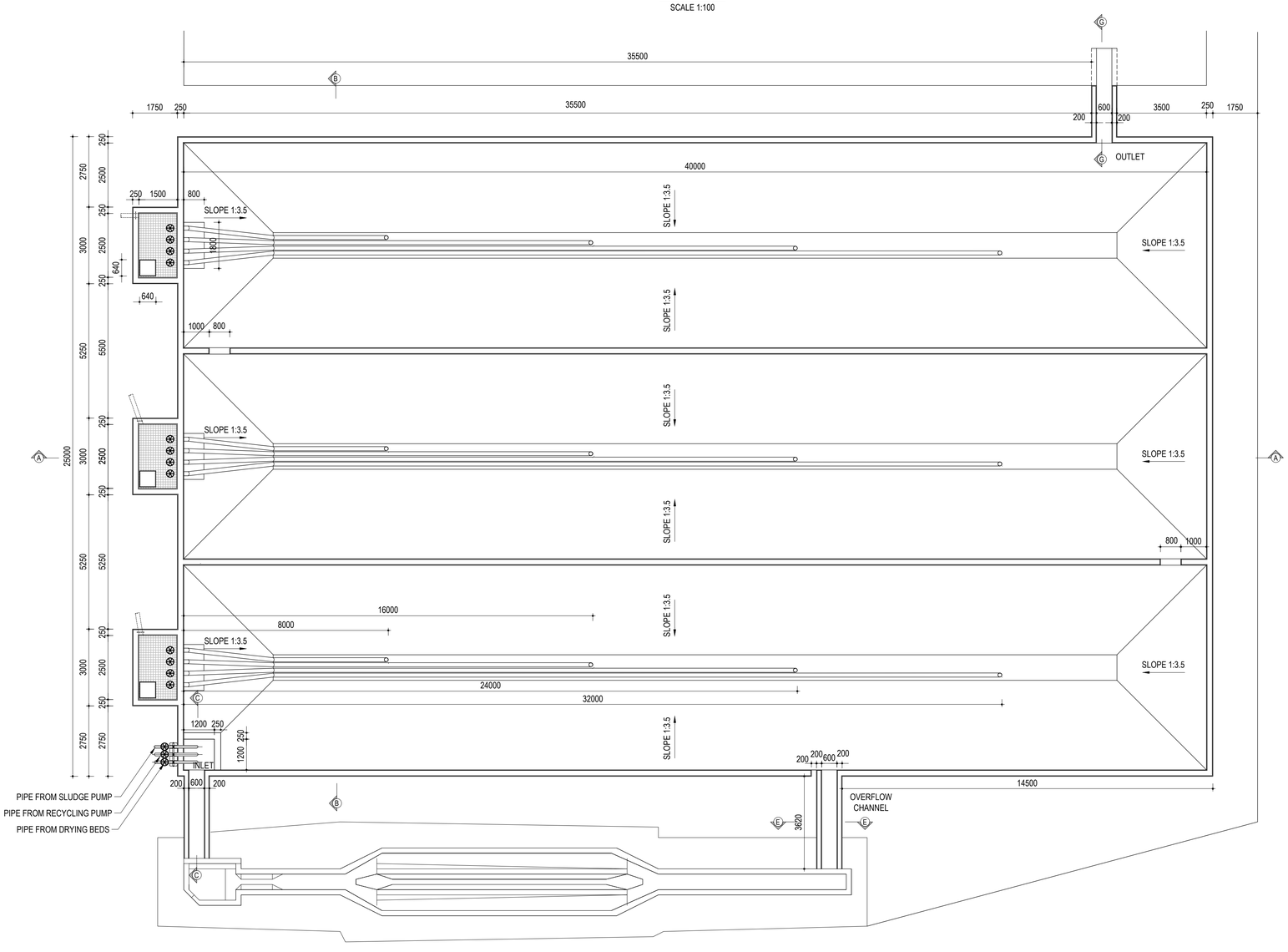
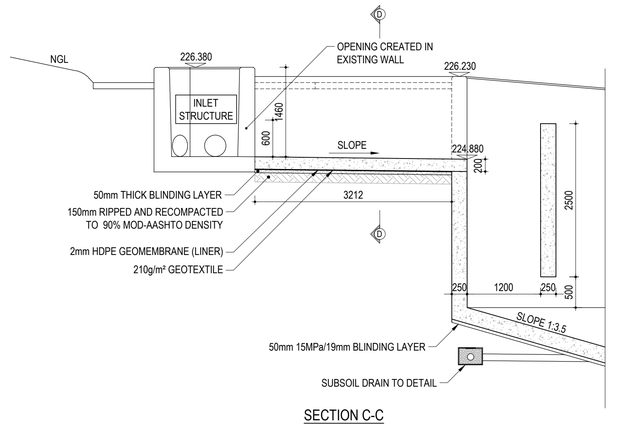
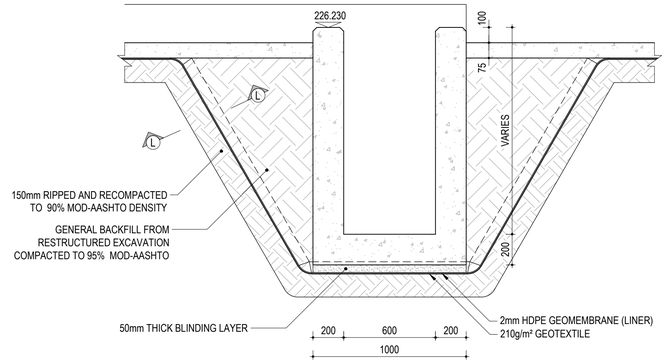


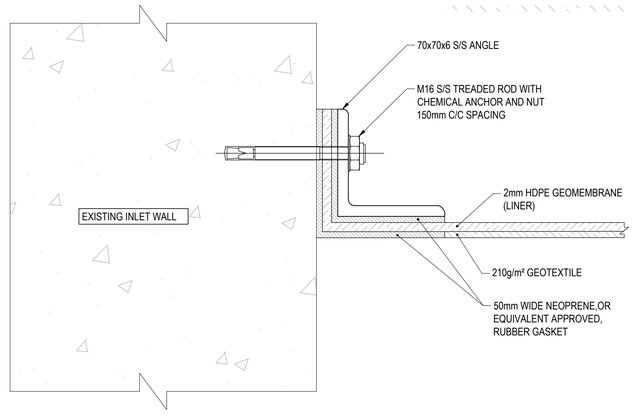
PLAN VIEW
SCALE 1:100



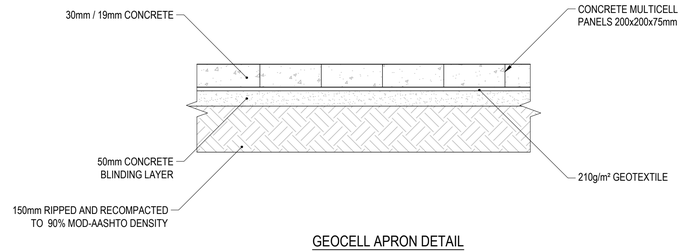
SECTION C-C
SCALE 1:50



SECTION D-D
SCALE 1:20



SECTION L-L
SCALE 1:2



GEOCELL APRON DETAIL
SCALE 1:10

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC2013/CIV/2402.
5. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

GENERAL CONCRETE

1. THE CONTRACTOR WILL BE RESPONSIBLE FOR SETTING OUT THE WORKS. ALL DISCREPANCIES ON THE DRAWINGS AND INFORMATION PROVIDED TO THE CONTRACTOR TO BE REFERRED TO THE ENGINEER FOR CLARITY.

CONCRETE :

2. CONCRETE MATERIAL AND EXECUTION OF WORKS SHALL COMPLY WITH SANS 0100-2 AND SANS 2001-CC1 UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER IN WRITING.
3. THE ENGINEER WILL PROVIDE THE STRENGTH OF CONCRETE REQUIRED AND THE SIZE OF THE STONE TO BE USED. UNLESS OTHERWISE SPECIFIED THE CONTRACTOR IS RESPONSIBLE FOR THE MIX DESIGN OF STANDARD CONCRETE WHICH WILL CONSIST OF
   - ORDINARY PORTLAND CEMENT ,SANS 471
   - NORMAL DENSITY AGGREGATES, SANS 1083
   - CLEAN WATER, FREE OF SUBSTANCES THAT WOULD IMPAIR THE STRENGTH OF THE CONCRETE.
3. CONCRETE SHOULD BE PROPORTIONED TO ENSURE WORKABILITY WITHOUT SEGREGATION OF THE MIX NOR EXCESSIVE BLEEDING. WHERE SPECIAL MIX DESIGN ARE REQUIRED OR SPECIFIED, THE ENGINEER WILL PROVIDE THE MIX DEIGN.
4. IF MIXED ON SITE, CONCRETE TO BE MIXED AT LEAST 1.5min PER 1.5m³ BATCH USING A DRUM MIXER. CONCRETE TO BE PLACED IMMEDIATELY AFTER BEING MIXED. IT MAY BE KEPT IN THE DRUM TO A MAXIMUM OF 2Hrs SUBJECT TO THE PROVISIONS OF SANS 0100-2.
5. CONCRETE TO BE MIXED AS CLOSE AS PRACTICABLE TO THE POSITION OF PLACEMENT AND TO BE TRANSPORTED IN A MANNER TO PREVENT SEGREGATION, ADULTERATION, LOSS OF INGREDIENTS OR CONTAMINATION. ALL CONVEYANCE EQUIPMENT TO BE CLEANED AT THE END OF EACH DAY.
6. CONCRETE MAY NOT FALL MORE THAN 3m NOR BE PLACED WITH A CHUTE STEEPER THAN 30°.
7. CONCRETE TO BE COMPACTED AND THOROUGHLY WORKED AROUND REINFORCEMENT IMMEDIATELY AFTER PLACEMENT.
8. CONCRETE MAY NOT BE PLACED, NOR EXPOSED TO, TEMPERATURES BELOW 5°C OR EXCEEDING 30°C WITHOUT A WRITTEN INSTRUCTION FROM THE ENGINEER ON THE ADEQUATE PROTECTION OF THE CONCRETE.
9. ALL EXPOSED CORNERS TO BE CHAMFERED 25mm

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: ANAEROBIC POND LAYOUT AND DETAILS

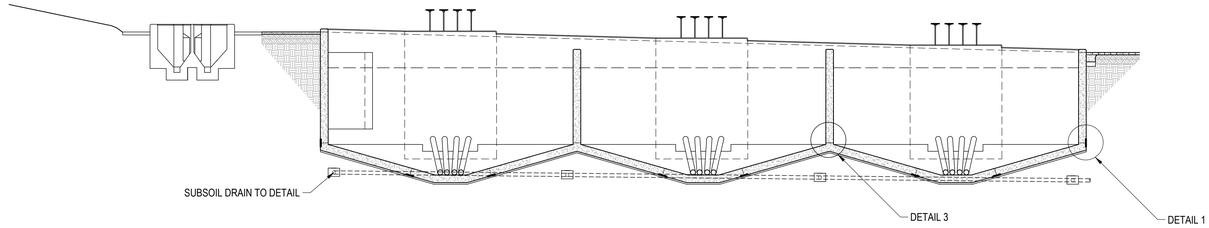
DRAWING NUMBER: PC20013 / CIV / 2401

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
AS SHOWN	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:



SECTION B-B
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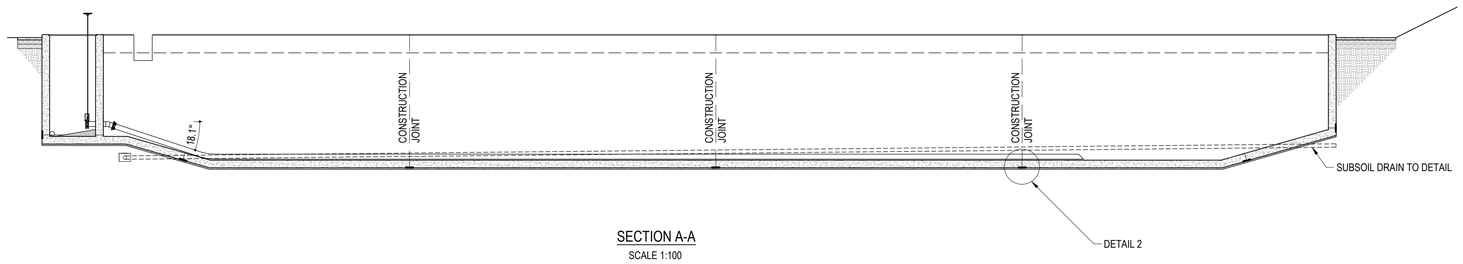

SECTION A-A
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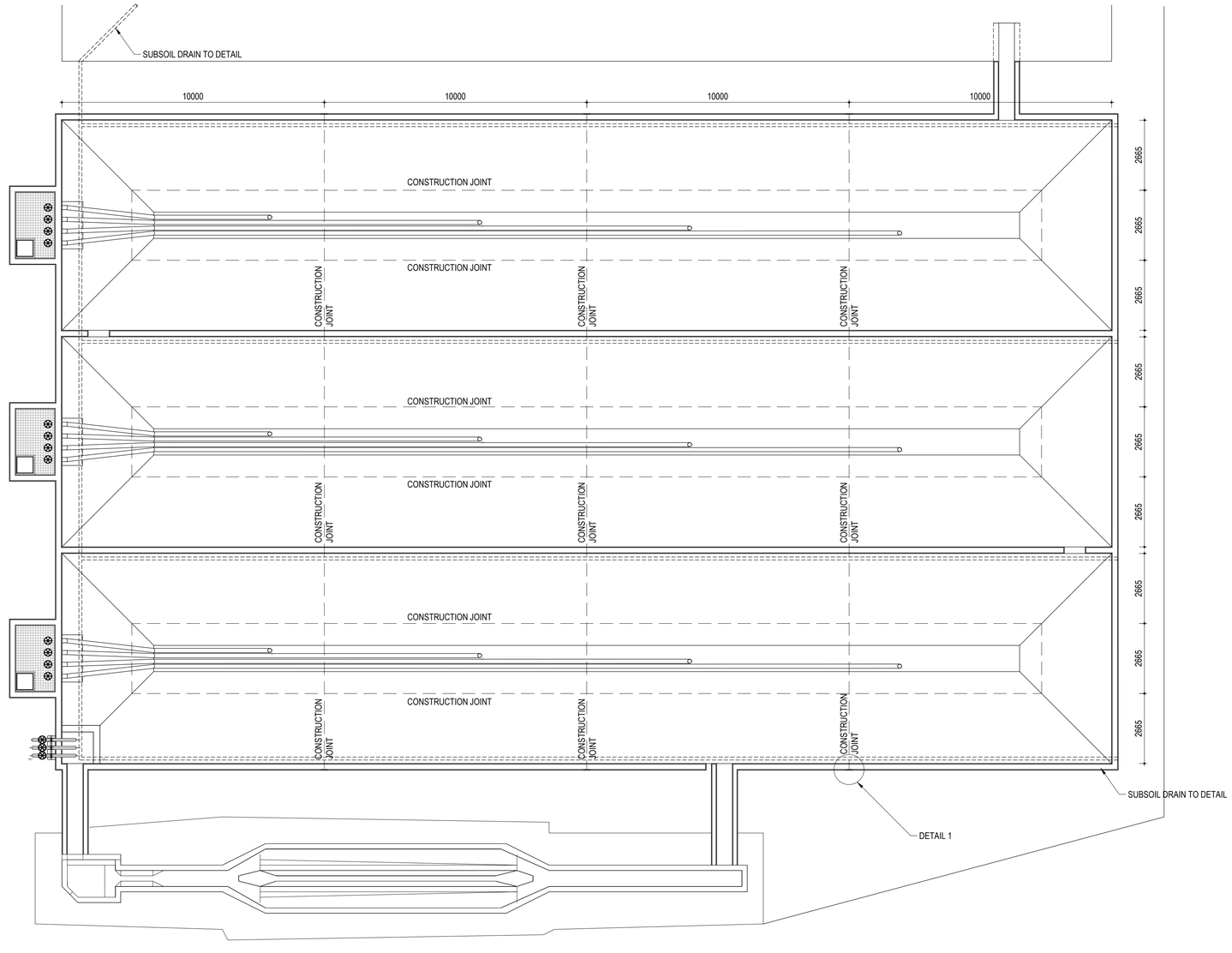
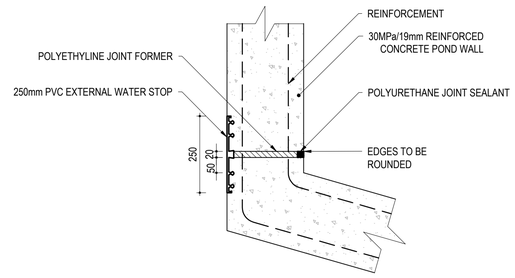
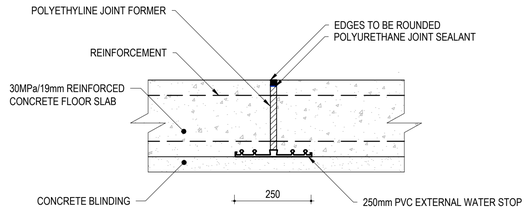
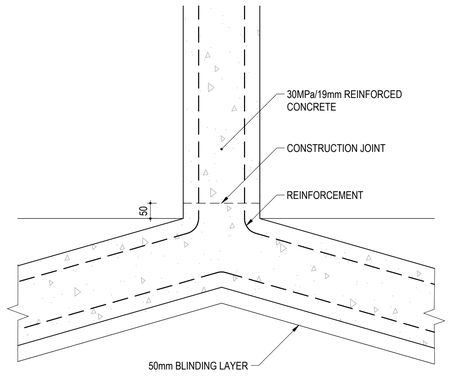




DETAIL 1
WALL CONSTRUCTION JOINT DETAIL
SCALE 1:10



DETAIL 2
FLOOR CONSTRUCTION JOINT DETAIL
SCALE 1:10



DETAIL 3
MID WALL CONSTRUCTION JOINT DETAIL
SCALE 1:10

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

FORMWORK

1. DESIGN OF FORMWORK IS THE RESPONSIBILITY OF THE CONTRACTOR. FORMWORK MUST BE ABLE TO WITHSTAND THE WORST COMBINATION OF LOADS, INCLUDING SHOCK LOADS DUE TO PLACING.
2. FORMWORK WILL BE SMOOTH, CLEAN AND PLACED TO MINIMISE THE VISIBILITY OF JOINTS ON THE FORMWORK IMPRESSED ONTO THE CONCRETE.
3. ALL FORMWORK TO BE INSPECTED BY THE ENGINEER PRIOR TO PLACEMENT OF THE CONCRETE.
4. FORMWORK TO BE WETTED PRIOR TO PLACEMENT OF CONCRETE.
5. FORMWORK STRIPPING CAN BE DONE AS FOLLOWS UNDER NORMAL CONDITIONS: "SUMMARY OF SANS0100-2 TABLE 7"

CONCRETE MIX

6. ALL CONCRETE WORKS TO BE CARRIED OUT ACCORDING TO SABS 1200 GA.
7. CONCRETE MATERIAL AND EXECUTION OF WORKS SHALL COMPLY WITH SANS 0100-2 AND SANS 2001-CC1 UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER IN WRITING.
8. CONCRETE MIX TO BE DESIGNED IN ACCORDANCE WITH SANS 0100-1. CONTRACTOR TO SUBMIT MIX DESIGN TO ENGINEER FOR APPROVAL.
9. CONCRETE GRADE TO BE 30MPa/19mm UNLESS OTHERWISE SPECIFIED.
10. WATER/CEMENT RATIO = 0.52
11. MINIMUM CEMENT CONTENT = 360kg/m³
12. UNLESS OTHERWISE SPECIFIED THE CONTRACTOR IS RESPONSIBLE FOR THE MIX DESIGN OF STANDARD CONCRETE WHICH WILL CONSIST OF :
    - ORDINARY PORTLAND CEMENT SANS 471
    - NORMAL DENSITY AGGREGATES SANS 1083
    - CLEAN WATER, FREE OF SUBSTANCES THAT WOULD IMPAIR THE STRENGTH OF THE CONCRETE.
8. CONCRETE SHOULD BE PROPORTIONED TO ENSURE WORKABILITY WITHOUT SEGREGATION OF THE MIX NOR EXCESSIVE BLEEDING. WHERE SPECIAL MIX DESIGN ARE REQUIRED OR SPECIFIED, THE ENGINEER WILL PROVIDE THE MIX DESIGN.
9. IF MIXED ON SITE, CONCRETE TO BE MIXED AT LEAST 1.5min PER 1.5m³ BATCH USING A DRUM MIXER. CONCRETE TO BE PLACED IMMEDIATELY AFTER BEING MIXED. IT MAY BE KEPT IN THE DRUM TO A MAXIMUM OF 2Hrs SUBJECT TO THE PROVISIONS OF SANS 0100-2.
10. CONCRETE TO BE MIXED AS CLOSE AS PRACTICABLE TO THE POSITION OF PLACEMENT AND TO BE TRANSPORTED IN A MANNER TO PREVENT SEGREGATION, ADULTERATION, LOSS OF INGREDIENTS OR CONTAMINATION. ALL CONVEYANCE EQUIPMENT TO BE CLEANED AT THE END OF EACH DAY.
11. CONCRETE MAY NOT FALL MORE THAN 3m NOR BE PLACED WITH A CHUTE STEEPER THAN 30°.
12. CONCRETE MAY NOT BE PLACED, NOR EXPOSED TO, TEMPERATURES BELOW 5°C OR EXCEEDING 30°C WITHOUT A WRITTEN INSTRUCTION FROM THE ENGINEER ON THE ADEQUATE PROTECTION OF THE CONCRETE.
13. IF THE ABOVE CANNOT BE ACHIEVED THE ENGINEER SHOULD BE CONSULTED PRIOR TO PLACEMENT OF THE CONCRETE
14. THE PROPOSED SEQUENCE OF CASTING ALL CONCRETE TO BE APPROVED BY THE ENGINEER 14 DAYS PRIOR TO CASTING
15. PREPARED GRAVEL SURFACE TO BE WETTED PRIOR TO CASTING TO ENSURE SURFACE IS DAMP WHEN CONCRETE IS CAST.
16. THE TOP OF CONCRETE ELEMENTS AND THE SURFACE OF ALL CONSTRUCTION JOINTS SHALL BE SCABBLED OR WATER JETTED TO REMOVE LATENCIES AND LOOSE MATERIAL AND ROUGHENED EDGES PRIOR TO CASTING THE NEXT LIFT OF CONCRETE. A WET TO DRY EPOXY TO BE PROVIDED TO THE ENGINEER'S APPROVAL ON TOP OF SCABBLED SURFACE WHERE NEXT LIFT IS TO BE CAST.
17. CONCRETE TO BE COMPACTED AND THOROUGHLY WORKED AROUND REINFORCEMENT IMMEDIATELY AFTER PLACEMENT.
18. ALL CONCRETE TO BE COMPACTED USING A MECHANICAL VIBRATOR OF A SUITABLE SIZE. POURS DEEPER THAN 300mm TO BE DOUBLY VIBRATED WITH THE SECOND VIBRATING BEING DONE JUST BEFORE INITIAL SET.
19. ALL EXPOSED CORNERS TO BE CHAMFERED 25mm.
20. ALL EXPOSED SURFACES TO HAVE STEEL FLOAT FINISHES.ALL SURFACE BEDS TO BE REINFORCED WITH MESH.
21. EXCAVATION TO ONLY BE FILLED AFTER APPROVAL BY THE ENGINEER WITH CLASS 20MPa/19mm CONCRETE (WHERE APPLICABLE) OR A SUITABLE MATERIAL AS INSTRUCTED BY THE ENGINEER.
22. UNLESS SPECIFIED OTHERWISE BY THE ARCHITECT CONCRETE SHALL HAVE THE FOLLOWING FINISHES
    - CONCRETE VISIBLE AFTER THE WORKS ARE SMOOTH FORM FINISH.
    - ALL OTHER CONCRETE = ROUGH FORM FINISH.
23. CONCRETE GRADE 20/19 FOR FOUNDATION, SLABS AND APRONS.
24. CONSTRUCTION JOINTS WILL NOT BE PERMITTED WITHOUT THE ENGINEERS PRIOR APPROVAL.

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

DRAWING NAME: ANAEROBIC POND CONSTRUCTION JOINTS

DRAWING NUMBER: PC20013 / CIV / 2402

DRAWING ISSUED FOR: TENDER

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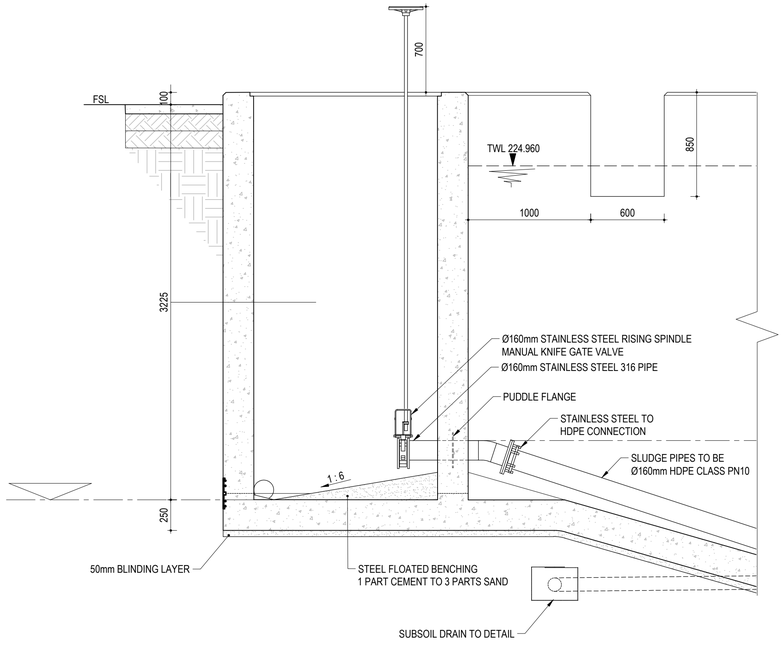
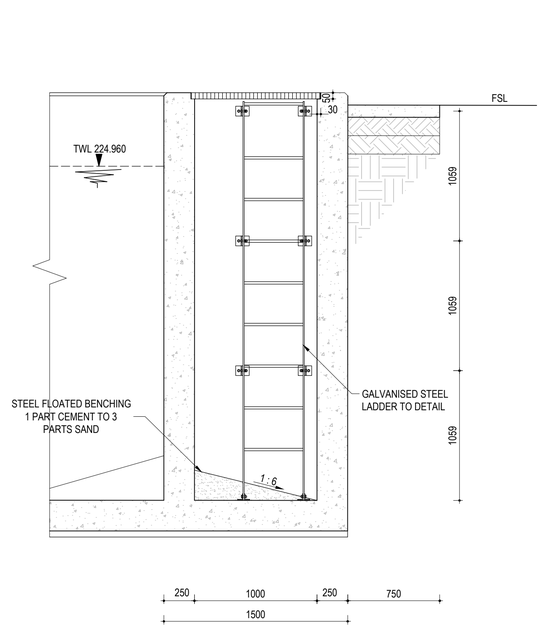
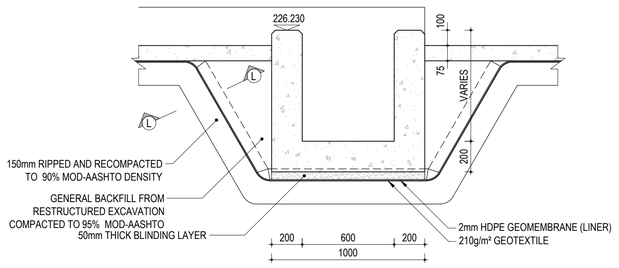


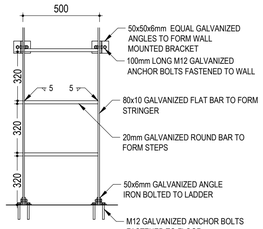
SECTION J-J
SCALE 1:25



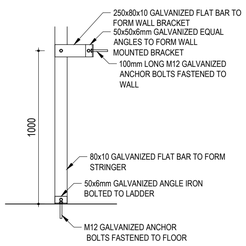
SECTION H-H
TYPICAL CROSS SECTION
SCALE 1:25



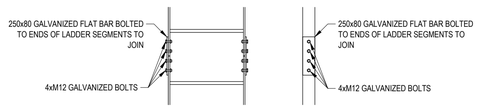
SECTION E-E
SCALE 1:20



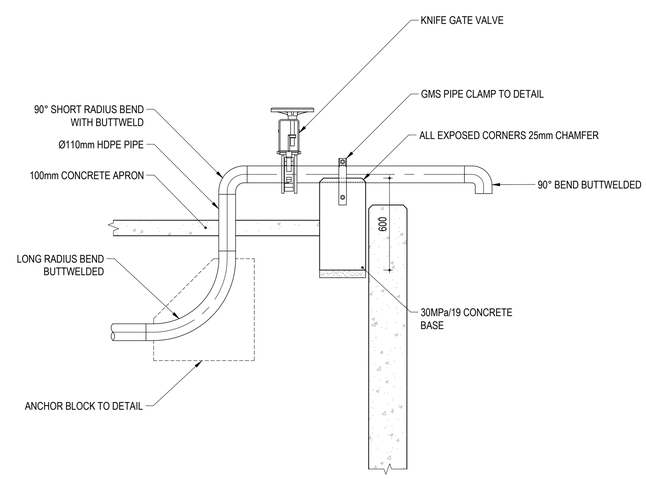
LADDER DETAIL 1
FRONT VIEW
SCALE 1:20



LADDER DETAIL 2
SIDE VIEW
SCALE 1:20



LADDER DETAIL 3
JOINT DETAIL
SCALE 1:20



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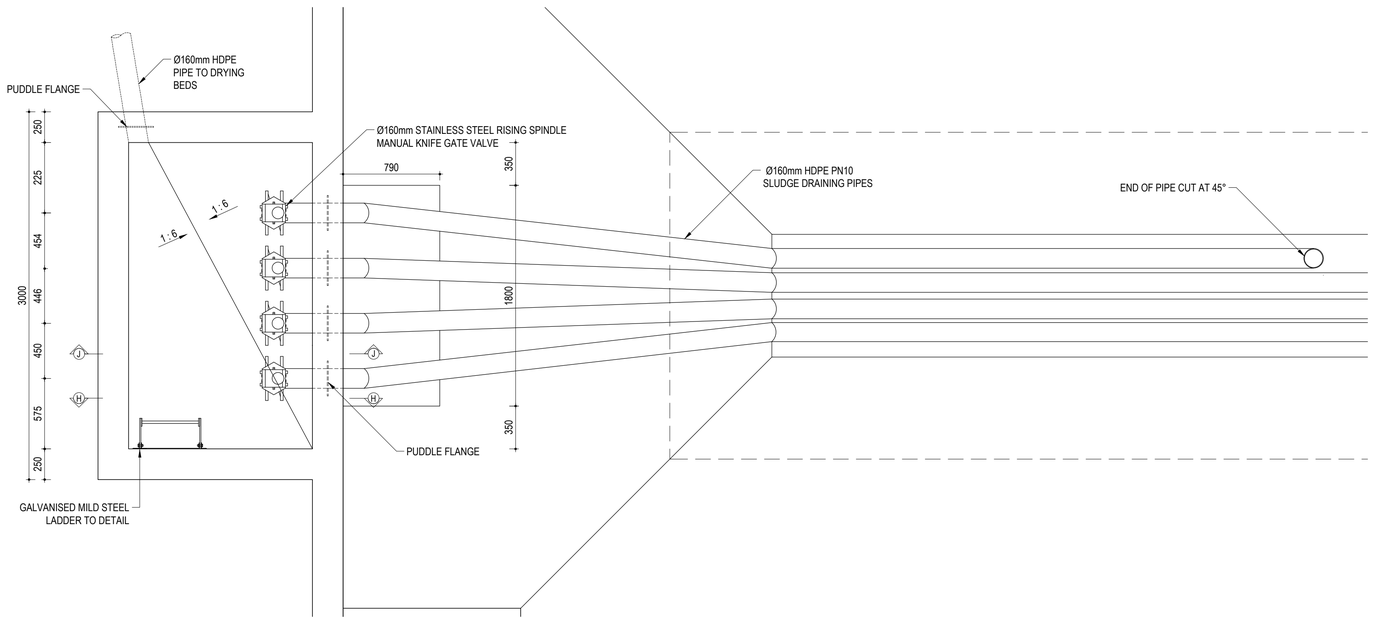
SCALE 1:20



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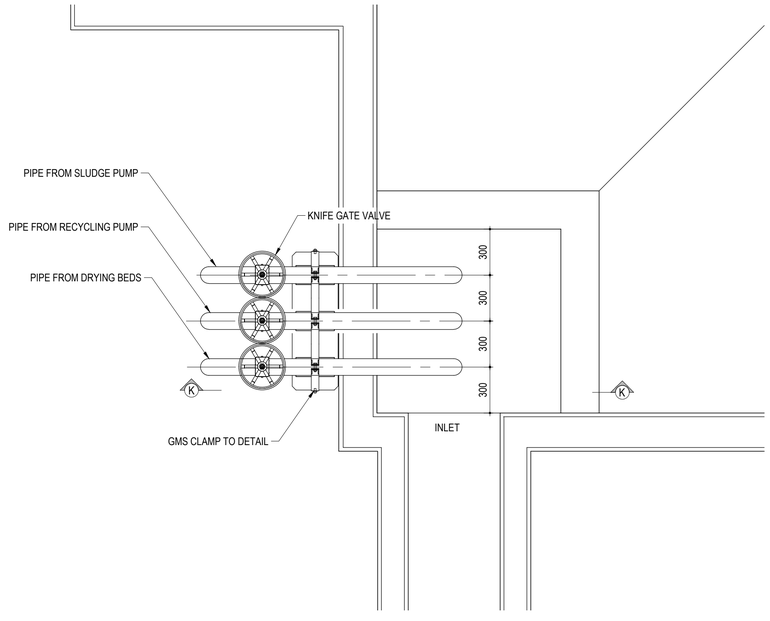

RECYCLED INLET DETAIL
PLAN VIEW
SCALE 1:20

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC20013/CIV/2402.

CURING

1. ALL CONCRETE TO BE CONTINUOUSLY CURED IN ACCORDANCE WITH SABS 1200 G FOR A MIN. OF 7 DAYS.
2. SHOULD NO ALTERNATIVE CURING METHOD BE APPROVED BY THE ENGINEER IN WRITING, THE FOLLOWING SHOULD BE DONE:
   - CURE BY COVERING WITH PLASTIC SHEETING IMMEDIATELY AFTER STRIKING OF FORMWORK.
   - FOR POWER FLOATED SLABS, COVER SLAB WITH PLASTIC SHEETING IMMEDIATELY AFTER STRIKING OFF FORMWORK AND REPLACE PLASTIC SHEETING AFTER POWER FLOATING.
   - FOR WIRE BRUSH FINISH, CONCRETE TO BE COVERED WITH POLYTHENE SHEETS IMMEDIATELY AFTER BRUSHING IN ORDER TO ENSURE SUFFICIENT CURING OF CONCRETE.
   - CURING COMPOUND TO BE APPROVED BY THE ENGINEER PRIOR TO COMMENCING OF WORK.
3. CONCRETE TO BE PROTECTED DURING CURING AS SPECIFIED IN SANS 10100 10.8.1
4. CONCRETE DEFECTS MAY ONLY BE REPAIRED AFTER THE ENGINEER HAS APPROVED A METHOD STATEMENT FOR THE REPAIR.

TESTING

5. THE CONTRACTOR TO PROVIDE THE ENGINEER WITH THE RESULTS OF THE SLUMP TEST IMMEDIATELY AS TESTS ARE DONE AND SHOULD KEEP A WRITTEN AND PHOTOGRAPHIC RECORD OF TESTS.
6. UNLESS OTHERWISE SPECIFIED BY THE ENGINEER, FOR CUBE TESTS A SAMPLE SHALL CONSIST OF 3 CUBES TAKEN AT THE POINT OF PLACING:
   - EACH DAY OF PLACING OR AT LEAST ONCE EVERY 50m³, WHICHEVER IS SHORTER PERIOD.
   - FOR SMALL BATCH MIXING, EVERY THIRD BATCH OF EACH MIX.
   - A SLUMP TEST SHALL BE CARRIED OUT ON EVERY BATCH/TRUCK OF CONCRETE DELIVERED TO SITE. ANY BATCH OR TRUCK LOAD OF CONCRETE THAT FALLS OUTSIDE THE LIMITS WILL BE REJECTED AND REMOVED FROM SITE.

REINFORCEMENT

7. REINFORCING STEEL TO SANS 920:2011.
8. BENDING OF REINFORCEMENT SHALL BE TO SANS 282.
9. CARE SHOULD BE TAKEN TO ENSURE THAT MINIMUM CONCRETE COVER TO REINFORCEMENT IS ACHIEVED THROUGHOUT.
10. REINFORCEMENT TO HAVE A MINIMUM COVER OF 50mm UNLESS OTHERWISE SPECIFIED.
11. ALL THE REINFORCEMENT IS TO BE APPROVED BY THE ENGINEER PRIOR TO CASTING OF CONCRETE
3. WELDED STEEL FABRIC TO CONFORM TO SABS 1024.
4. ALL MESH TO HAVE A MINIMUM LAP LENGTH OF 400mm
5. COVER TO MESH: 50mm TOP, 50mm SIDES UNLESS OTHERWISE SPECIFIED
6. REINFORCEMENT TO BE CLEAN, FREE OF OIL / GREASE, FREE OF RUST AND BENT ACCURATELY TO THE REQUIRED SHAPE CODE.
7. REINFORCEMENT SHALL NOT BE MECHANICALLY DAMAGED, ROUGH HANDLED, DROPPED OR SHOCK LOADED.
8. REINFORCEMENT TO BE PLACED AND HELD IN PLACE TO ACHIEVE POSITIONS AS INDICATED ON THE DRAWINGS.
9. REINFORCEMENT TO BE ADEQUATELY AND NEATLY TIED USING ANNEALED WIRE OF Ø1.6mm.
10. THE MINIMUM CONCRETE COVER TO STEEL TO BE 50mm..
11. ALL MESH TO HAVE A MINIMUM LAP LENGTH OF 450mm
9. 10. COVER TO MESH: 50mm TOP & 50mm SIDES

PROJECT NUMBER: PC20013

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REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: ANAEROBIC POND DETAILS

DRAWING NUMBER: PC20013 / CIV / 2403

DRAWING ISSUED FOR: TENDER

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AS SHOWN	A1	00

APPROVED BY ENGINEER:

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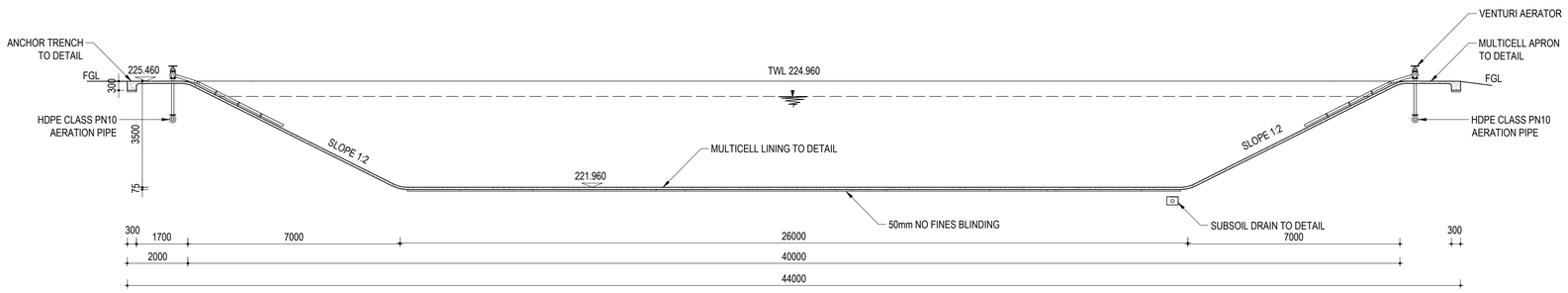
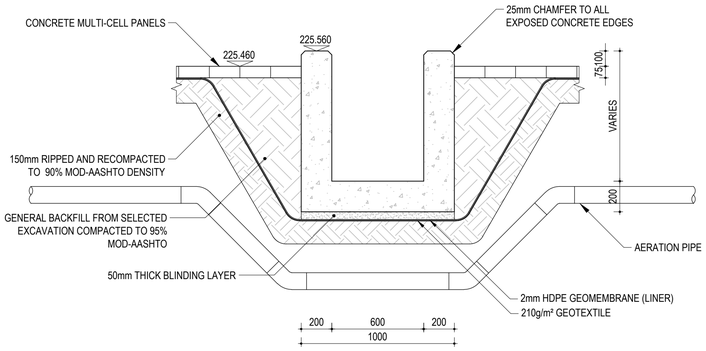
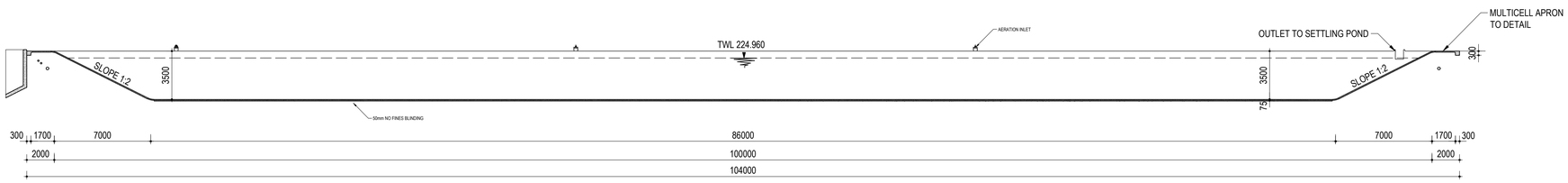


SECTION B-B
SCALE 1:100



SECTION G-G
SCALE 1:20



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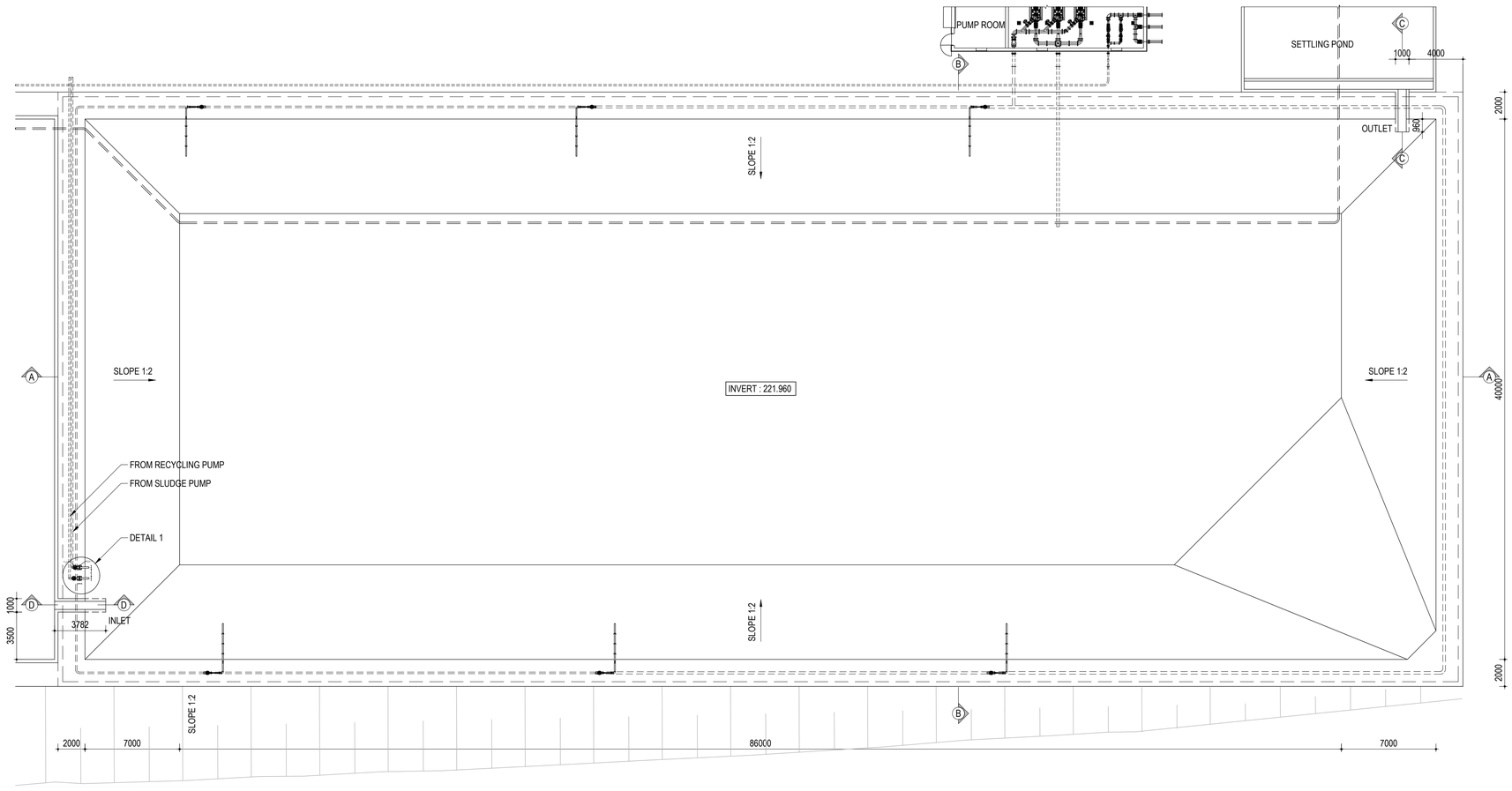

PLAN VIEW
SCALE 1:200

SECTION D-D
SCALE 1:50

SUBSOIL DRAIN DETAIL
SCALE 1:10

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
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3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC20013/CIV/2402.
6. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

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PC20003/STR/3000 - DETAILS
REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: AEROBIC POND LAYOUT AND DETAILS

DRAWING NUMBER: PC20013 / CIV / 2501

DRAWING ISSUED FOR: TENDER

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AS SHOWN	A1	00

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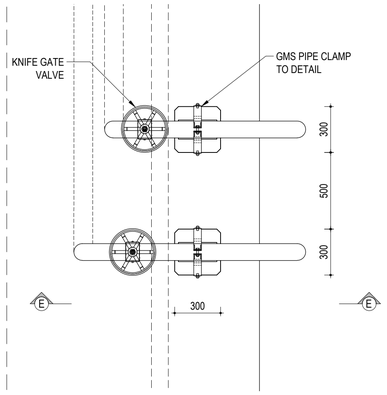
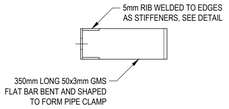
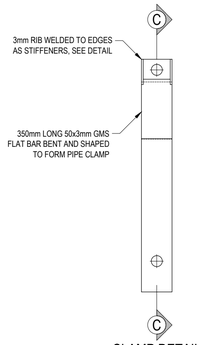


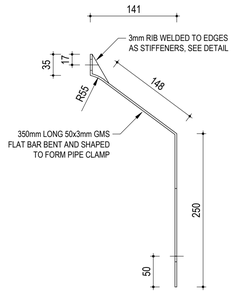
DETAIL 1
AERATION POND PIPE INLET
SCALE 1:20



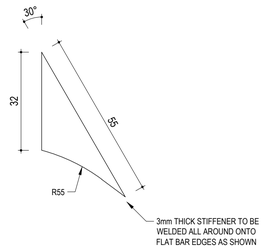
CLAMP DETAIL
TOP VIEW
SCALE 1:5



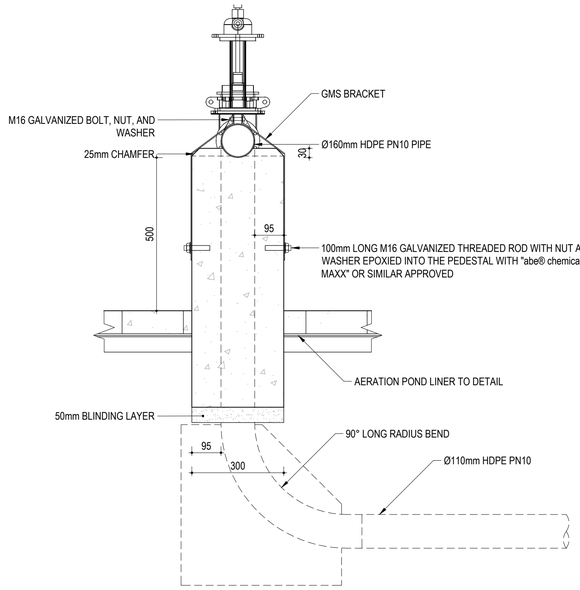
CLAMP DETAIL
FRONT VIEW
SCALE 1:5



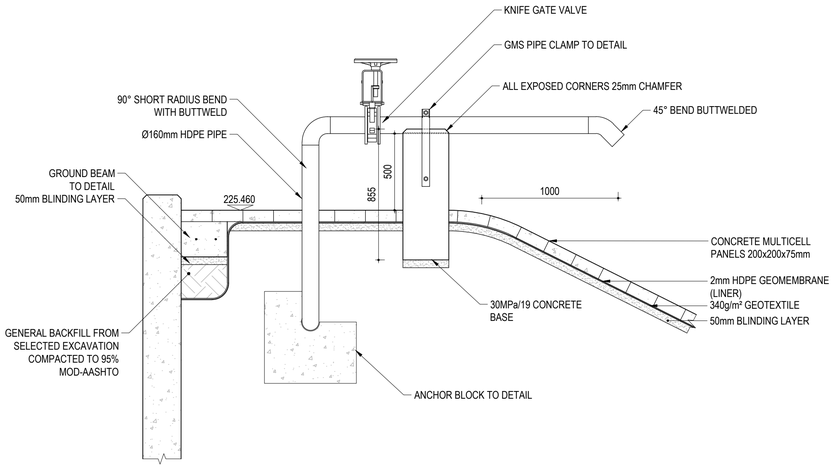
SECTION C-C
PIPE PEDESTAL DETAIL
SCALE 1:5



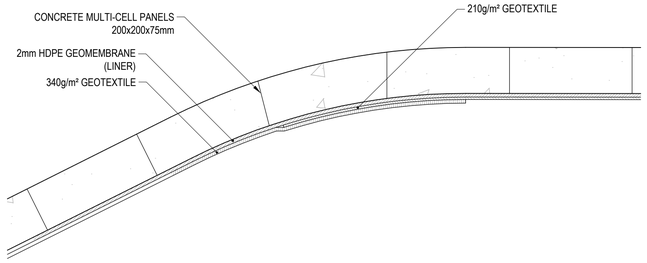
STIFFNER DETAIL
SIDE VIEW
SCALE 1:1



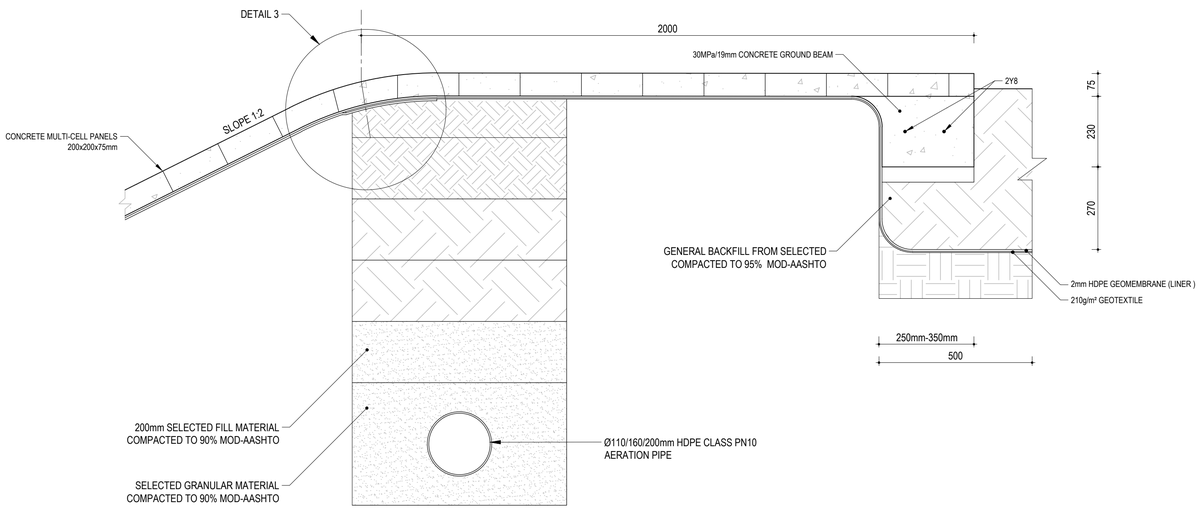
SECTION A-A
PIPE PEDESTAL DETAIL
SCALE 1:10



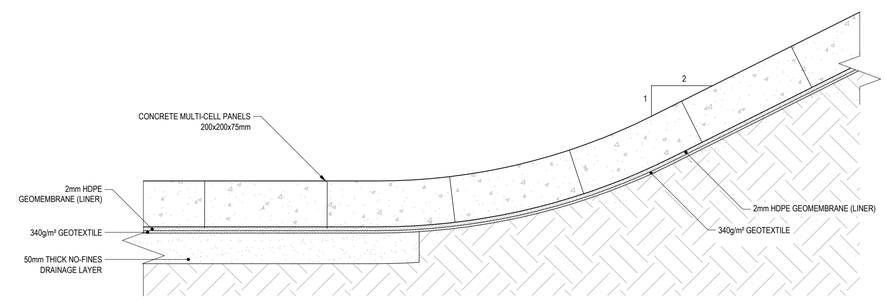
SECTION E-E
SCALE 1:20



DETAIL 3
SCALE 1:5



ANCHOR TRENCH DETAIL
TYPICAL CROSS SECTION DETAIL
SCALE 1:10



AERATION POND LINER DETAIL
TYPICAL CROSS SECTION DETAIL
SCALE 1:5

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC20013/CIV/2402.
6. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
FAX: 086 520 6942
www.newground.co.za

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: AEROBIC POND DETAILS

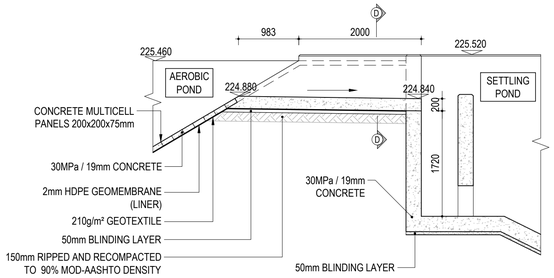
DRAWING NUMBER: PC20013 / CIV / 2502

DRAWING ISSUED FOR: TENDER

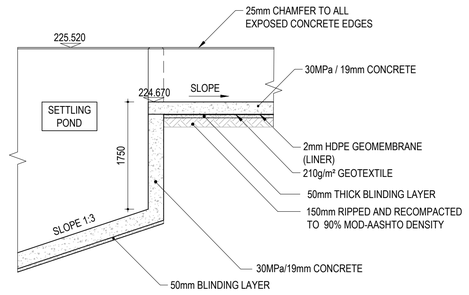
SCALE: AS SHOWN	PAPER SIZE: A1	REVISION: 00

APPROVED BY ENGINEER:

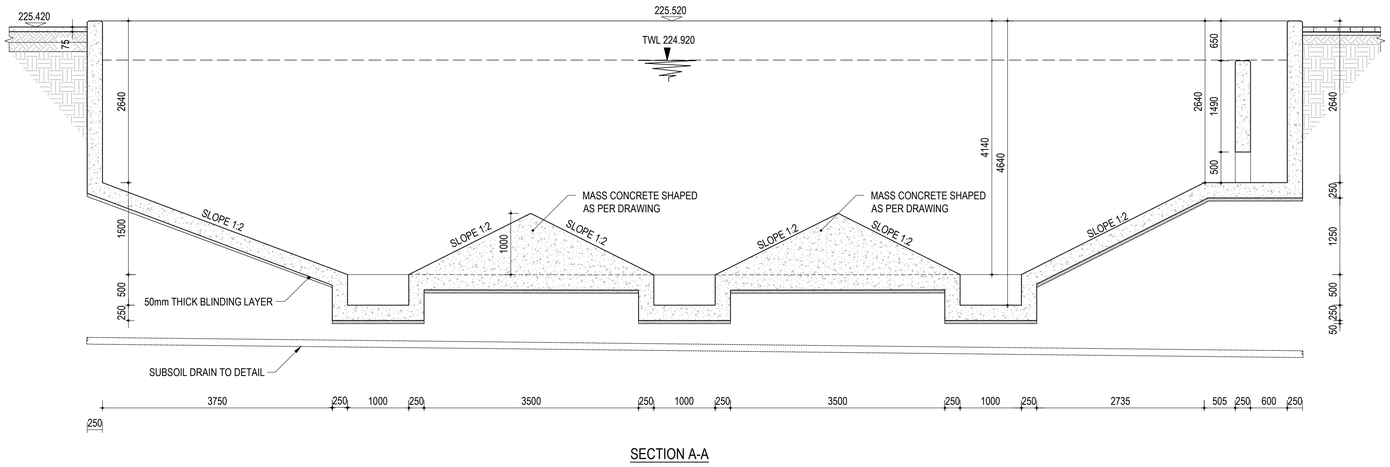
SIGNATURE: DATE:



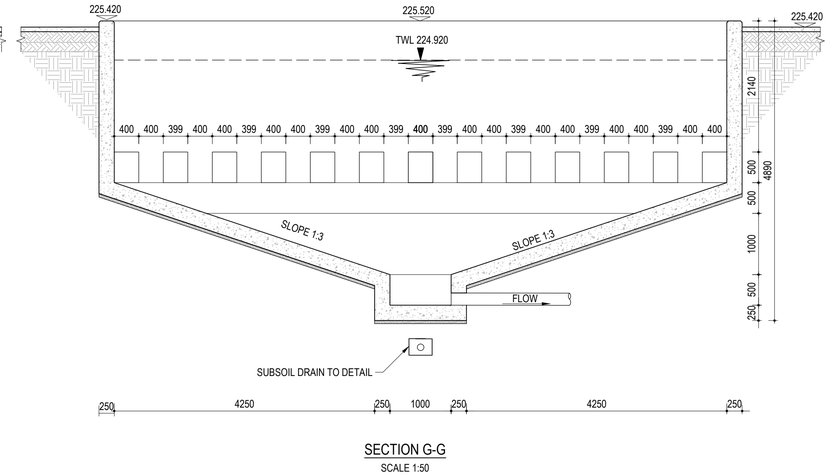
SECTION C-C
SCALE 1:50



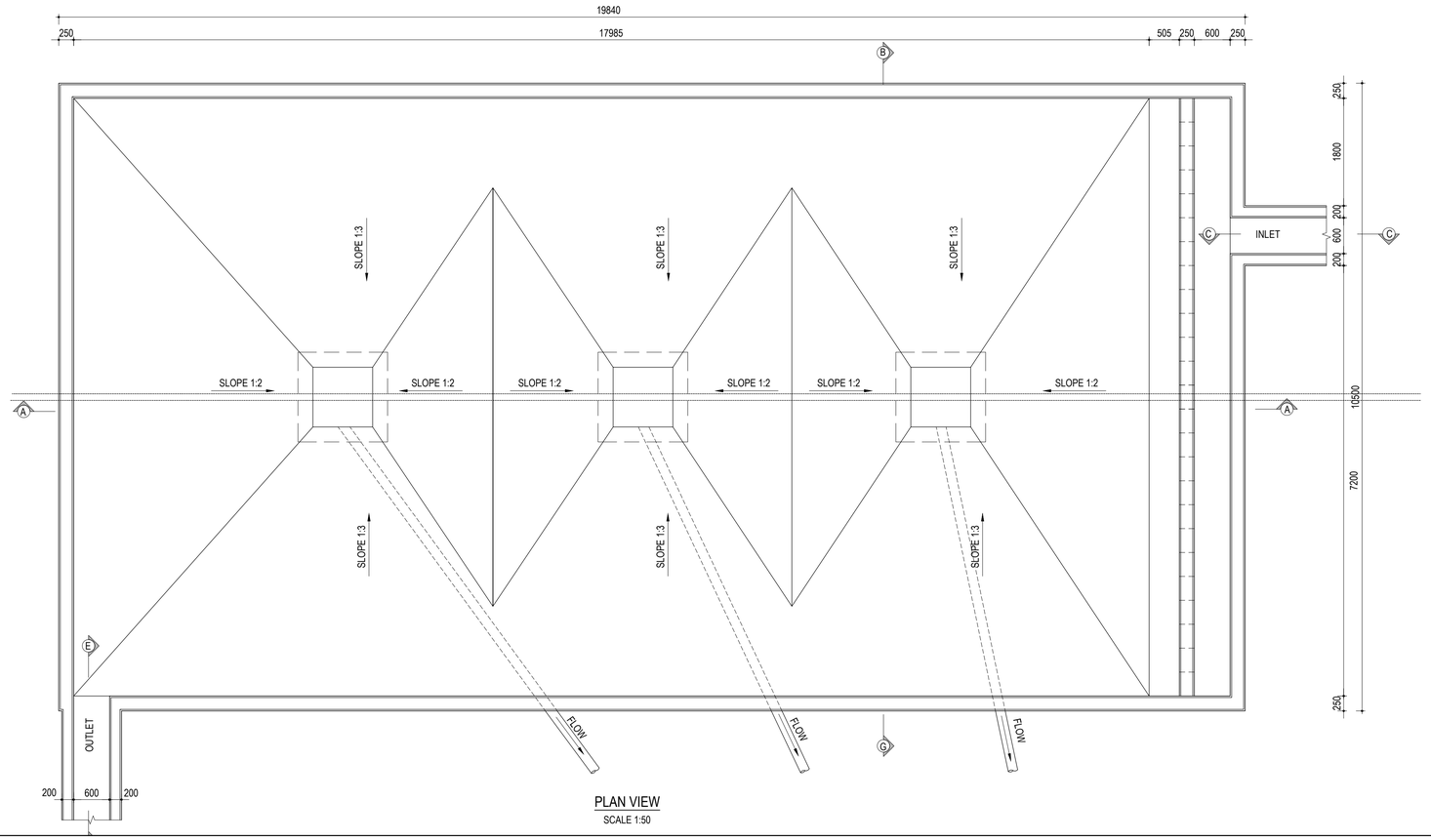
SECTION E-E
SCALE 1:50



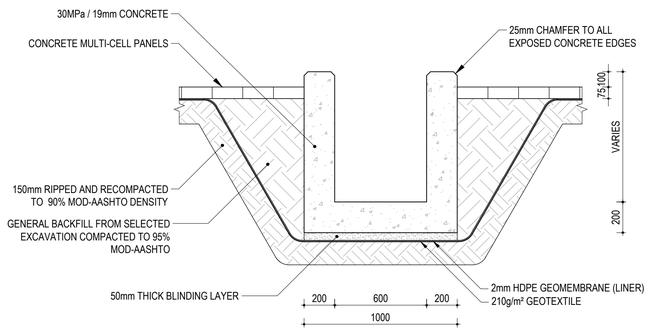
SECTION A-A
SCALE 1:50



SECTION G-G
SCALE 1:50



PLAN VIEW
SCALE 1:50



SECTION D-D
SCALE 1:20

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC20013/CIV/2402.
6. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
FAX: 086 520 8942
www.newground.co.za

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: SETTLING POND LAYOUT AND DETAILS

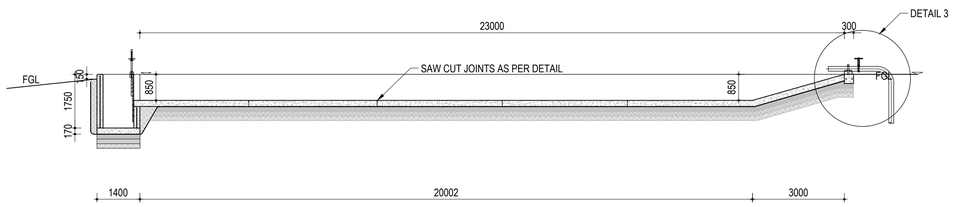
DRAWING NUMBER: PC20013 / CIV / 2601

DRAWING ISSUED FOR: TENDER

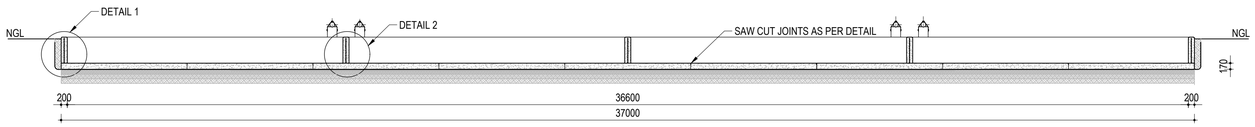
SCALE:	PAPER SIZE:	REVISION:
AS SHOWN	A1	00

APPROVED BY ENGINEER:

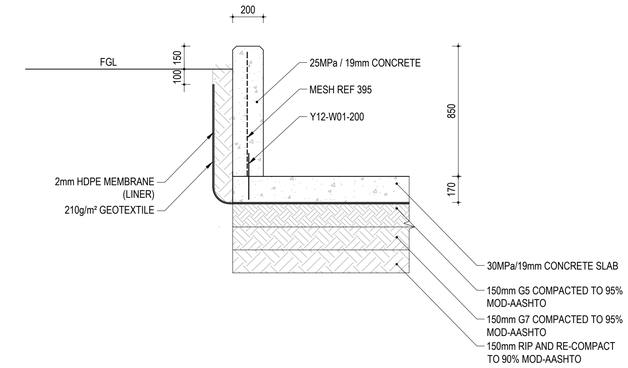
SIGNATURE: DATE:



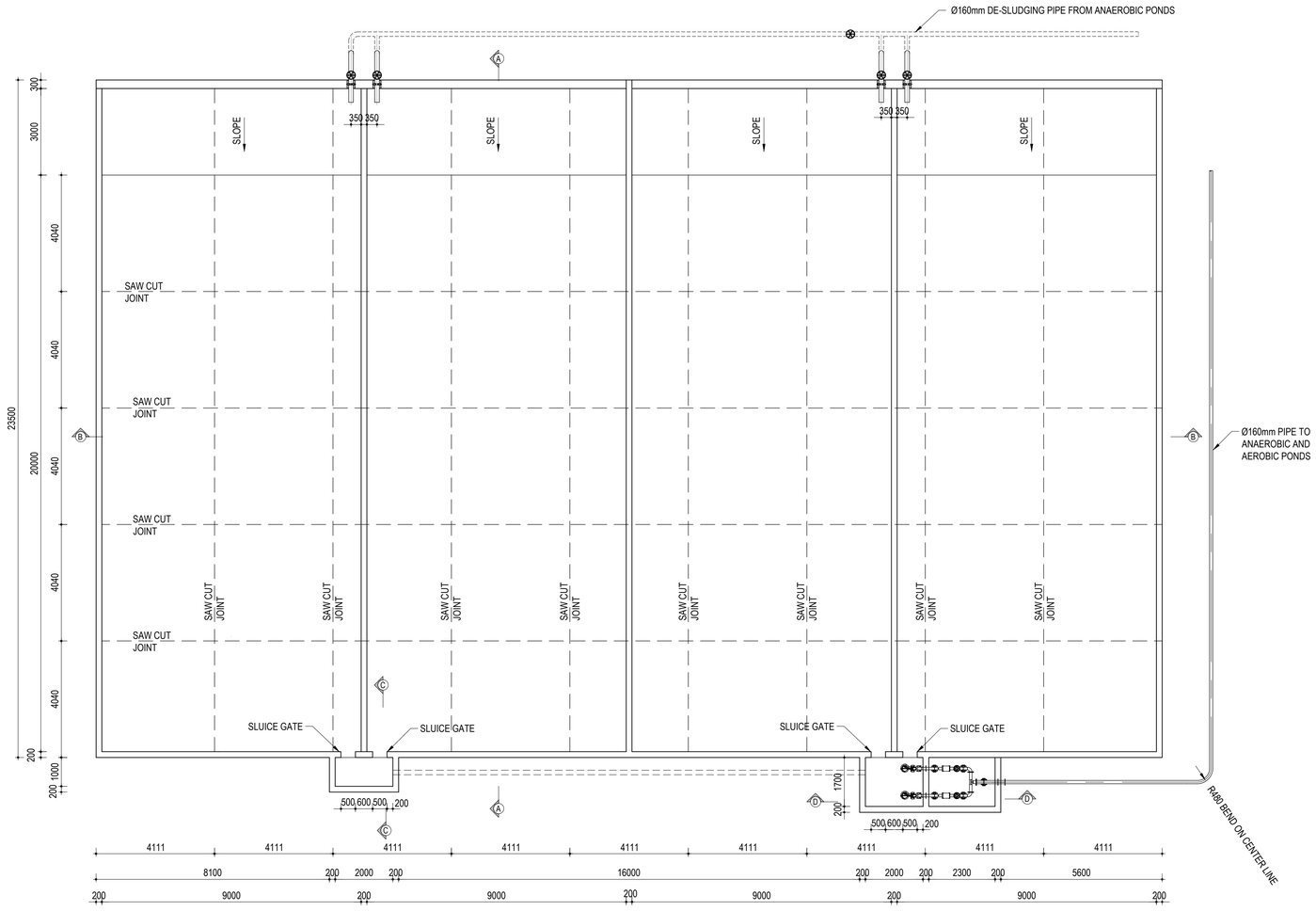
SECTION A-A
SCALE 1:100



SECTION B-B
SCALE 1:100

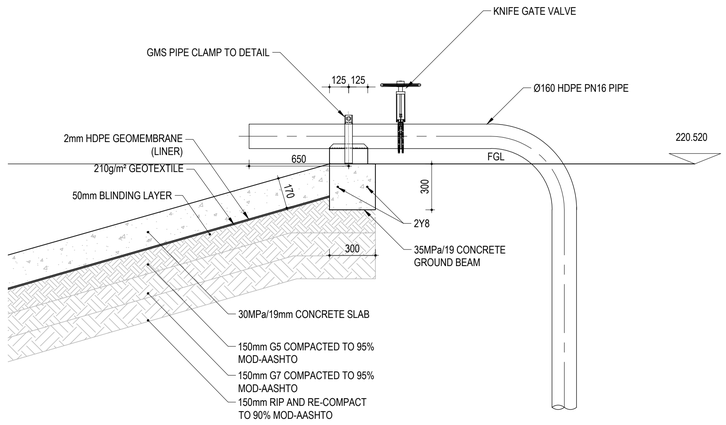


DETAIL 1
SCALE 1:20



PLAN VIEW
SCALE 1:100

DETAIL 2
SCALE 1:20



DETAIL 3
TYPICAL SECTION DETAIL
SCALE 1:20

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
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6. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

PROJECT NUMBER:
PC20013

PROJECT NAME:
UPGRADE OF BATHURST BULK SEWER

CLIENT:
NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:
NEWGROUND PROJECTS
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PO Box 10568, Tacoma, 5214
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FAX: 086 520 6942
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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

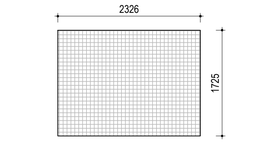
DRAWING NAME:
DRYING BED LAYOUT AND DETAILS

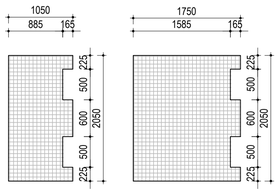
DRAWING NUMBER:
PC20013 / CIV / 2701

DRAWING ISSUED FOR: TENDER

SCALE	PAPER SIZE	REVISION:
AS SHOWN	A1	00

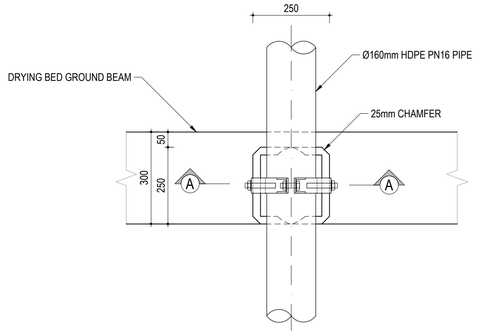
APPROVED BY ENGINEER:
SIGNATURE: DATE:



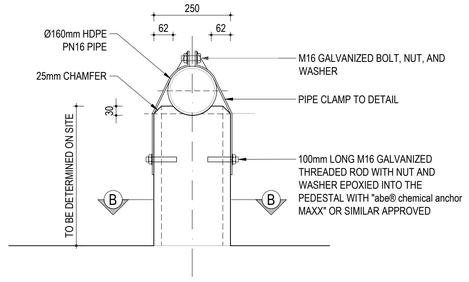


NOTE:
DIMENSIONS OF RECTAGRID AND CUT-OUTS ARE TO BE CONFIRMED ON SITE BY THE CONTRACTOR AND ENGINEER

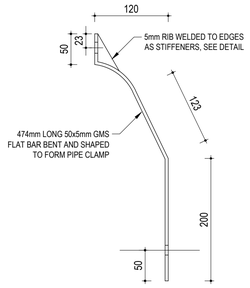
RECTAGRID DETAILS
SCALE 1:50



PIPE PEDESTAL
TOP VIEW
SCALE 1:10

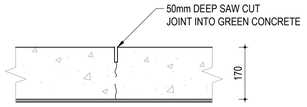


PIPE PEDESTAL
SECTION A-A
SCALE 1:10

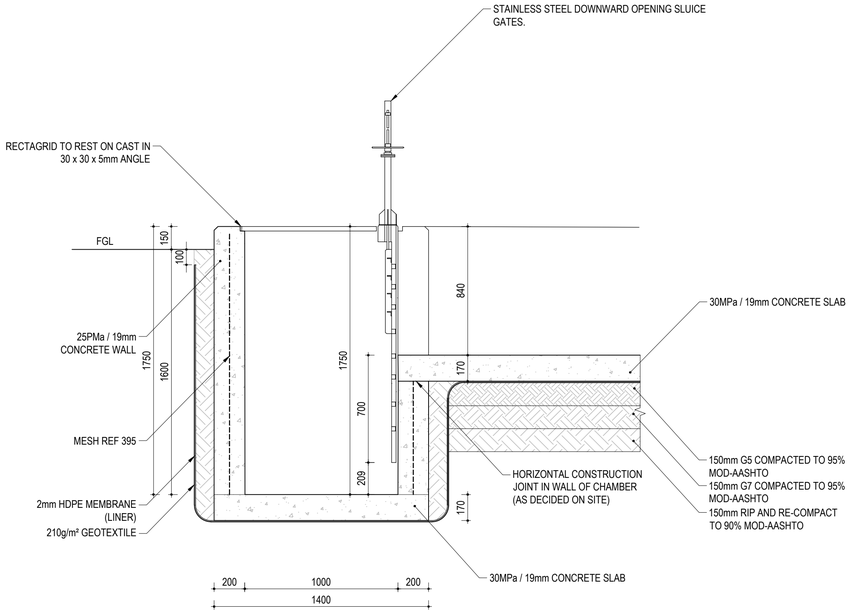


SECTION C-C
PIPE PEDESTAL DETAIL
SCALE 1:5

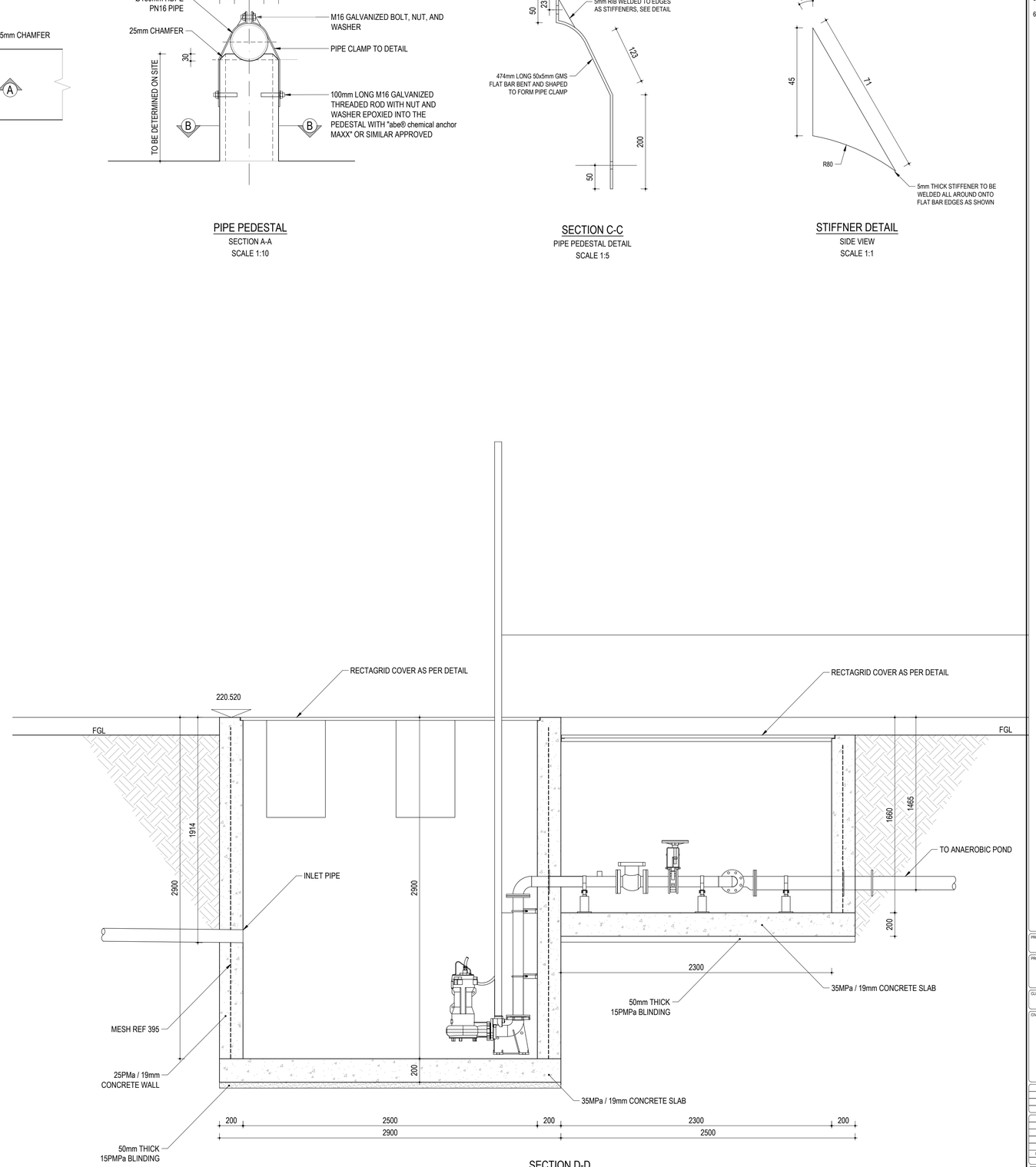
STIFFNER DETAIL
SIDE VIEW
SCALE 1:1



SAW CUT JOINT
SCALE 1:10



SECTION C-C
SCALE 1:20



SECTION D-D
SCALE 1:20

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301
4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC20013/CIV/2402.
6. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:
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17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
PO Box 19568, Tecoma, 5214
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FAX: 086 520 6942
www.newground.co.za

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: DRYING BED DETAILS

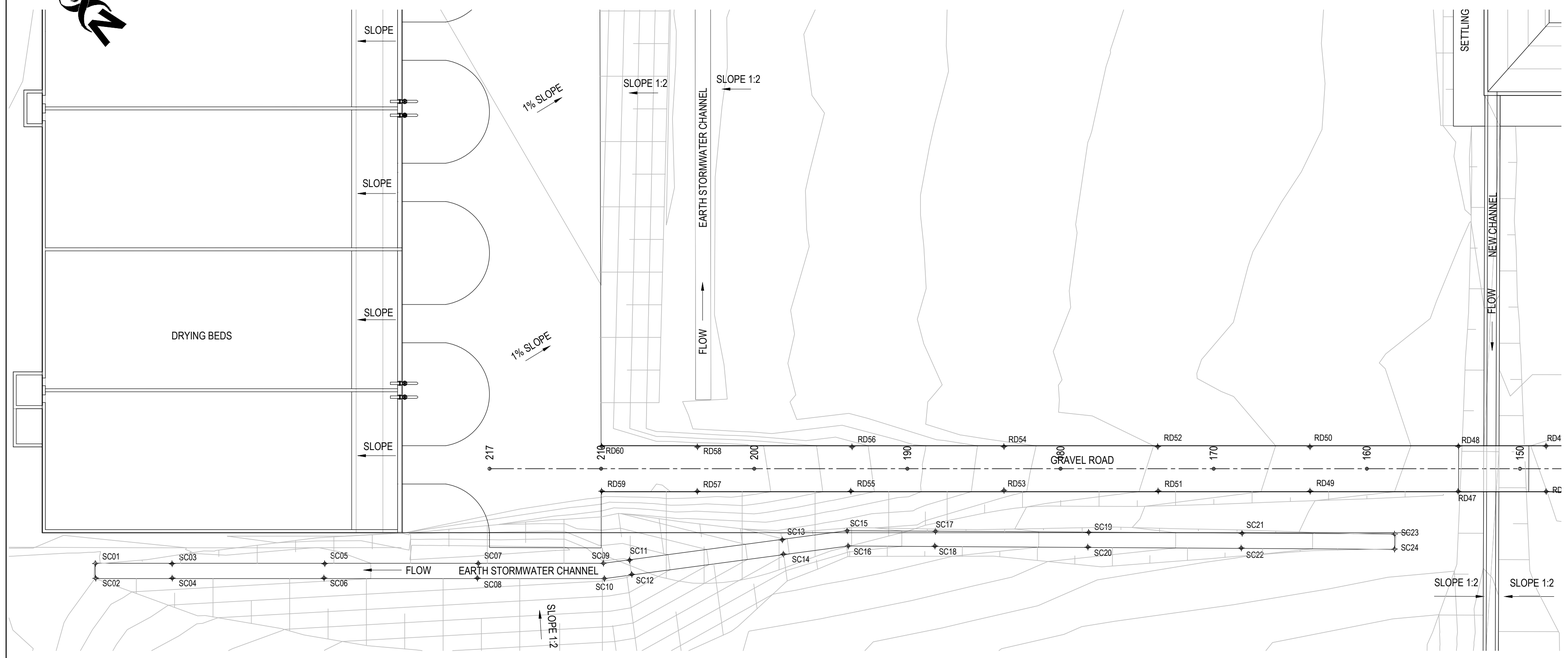
DRAWING NUMBER: PC20013 / CIV / 2702

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
AS SHOWN	A1	00

APPROVED BY ENGINEER:

SIGNATURE: DATE:

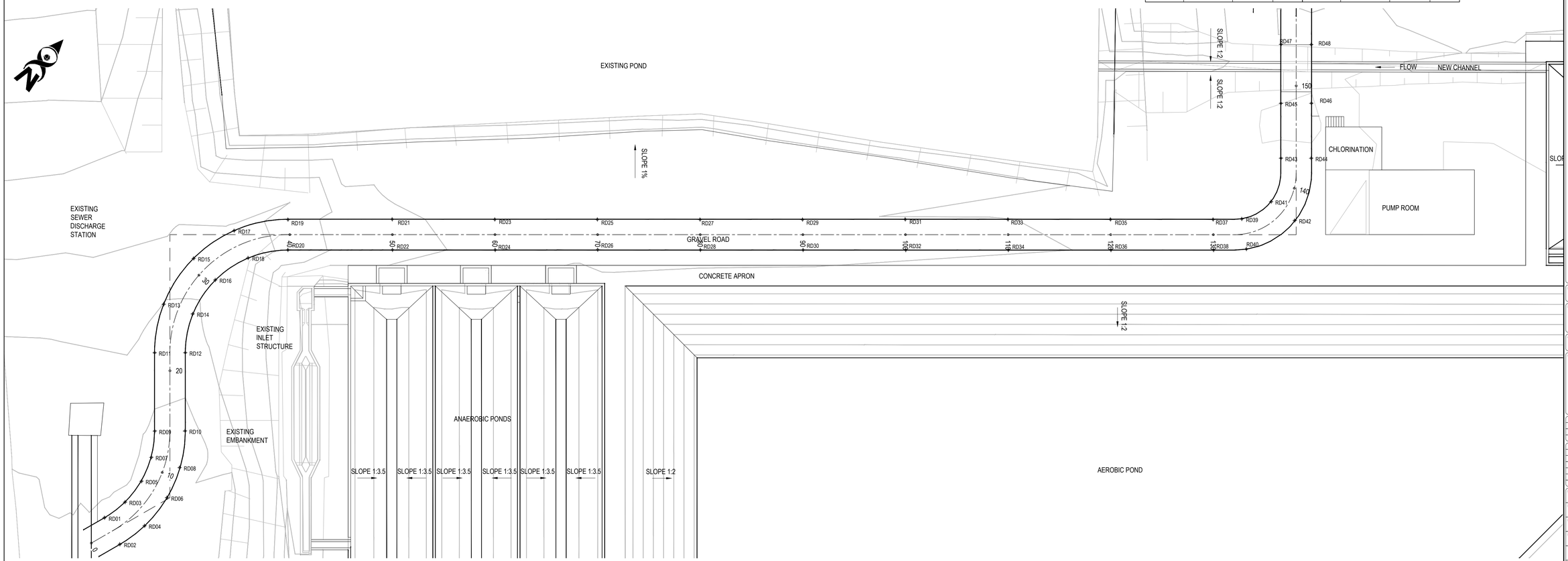


NORTHERN SECTION OF GRAVEL ROAD

SCALE 1:200

SIDE STORMWATER CHANNEL POINTS				SIDE STORMWATER CHANNEL POINTS			
POINT	Y	X	Z	POINT	Y	X	Z
SC01	-3 705 483.729	-14 393.454	220.001	SC13	-3 705 515.690	-14 361.955	222.973
SC02	-3 705 484.393	-14 394.148	220.001	SC14	-3 705 516.380	-14 362.592	222.967
SC03	-3 705 487.426	-14 390.075	220.140	SC15	-3 705 518.412	-14 358.649	223.310
SC04	-3 705 488.068	-14 390.762	220.140	SC16	-3 705 519.132	-14 359.338	223.310
SC05	-3 705 494.759	-14 383.325	220.416	SC17	-3 705 522.678	-14 354.772	223.623
SC06	-3 705 495.356	-14 384.046	220.415	SC18	-3 705 523.301	-14 355.508	223.621
SC07	-3 705 502.131	-14 376.529	220.695	SC19	-3 705 530.089	-14 348.050	224.182
SC08	-3 705 502.733	-14 377.274	220.693	SC20	-3 705 530.699	-14 348.795	224.179
SC09	-3 705 508.130	-14 370.988	220.920	SC21	-3 705 537.499	-14 341.314	224.742
SC10	-3 705 508.855	-14 371.677	220.920	SC22	-3 705 538.112	-14 342.061	224.740
SC11	-3 705 509.250	-14 369.681	221.001	SC23	-3 705 544.867	-14 334.608	225.300
SC12	-3 705 509.988	-14 370.267	221.006	SC24	-3 705 545.527	-14 335.337	225.299

GRAVEL ROAD POINTS				GRAVEL ROAD POINTS			
POINT	Y	X	Z	POINT	Y	X	Z
RD01	-3 705 657.577	-14 382.916	228.289	RD31	-3 705 583.366	-14 345.161	225.545
RD02	-3 705 658.471	-14 380.067	228.349	RD32	-3 705 585.534	-14 343.104	225.605
RD03	-3 705 655.103	-14 382.471	228.428	RD33	-3 705 576.595	-14 337.797	225.508
RD04	-3 705 655.513	-14 379.511	228.490	RD34	-3 705 578.762	-14 335.746	225.568
RD05	-3 705 652.525	-14 382.671	228.335	RD35	-3 705 569.831	-14 330.442	225.400
RD06	-3 705 652.017	-14 379.762	228.398	RD36	-3 705 571.997	-14 328.388	225.459
RD07	-3 705 650.156	-14 383.540	228.244	RD37	-3 705 563.069	-14 323.076	225.291
RD08	-3 705 649.030	-14 380.833	228.309	RD38	-3 705 565.226	-14 321.030	225.350
RD09	-3 705 648.044	-14 385.024	228.118	RD39	-3 705 561.138	-14 321.054	225.259
RD10	-3 705 646.050	-14 382.863	228.177	RD40	-3 705 562.988	-14 318.740	225.318
RD11	-3 705 642.442	-14 390.198	227.697	RD41	-3 705 557.965	-14 320.087	225.242
RD12	-3 705 640.422	-14 388.006	227.757	RD42	-3 705 557.751	-14 317.151	225.300
RD13	-3 705 638.368	-14 392.741	227.518	RD43	-3 705 554.191	-14 322.246	225.302
RD14	-3 705 637.148	-14 390.030	227.570	RD44	-3 705 552.199	-14 320.075	225.361
RD15	-3 705 633.108	-14 393.618	227.383	RD45	-3 705 550.263	-14 325.866	225.346
RD16	-3 705 633.231	-14 390.647	227.443	RD46	-3 705 548.254	-14 323.685	225.405
RD17	-3 705 628.453	-14 392.546	227.250	RD47	-3 705 546.033	-14 329.754	225.556
RD18	-3 705 629.488	-14 389.747	227.295	RD48	-3 705 544.050	-14 327.564	225.616
RD19	-3 705 624.104	-14 389.419	226.795	RD49	-3 705 538.906	-14 336.284	225.071
RD20	-3 705 626.282	-14 387.422	226.855	RD50	-3 705 536.939	-14 334.157	225.013
RD21	-3 705 617.209	-14 381.963	226.089	RD51	-3 705 531.597	-14 342.992	224.504
RD22	-3 705 619.379	-14 379.927	226.148	RD52	-3 705 529.617	-14 340.876	224.445
RD23	-3 705 610.449	-14 374.591	225.812	RD53	-3 705 524.165	-14 349.785	223.872
RD24	-3 705 612.610	-14 372.557	225.871	RD54	-3 705 522.223	-14 347.672	223.814
RD25	-3 705 603.685	-14 367.237	225.629	RD55	-3 705 516.834	-14 356.585	222.782
RD26	-3 705 605.836	-14 365.219	225.688	RD56	-3 705 514.936	-14 354.400	222.852
RD27	-3 705 596.914	-14 359.865	225.587	RD57	-3 705 509.462	-14 363.381	221.292
RD28	-3 705 599.071	-14 357.841	225.646	RD58	-3 705 507.504	-14 361.235	221.352
RD29	-3 705 590.157	-14 352.514	225.554	RD59	-3 705 504.859	-14 367.599	220.586
RD30	-3 705 592.300	-14 350.473	225.614	RD60	-3 705 502.885	-14 365.440	220.645



SOUTHERN SECTION OF GRAVEL ROAD

SCALE 1:200

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
2. FOR EARTHWORK NOTES, REFER TO DRAWING PC20013/CIV/2102
3. FOR PIPELINE NOTES REFER TO DRAWING PC20013/CIV/2301

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

CIVIL & STRUCTURAL ENGINEER:

NEWGROUND PROJECTS
17 ST ANDREWS ROAD, SELBORNE, EAST LONDON, 5201
PO Box 19568, Tecoma, 5214
TEL: 043 722 5864
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www.newground.co.za

REFERENCE DRAWINGS:

REV	DATE	DESCRIPTION

REVISIONS:

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: INTERNAL ROAD EARTHWORKS

DRAWING NUMBER: PC20013 / CIV / 2801

DRAWING ISSUED FOR: TENDER

SCALE	PAPER SIZE	REVISION:
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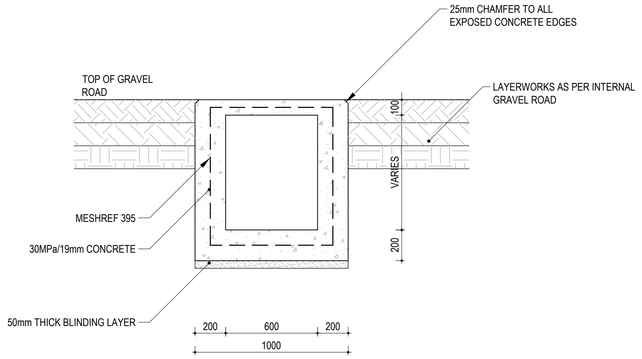
APPROVED BY ENGINEER:

SIGNATURE: DATE:



CHANNEL CROSSING

CROSS SECTION
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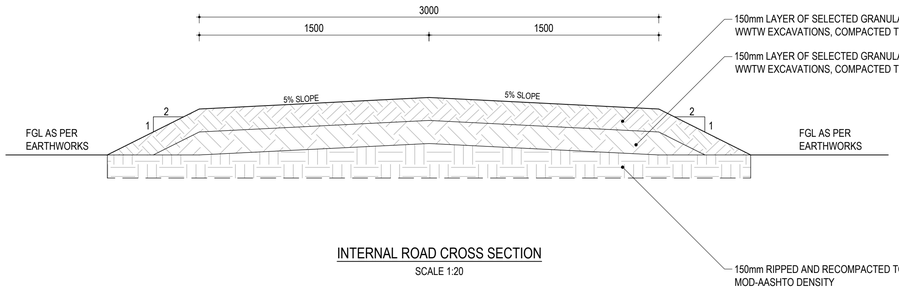

INTERNAL ROAD CROSS SECTION

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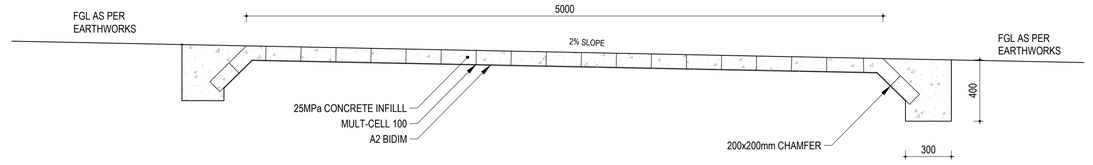

GEOCELL ROAD CROSS SECTION

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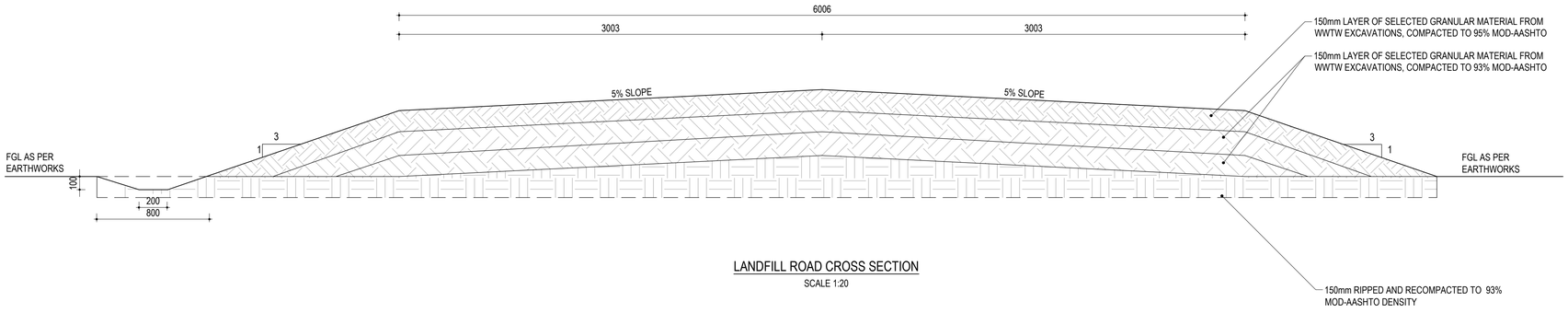

LANDFILL ROAD CROSS SECTION

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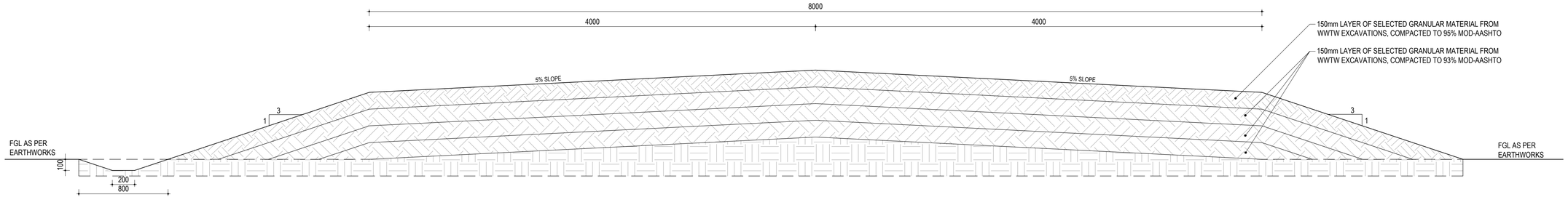

ACCESS ROAD CROSS SECTION

SCALE 1:20

NOTES:

1. FOR GENERAL NOTES, REFER TO DRAWING PC20013/CIV/2101
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4. FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401
5. FOR FORMWORK AND CONCRETE MIX NOTES. REFER TO DRAWING PC20013/CIV/2402.
6. FOR CURING, TESTING AND REINFORCEMENT NOTES, REFER TO DRAWING PC20013/CIV/2403

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REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 2 FEBRUARY 2026

DRAWING NAME: ROADS DETAILS

DRAWING NUMBER: PC20013 / CIV / 2802

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
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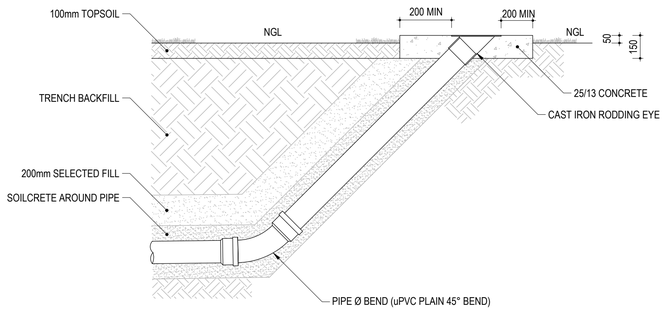
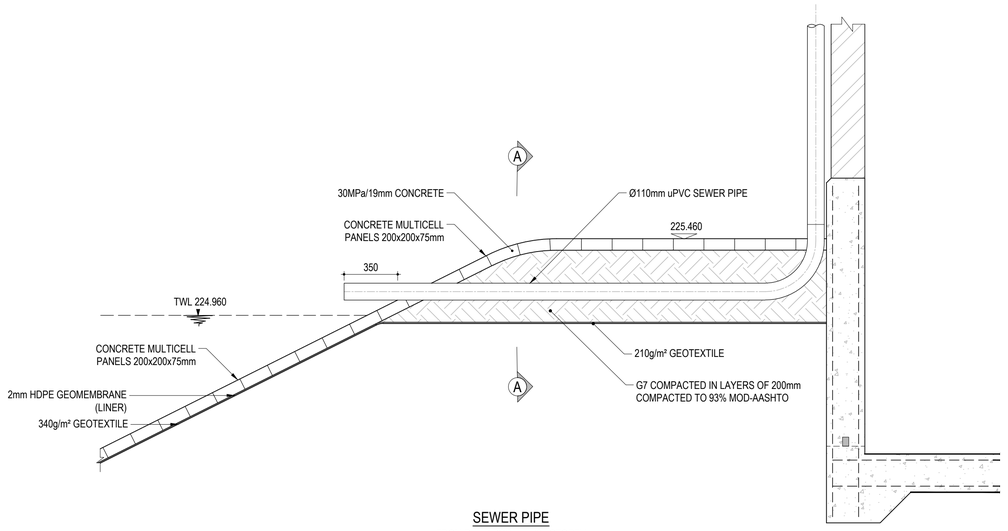
APPROVED BY ENGINEER:

SIGNATURE: DATE:



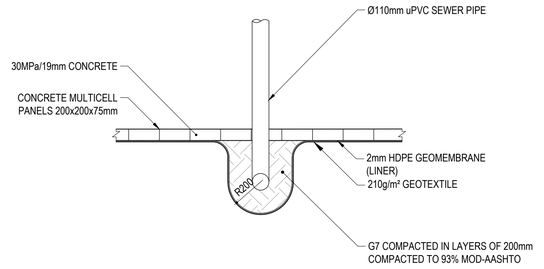
TYPICAL DETAIL OF RODDING EYE

AT THE HEAD OF THE ERF SEWER LINE
SCALE 1:20



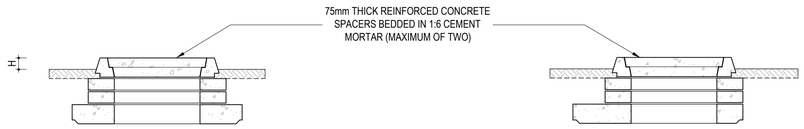
SEWER PIPE

FROM PUMP ROOM FIRST STOREY
SCALE 1:20



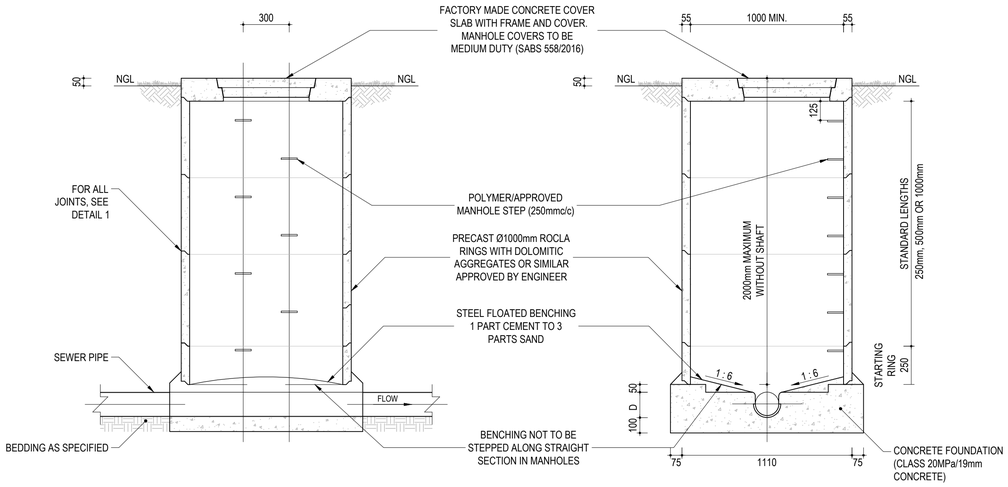
SECTION A-A

SCALE 1:20



ALTERNATIVE LAYOUT WITH SPACERS

SCALE 1:20



TYPICAL SECTIONS THROUGH PRECAST MANHOLE

SCALE 1:20

NOTE:
FOR GENERAL AND EARTHWORKS NOTES,
REFER TO DRAWING NUMBER PC20013/CIV/2101

FOR CONCRETE NOTES, REFER TO DRAWING
PC20013/CIV/2401

FOR PIPE NOTES, REFER TO DRAWING
PC20013/CIV/2902

CATCH PIT AND MANHOLE NOTES:

1. ALL DIMENSIONS, INVERT LEVELS AND COORDINATES MEASURED FROM THE CENTER OF MANHOLES AND CATCH PITS.

CARRIAGEWAYS : COVER TO BE FLUSH WITH THE FINISH ROAD SURFACE
ROAD RESERVE : COVER TO BE 50mm ABOVE THE FINISH GROUND LEVEL
OPEN SPACES : COVER TO BE 500mm ABOVE FINISH GROUND LEVEL

2. CHANNELING TO BE CONSTRUCTED WITH WATER TIGHT CONCRETE WITH A SMOOTH FINISH.
3. CHANNELS TO BE LAID IN THE WET CONCRETE FLOOR. THE FIRST BRICKWORK TO BE PLACED, AND THE BENCHING COMPLETED WITHIN 24 HOURS AFTER CASTING THE CONCRETE FLOOR.
4. PIPE AND BENCHING ARRANGEMENT ARE TYPICAL BUT CAN VARY WITH CIRCUMSTANCES.
5. ALL BENCHING TO BE RENDERED IN 20mm THICK MORTAR OF 1:3 CEMENT:SAND RATIO AND FINISHED SMOOTH AND TRUE WITH A STEEL TROWEL. BENCHING, CORNERS AND EDGES TO BE ROUNDED.
6. OVER EXCAVATION CAN ONLY BE FILLED AFTER APPROVAL BY THE ENGINEER WITH CLASS 20MPa/19mm CONCRETE (WHERE APPLICABLE) OR A SUITABLE MATERIAL AS INSTRUCTED BY THE ENGINEER.
7. NO PART OF THE MANHOLE AND CATCH PIT TO BE FINISHED OFF WITH CEMENT SLUDGE OR MORTAR.
8. ALL CONCRETE, BENCHING AND SEALERS TO COMPLY WITH SABS 1200 GA OR SABS 1200 AS APPLICABLE.
9. ALL PRECAST CONCRETE SECTIONS TO CONSIST OF 30MPa CONCRETE. ALL OTHER CONCRETE - 25MPa/19mm
10. NO ADDITIVES FOR QUICK DRYING TO BE PERMITTED FOR THE BENCHING
11. STEP IRONS TO BE MADE FROM CALCAMITE OR AN EQUIVALENT MATERIAL AND TO BE APPROVED BY THE ENGINEER, THEY SHALL HAVE A VERTICAL SPACING OF 250mm AND TO BE STAGGERED LEFT AND RIGHT AT 200mm CENTER TO CENTER. STEPS TO BE INSTALLED TO MANUFACTURER DETAILS WHERE APPLICABLE.
12. ALL BRICKWORK TO BE 220mm BURNT CLAY BRICK WALLS WITH CLASS II MORTAR.
13. ALL INTERNAL FACES OF EXPOSED BRICKWORK TO BE PLASTERED 15mm THICK.
14. NO CEMENT BRICKS WILL BE ALLOWED.

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER:	DRAFTER:
G TESELING	H OOSTHUIZEN
REVIEWER:	DATE:
L FOURIE	2 FEBRUARY 2026

DRAWING NAME: SEWER DETAILS

DRAWING NUMBER: PC20013 / CIV / 2901

DRAWING ISSUED FOR: TENDER

SCALE:	PAPER SIZE:	REVISION:
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APPROVED BY ENGINEER:

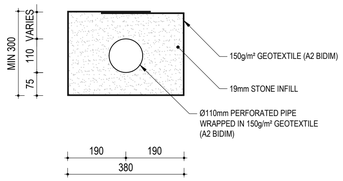
SIGNATURE: DATE:

MINIMUM TRENCH BASE WIDTHS	
FOR PIPES WITH OUTER Ø < 300mm	W (mm)
Ø ≤ 110mm	700
110 < Ø ≤ 200mm	800
200 < Ø ≤ 300mm	900
FOR MULTIPLE PIPES IN SAME TRENCH	ADD 300 AND THE ADDITIONAL PIPE Ø PER ADDITIONAL SERVICE

CHAMBER AND SHAFT SECTIONS		
TYPE	NOMINAL DIAMETER(mm)	MIN.WALL THICKNESS(mm)
CHAMBER	1250	75
SHAFT	700 APPROX.	55

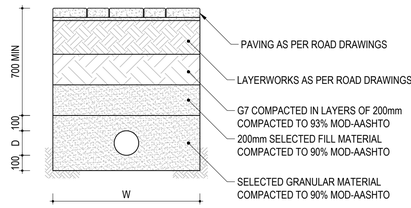
REDUCER AND ADAPTOR SLABS		
TYPE	NOMINAL DIAMETER(mm)	MIN. THICKNESS(mm)
REDUCER	1250	150
ADAPTOR	750	150

MINIMUM TRENCH BASE WIDTHS (W) AND BEDDING BELOW PIPE HEIGHTS (H)		
FOR PIPES WITH OUTER Ø < 825mm (D)	W (mm)	H (mm)
Ø 160mm	800	100
Ø 200mm	800	100
Ø 450mm	1100	100
Ø 600mm	1300	100
Ø 825mm	1500	150



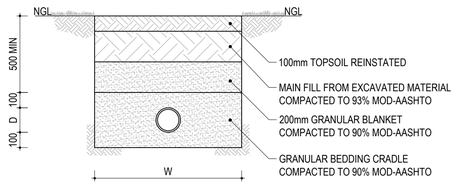
SUBSOIL DRAIN DETAIL

SCALE 1:10



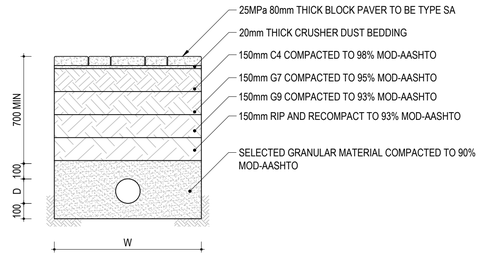
TYPICAL TRENCH DETAIL FOR PIPES UNDER PAVING

SCALE 1:20



TYPICAL TRENCH DETAIL FOR PIPES UNDER NATURAL GROUND

SCALE 1:20



TYPICAL TRENCH DETAIL FOR PIPES UNDER PAVING

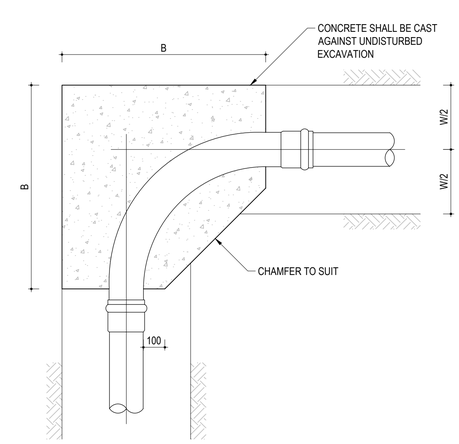
SCALE 1:20

NOTE:
FOR GENERAL AND EARTHWORKS NOTES, REFER TO DRAWING NUMBER PC20013/CIV/2101

FOR CONCRETE NOTES, REFER TO DRAWING PC20013/CIV/2401

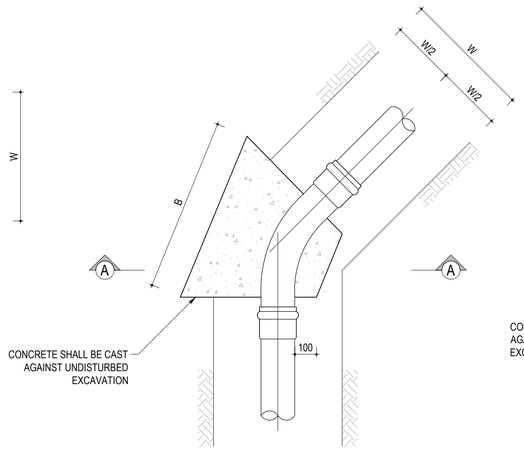
PIPELINE NOTES:

1. Ø REFERS TO THE NOMINAL DIAMETER OF THE PIPES.
2. PIPES WITH A GRADE STEEPER THAN 1:10 MUST HAVE ANCHOR BLOCKS.
3. EXCAVATION AND BACKFILLING OF TRENCHES TO COMPLY WITH SABS 1200 DB.
4. BEDDING OF PIPES TO COMPLY WITH SABS 1200 LB.
5. BEDDING SHOULD BE TO A CLASS AS SPECIFIED BY THE ENGINEER. IN THE ABSENCE OF ENGINEERING INSTRUCTIONS, IT IS ADVISABLE TO USE A BEDDING CLASS FOR FLEXIBLE PIPES IN ACCORDANCE WITH SABS 1200 LB WHERE UNDER TRAFFIC LOAD AND A CLASS C BEDDING ELSEWHERE.
6. TRENCHES DEEPER THAN 1000mm IN CERTAIN TYPES OF MATERIAL MAY BE REQUIRED TO BE CHAMFERED TO PREVENT ACCIDENTAL INJURY FROM COLLAPSING SIDEWALLS.
7. TRENCH BOTTOMS TO BE FREE FROM STONES, PROJECTIONS, SOFT SPOTS, AND BE REASONABLY UNIFORM AND GRADED TO FALL.
8. BACKFILL TO BE DONE AS THE PIPE LAYING PROGRESSES AND A 300mm SECTION TO BE LEFT EXPOSED ON EITHER SIDE OF JOINTS FOR TESTING.
9. BACKFILL TO BE COMPACTED IN LAYERS NO MORE THAN 150mm TO 93% MOD AASHTO.
10. A MINIMUM COVER OF 600mm IS REQUIRED TO TOP OF ALL PIPES. THE ENGINEER TO BE NOTIFIED OF ANY SECTION OF PIPELINE WHERE THE COVER IS LESS THAN THE PRESCRIBED 600mm.
11. ALL HORIZONTAL AND VERTICAL BENDS TO HAVE THRUST BLOCKS.
16. TESTING TO BE DONE IN ACCORDANCE WITH SABS 1200 LD CLAUSE 7.
17. THE CONTRACTOR TO MAKE GOOD ANY DEFECTS THAT MAY BE FOUND WHILE THE PIPE IS UNDER TEST AND AFTER THAT THE TESTS SHALL BE REPEATED AT HIS EXPENSE UNTIL THE PIPE IS FOUND TO COMPLY WITH THE SPECIFICATION.
18. AFTER THE PIPES HAS PASSED THE TESTS ALL ACCESS LIDS SHALL BE PROPERLY SEALED WITH BITUMEN OR BY ANY OTHER APPROVED METHOD THAT WILL ENSURE THAT THEY ARE WATERTIGHT
13. uPVC PIPES TO BE BOUGHT IN LENGTHS OF 6 m, AND COMPLY WITH THE RELEVANT REQUIREMENTS OF SABS 791 AND HAVE SUITABLE FLEXIBLE JOINTS :
    - RUBBER JOINT RINGS SHALL COMPLY WITH THE RELEVANT REQUIREMENTS OF PART I OF SABS 974.
    - WHEN A FLEXIBLE JOINT IS TESTED IN ACCORDANCE WITH SUB-CLAUSE 4.4 OF SECTION LD OF PART 3 OF SABS 0120, THERE SHALL BE NO SIGN OF LEAKAGE IN ANY OF THE TESTS
    - THE INFLOW OF STORMWATER IS TO BE PROHIBITED.
14. ONLY REINFORCED CONCRETE PIPES WITH RUBBER RING SEALS ARE PERMITTED. INTERLOCKING JOINT (OGEE) PIPES SHALL NOT BE USED.
15. PRECAST CONCRETE PIPE UNITS TO COMPLY WITH SABS 677.
16. WHERE CUTTING OF PIPES ARE REQUIRED, THE PIPE MUST BE NEATLY CUT, WITH ANY EXPOSED REINFORCEMENT BEING ADEQUATELY TREATED AND PROTECTED AGAINST CORROSION.



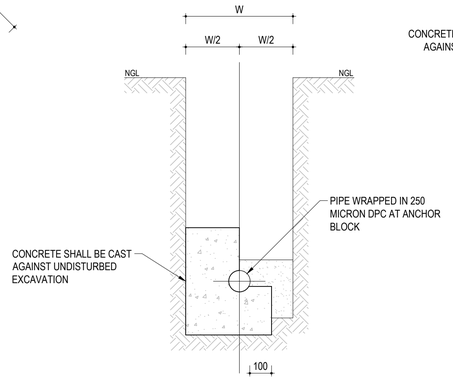
THRUST BLOCK: 90° BEND

NOT TO SCALE



THRUST BLOCK: 45° AND LESS BENDS

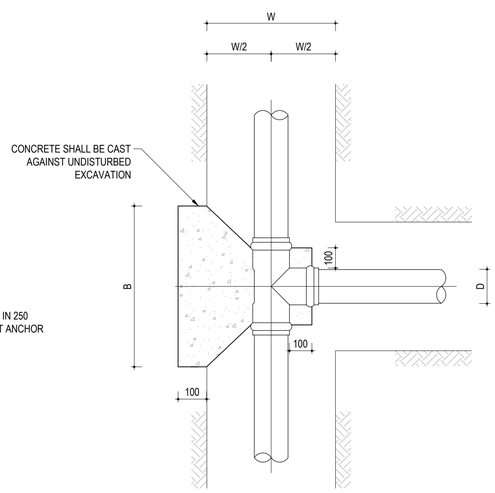
NOT TO SCALE



SECTION A-A

SECTION OF 45° AND LESS BENDS THRUST BLOCK

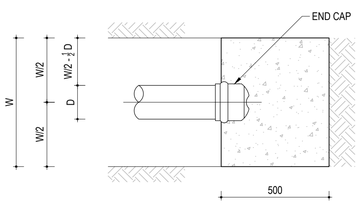
NOT TO SCALE



THRUST BLOCK: TEE

NOT TO SCALE

ANCHOR & THRUST BLOCK SIZING SOIL WITH 200kPA BEARING CAPACITY AND PIPE PRESSURE OF 9BAR								
45° < BENDS ≤ 90°			22.5° < BENDS ≤ 45°			BENDS ≤ 22.5°		
SIZE D (mm)	H (mm)	B (mm)	SIZE D (mm)	H (mm)	B (mm)	SIZE D (mm)	H (mm)	B (mm)
≤ 110	400	400	≤ 110	300	300	≤ 110	300	300
160	400	700	160	300	400	160	300	300
200	600	750	200	400	450	200	400	400
250	700	1000	250	400	700	250	400	400
315	800	1350	315	600	750	315	600	600
355	900	1500	355	600	900	355	600	600



END CAP DETAIL

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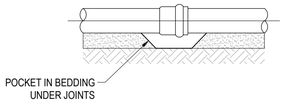
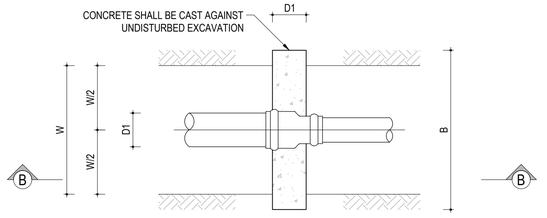


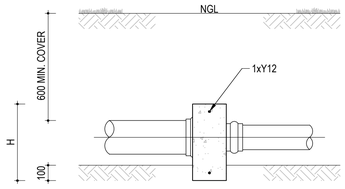
TYPICAL JOINT POCKETS FOR FLEXIBLE PIPES

NOT TO SCALE



ANCHOR BLOCK: REDUCER

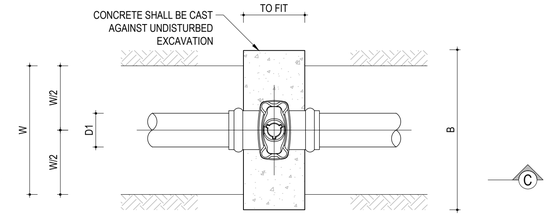
NOT TO SCALE



SECTION B-B

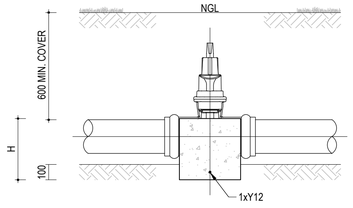
SECTION OF REDUCER ANCHOR BLOCK

NOT TO SCALE



ANCHOR BLOCK: VALVE

NOT TO SCALE



SECTION C-C

SECTION OF VALVE ANCHOR BLOCK

NOT TO SCALE

PROJECT NUMBER: PC20013

PROJECT NAME: UPGRADE OF BATHURST BULK SEWER

CLIENT: NDLAMBE MUNICIPALITY

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION

REVISIONS

DESIGNER: G TESELING	DRAFTER: H OOSTHUIZEN
REVIEWER: L FOURIE	DATE: 30 JANUARY 2026

DRAWING NAME: PIPE DETAILS

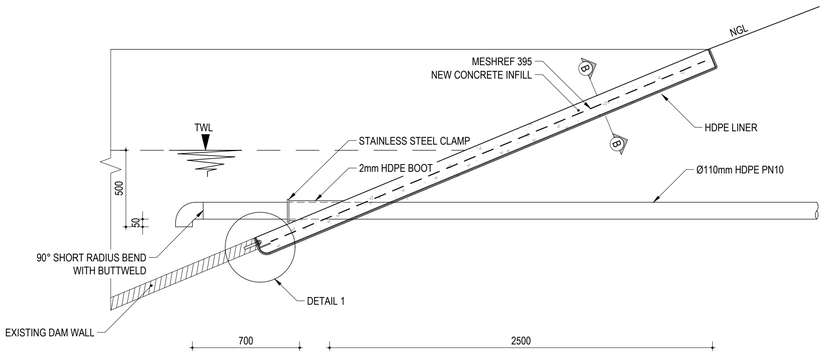
DRAWING NUMBER: PC20013 / CIV / 2902

DRAWING ISSUED FOR: TENDER

SCALE: 1 : 20	PAPER SIZE: A1	REVISION: 00

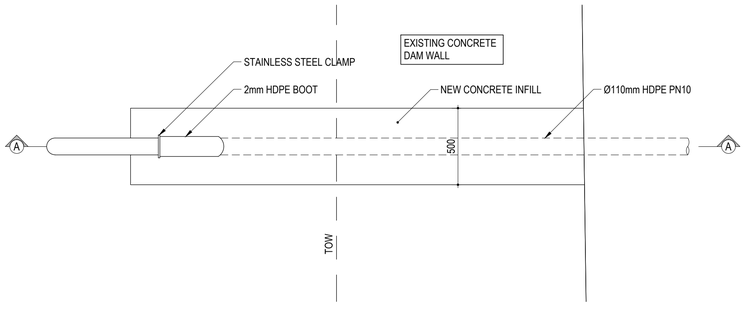
APPROVED BY ENGINEER:

SIGNATURE: DATE:



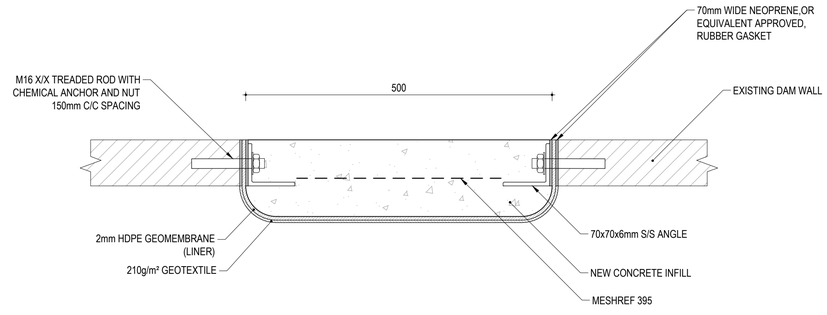
SECTION A-A

SCALE 1:20



RECYCLE SUCTION PIPELINE PLAN

SCALE 1:20



SECTION B-B

SCALE 1:5

NOTES:

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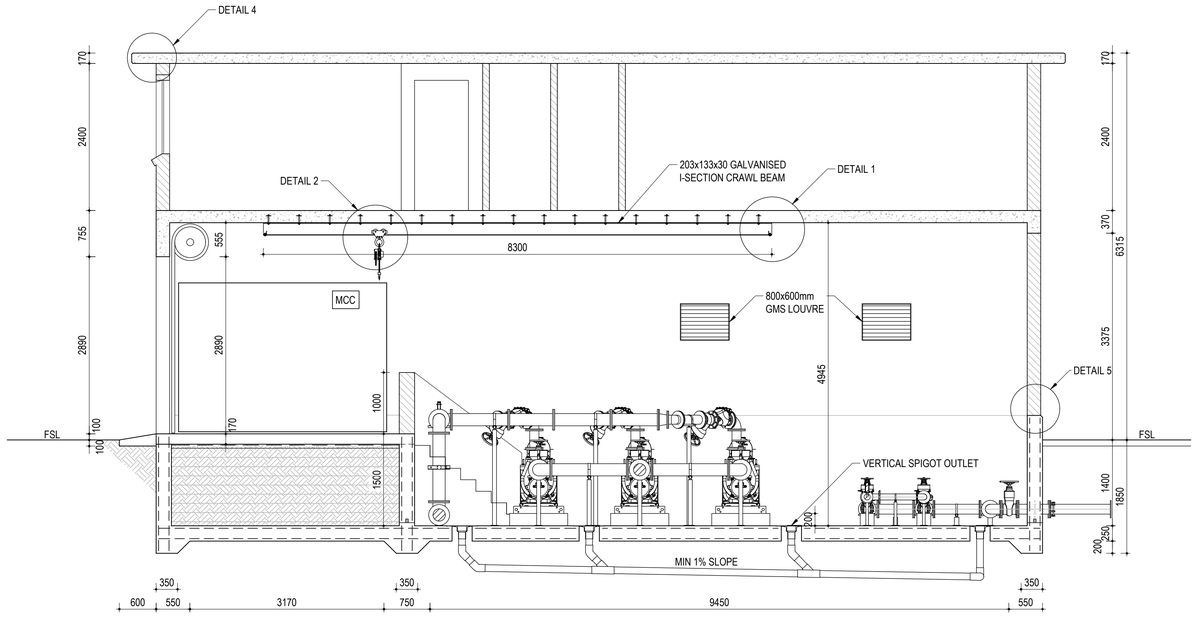

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SECTION A-A

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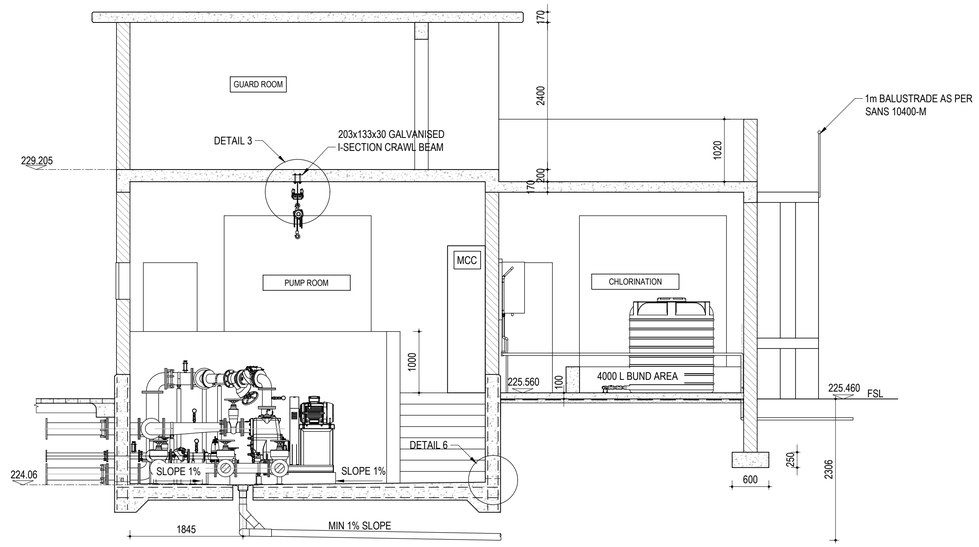

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SECTION B-B

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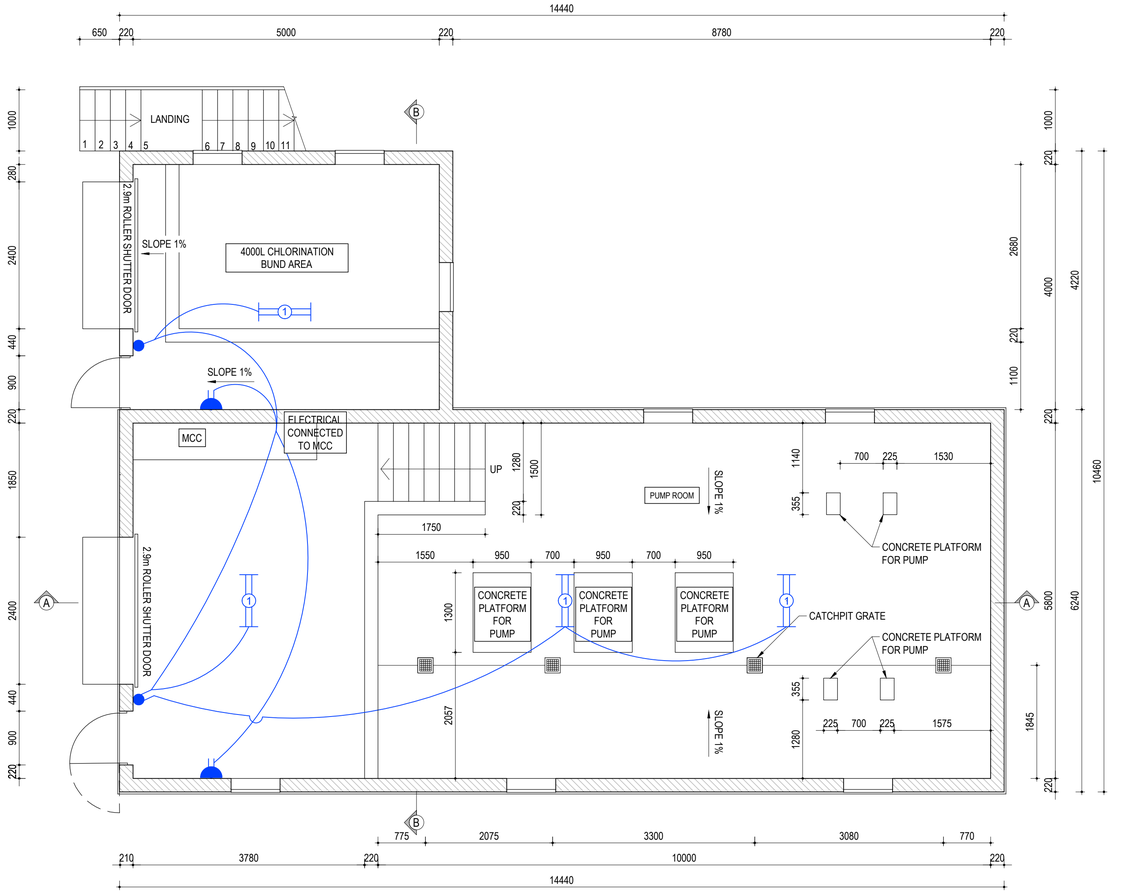

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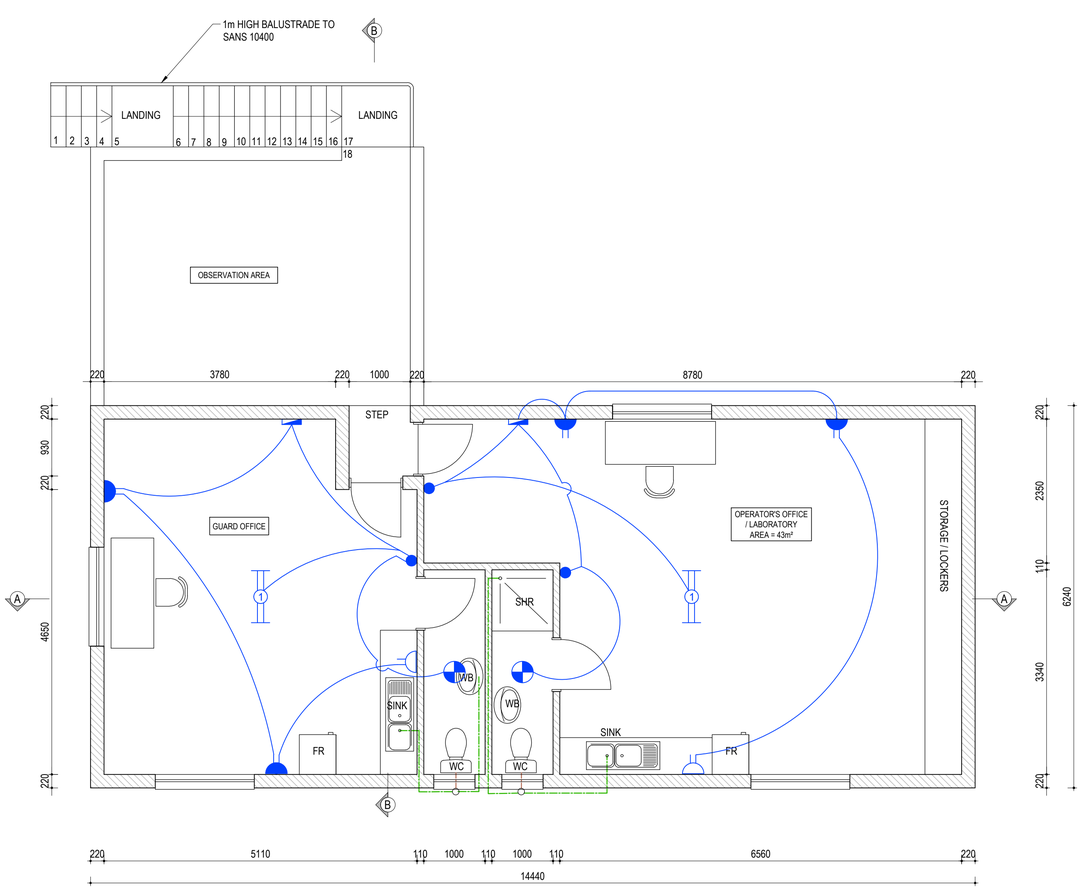

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ELECTRICAL LEGEND

- SINGLE LIGHT SWITCH
- MULTIPLE LIGHT SWITCH
- CEILING LIGHT
- FLUORESCENT LIGHT
- DISTRIBUTION BOARD
- DOUBLE 15A PLUG (350mm AFFL)
- DOUBLE 15A PLUG (1200mm AFFL)

BRICK WORK NOTES

1. ALL BRICKWORK TO BE 220mm BURNT CLAY BRICK WALLS WITH CLASS II MORTAR.
2. ALL INTERNAL FACES OF BRICKWORK THAT WILL BE EXPOSED TO BE PLASTERED 15mm THICK.
3. NO CEMENT BRICKS OR PLASTERING TO BE ALLOWED.

STEEL NOTES:

4. FABRICATION AND ERECTION OF STRUCTURAL STEELWORK TO BE CARRIED OUT IN ACCORDANCE WITH SABS 1200H.
5. ALL BOLTS TO BE GRADE 8.8 UNLESS OTHERWISE SPECIFIED.
6. ALL STEELWORK AND BOLTS TO BE HOT DIPPED GALVANIZED.
7. STEEL GRADES:
   - HOT ROLLED SECTIONS: S355JR
   - HOLLOW SECTIONS: S355
   - COLD FORMED SECTIONS:
   - 200MPa (YIELD STRESS)
   - 365 MPa (TENSILE STRESS)
8. ALL WELDS ELECTRODES TO BE E70XX.
9. ALL WELDS TO BE BOTH SIDES OTHERWISE SPECIFIED.
10. WELDING TO BE DONE IN WORKSHOP CONDITIONS IN ACCORDANCE WITH SANS 10044. WELDING TO BE DONE BY CODED WELDER. ALL WELDS TO BE CERTIFIED BY A CODED WELDER.
11. NO WELDING IS PERMITTED ON SITE.
12. ALL WELDS TO BE VISUALLY INSPECTED BY A CODED WELDER OR STRUCTURAL ENGINEER.
13. SHOP DRAWINGS TO BE APPROVED BY ENGINEER PRIOR TO FABRICATION.

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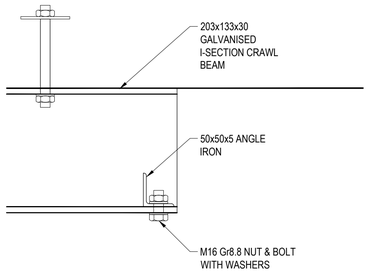

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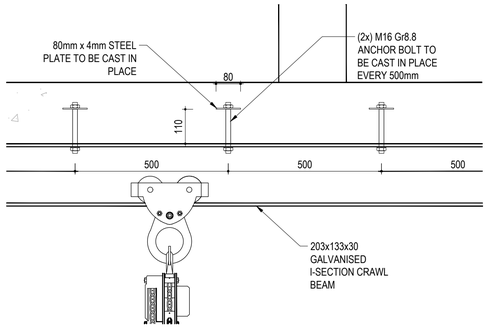

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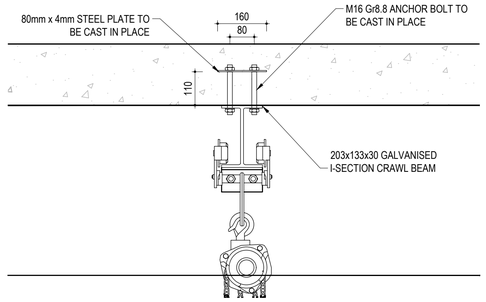

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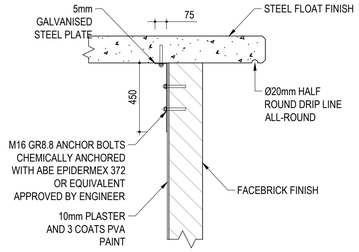

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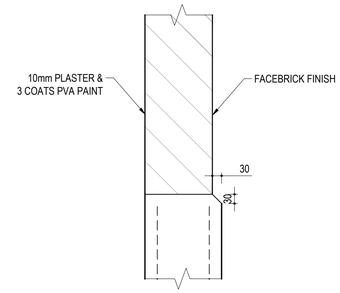

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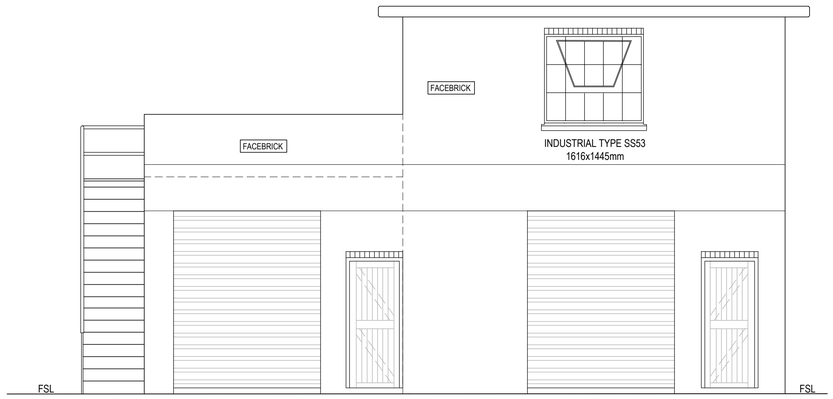

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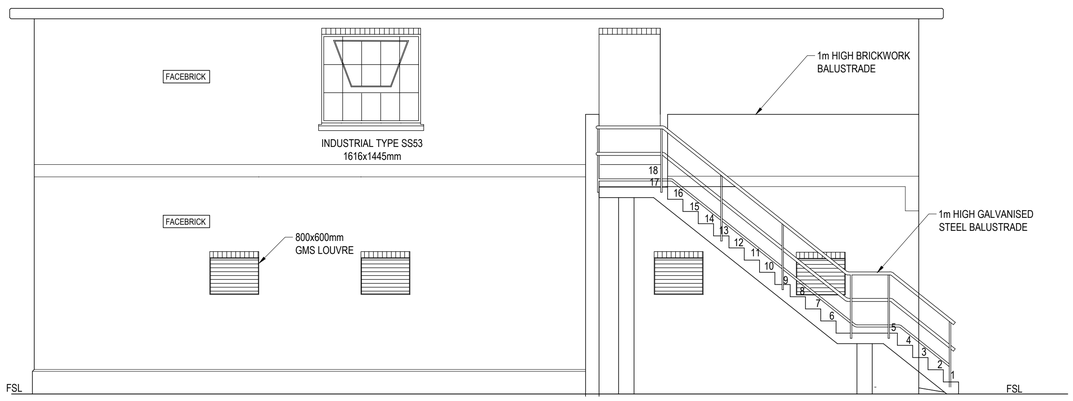

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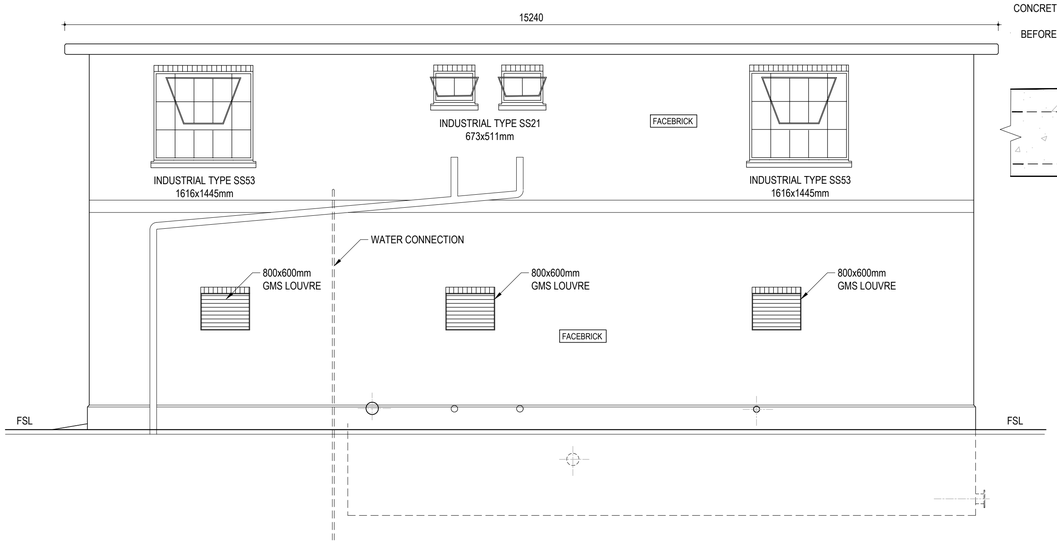
EAST ELEVATION 1
SCALE 1:50



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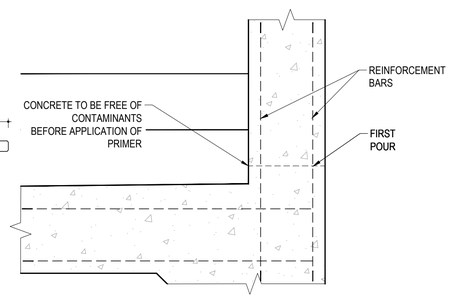

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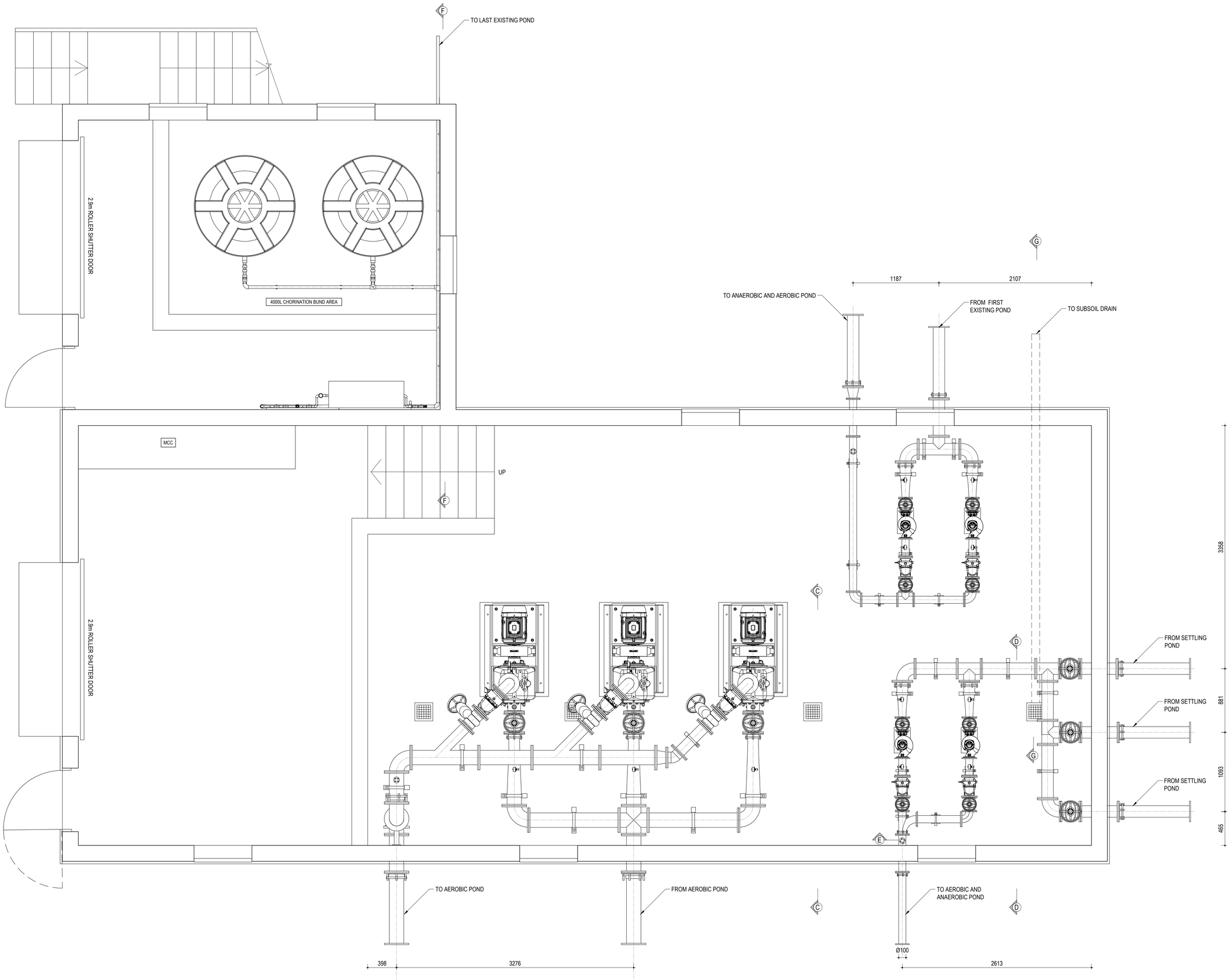

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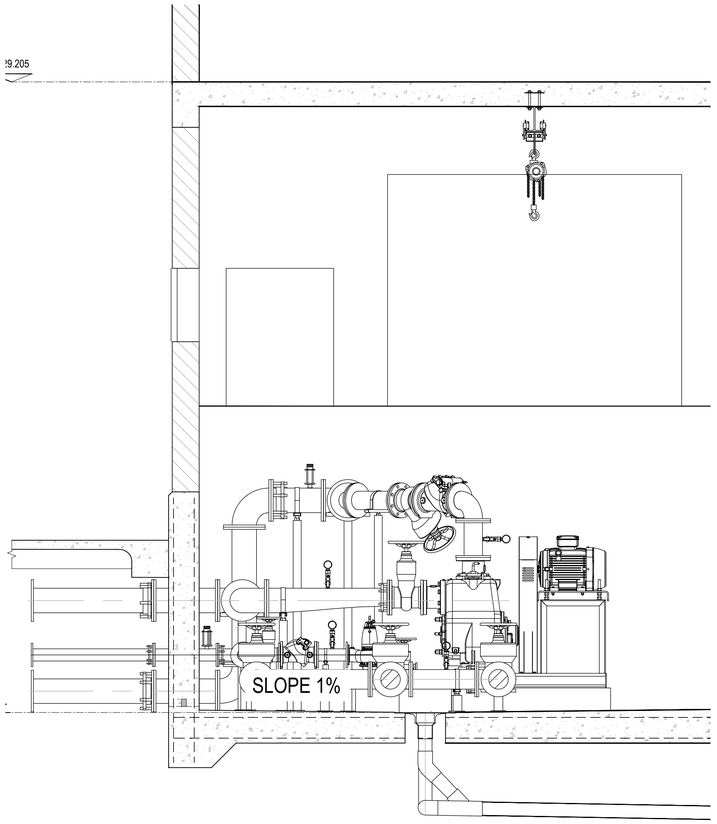

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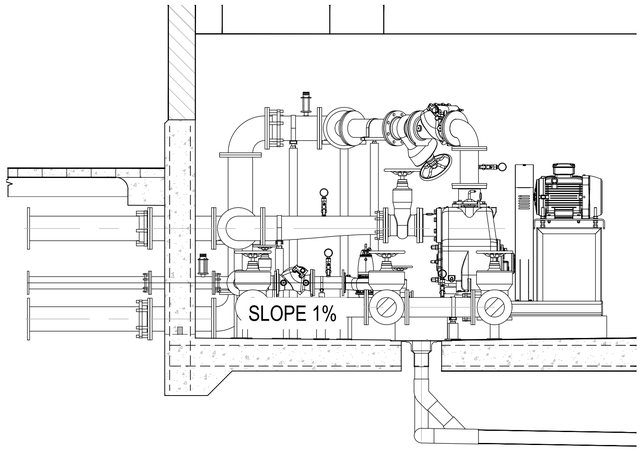

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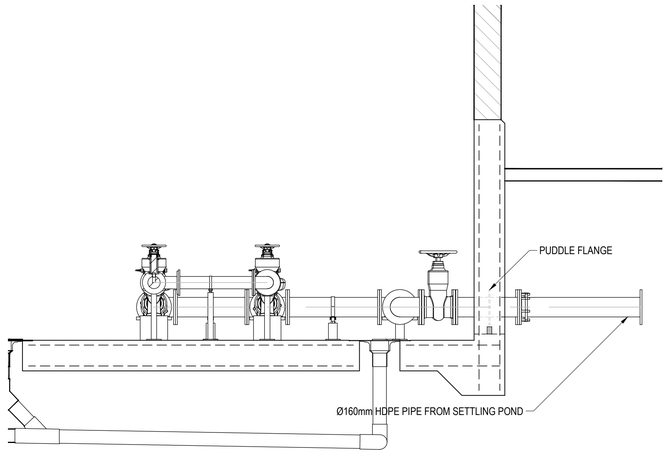

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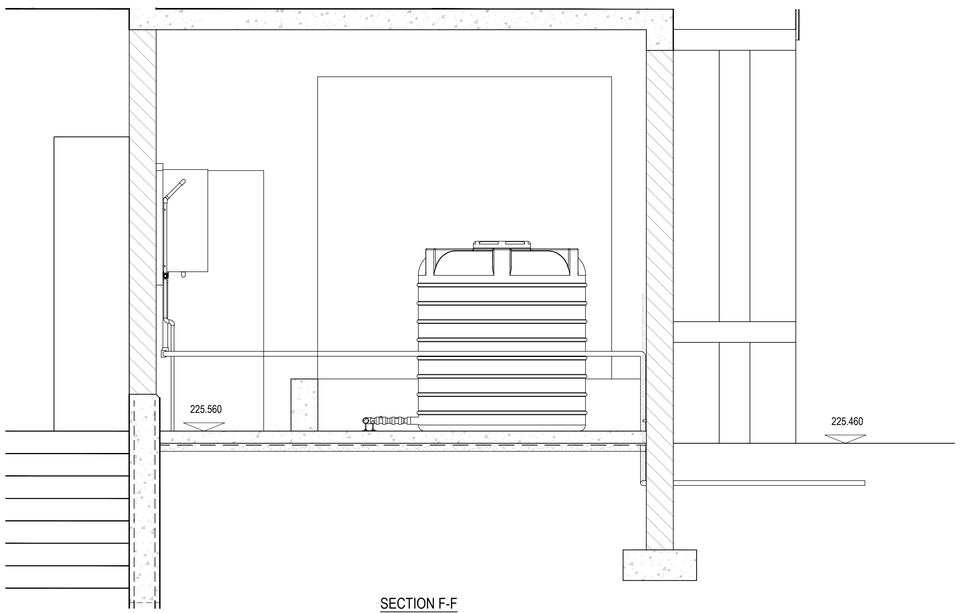

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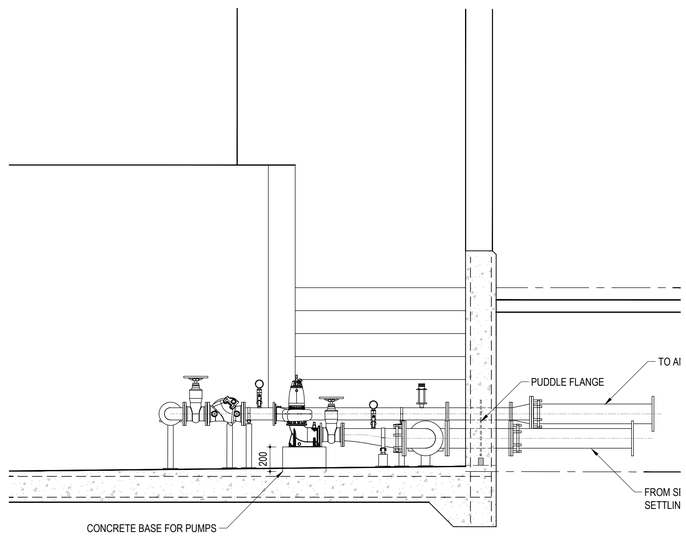

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C4.4 Geotechnical Report

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GEOTECHNICAL

ENVIRONMENTAL

SOCIAL DEVELOPMENT

Technical Report
2025 / 09 / 09 / GTEC

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Bathurst Upgrading of Sewer

Geotechnical investigation in support of the proposed upgrades to Bathurst WWTW and sewer reticulation in the Ndlambe Local Municipality, Sarah Baartman District, Eastern Cape

September 2025

Prepared for: **Newground Projects**
Document version 1.0 – Final Draft
Compiled by: AGES Omega (Pty) Ltd

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Technical report: 2025 / 09 / 09 / GTEC

Bathurst Upgrading of Sewer

Geotechnical investigation in support of the proposed upgrades to Bathurst WWTW and sewer reticulation in the Ndlambe Local Municipality, Sarah Baartman District, Eastern Cape

September 2025

Conducted on behalf of:

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Table of contents

1 INTRODUCTION 1

1.1 GENERAL 1
1.2 TERMS OF REFERENCE 1
1.3 SCOPE OF THE INVESTIGATION 1
1.4 LOCATION OF THE PROJECT AREA 1
1.5 REGIONAL GEOLOGICAL SETTING 3

2 SITE INVESTIGATION 5

2.1 TRIAL PIT PROFILING 5
2.2 DYNAMIC CONE PENETROMETER TESTING 8
2.3 SOIL CLASSIFICATION 8
2.4 GROUND WATER CONDITIONS 9
2.5 EXCAVATABILITY OF IN SITU MATERIALS 9
2.6 MATERIAL UTILISATION 12
2.7 CORROSIVITY OF SOILS 16
2.8 SOIL PERMEABILITY 16
2.9 ADVERSE SOIL CONDITIONS 19

3 SUMMARY AND CONCLUSIONS 20

4 BIBLIOGRAPHY 22

List of Appendixes

APPENDIX A – Trial pit logs and photographs
APPENDIX B – Dynamic Cone Penetrometer data
APPENDIX C – Laboratory analysis certificates

List of Figures

Figure 1: Regional Locality Map. 2
Figure 2: Geological Setting. 4
Figure 3: Layout of trial pits at WWTW area 5
Figure 4: Layout of trial pits – sewer reticulation areas. 6
Figure 5: Generalised soil conditions. 7
Figure 6: Double Ring Infiltrometer Test Data – Test 1 17
Figure 7: Double Ring Infiltrometer Test Data – Test 2 18

List of Tables

Table 1: ASTM Standard USCS Classification Summary Table 9
Table 2: Excavatibility conditions – General 10
Table 3: Excavatibility conditions – Excavation classes 11
Table 4: Materials compaction characteristics 14
Table 5: Materials Classification – Bedding (Selected Granular & Fill Assessment) 15
Table 6: Corrosivity of soils and Cathodic Protection 16
Table 7: Soil Permeability 16
Table 8: Adverse geotechnical soil conditions 19

1 INTRODUCTION

1.1 GENERAL

AGES Omega (PTY) Ltd was appointed by Newground Projects to conduct a detailed engineering geological investigation in support of the proposed upgrading to Bathurst Sewer, with the aim of identifying the in-situ soil and rock conditions that can be expected with the excavation of the new upgrades at the waste water treatment works, sewer reticulation and construction potential of in-situ soil materials.

1.2 TERMS OF REFERENCE

The investigation was requested by Mr. Gerhard Teseling of the firm Newground Projects (Pty) Ltd. AGES was appointed for the relevant geotechnical investigations following the submission of a detailed quotation and was appointed on the 18th of July 2024. The project was delayed due to unknown reasons with instruction received to proceed with the investigation in June 2025 with the initial scope of work changed to some extent.

1.3 SCOPE OF THE INVESTIGATION

The investigation had the following aims:

- Geotechnical investigation of proposed WWTW and Pipelines for determination of the following:
  - Soil/rock profiling in accordance with industry standards,
  - Soil Classification (USCS)
  - Ground water conditions.
  - Excavatibility of in-situ materials
  - Material utilisation (pipe bedding, backfill etc.)
  - Corrosivity (pH and conductivity) of soils

1.4 LOCATION OF THE PROJECT AREA

The project area is in the northeastern parts of the town of Bathurst and is under the authority of the Ndlambe Local Municipality of the Sarah Baartman District Municipality. The sewer reticulation pipelines are proposed in the settlement of Nolukhanyo on the eastern side of the R67 between Bathurst and Makhanda. The waste water treatment works (WWTW hereafter) is located to the north northeast of Nolukhanyo and approximately 3.6 km to the northeast of Bathurst CBD.

Figure 1: Regional Locality Map.

1.5 REGIONAL GEOLOGICAL SETTING

According to the 1:250 000 geology map 3326 GRAHAMSTOWN, the project area is covered by the Nanaga Formation (T-Q) for the Algoa Group with the lithology comprising Calcareous sandstone, (aeolian) and sandy limestone and underlain by the Weltevrede Formation (Dw) of the Cape Supergroup with the formation lithology comprised of shale and quartzite.

Dolerite intruded into the sedimentary formations in the form of dykes and sills. The geology map does not indicate any prominent dolerite dyke or sill intrusions near the project area.

No prominent geological structures such as fault zones and/or lineaments derived from LANDSAT imagery occur in the project area. The pipeline sections do not intersect any prominent LANDSAT lineaments. No other prominent geological structures are indicated in the project area.

The area does not reflect any risk for the formation of sinkholes or subsidence caused by the presence of water-soluble rocks (for example: dolomite or limestone), even though the Nanaga formation does comprise of sandy limestone.

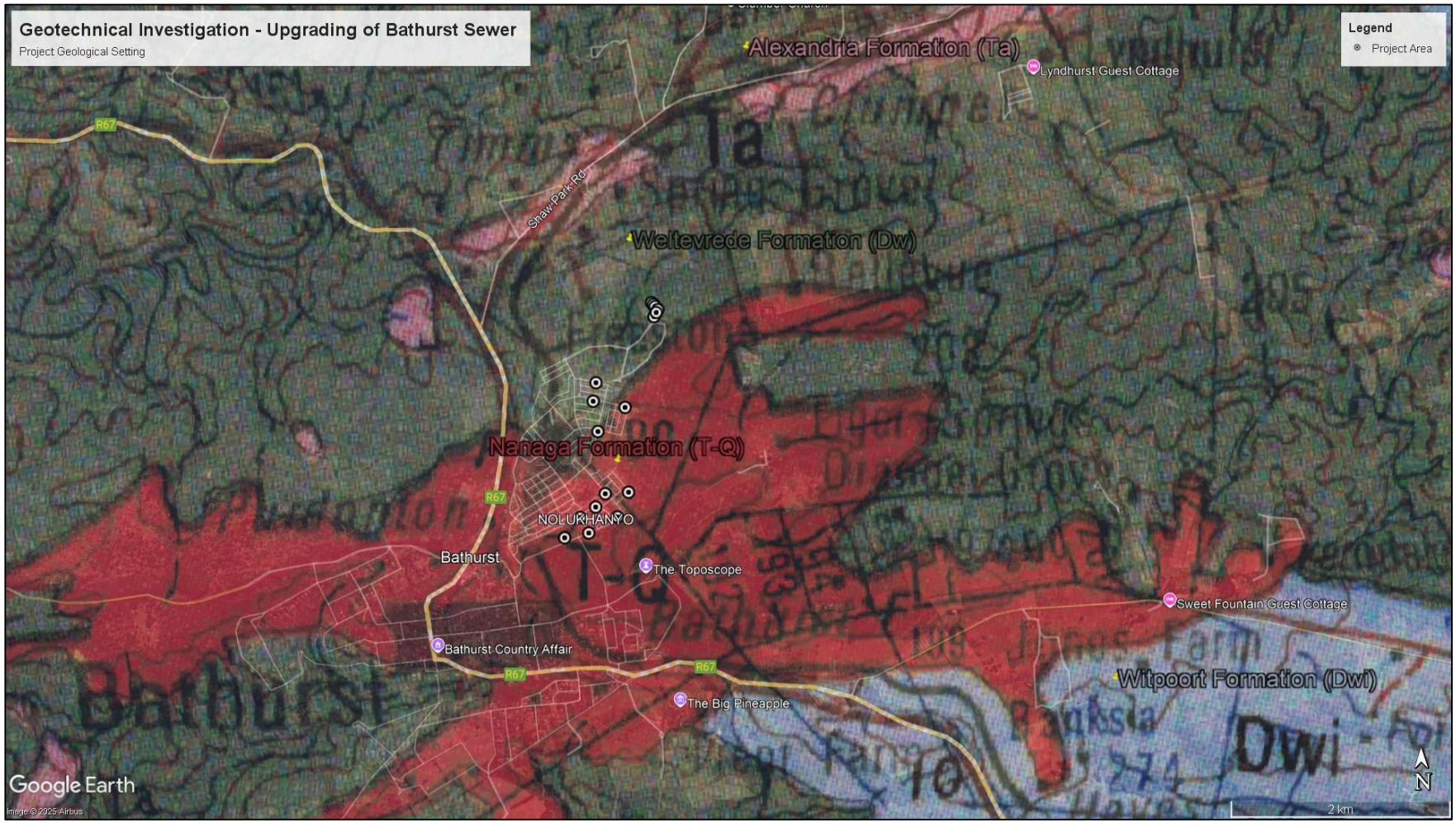


Figure 2: Geological Setting.

2 SITE INVESTIGATION

2.1 TRIAL PIT PROFILING

A total of 17 trial pits were excavated at the WWTW (6 trial pits) and along the pipeline service lines (11 trial pits) at positions indicated and discussed with the client utilising a JCB 3DX TLB-type excavator obtained from Messrs. Yanga Construction. The positions of the trial pits are indicated in the Figures below. Profiling of the trial pits were conducted according to the Guidelines for Soil and Rock Profiling in South Africa under the guidance of a competent person.

The fieldwork was conducted from the 28th of July to the 1st of August 2025. All trial pits were backfilled and tampered with the bucket of the TLB following completion of profiling and materials sampling.

Detailed trial pit profiles and photos are attached in Appendix A for reference.

Figure 3: Layout of trial pits at WWTW area .

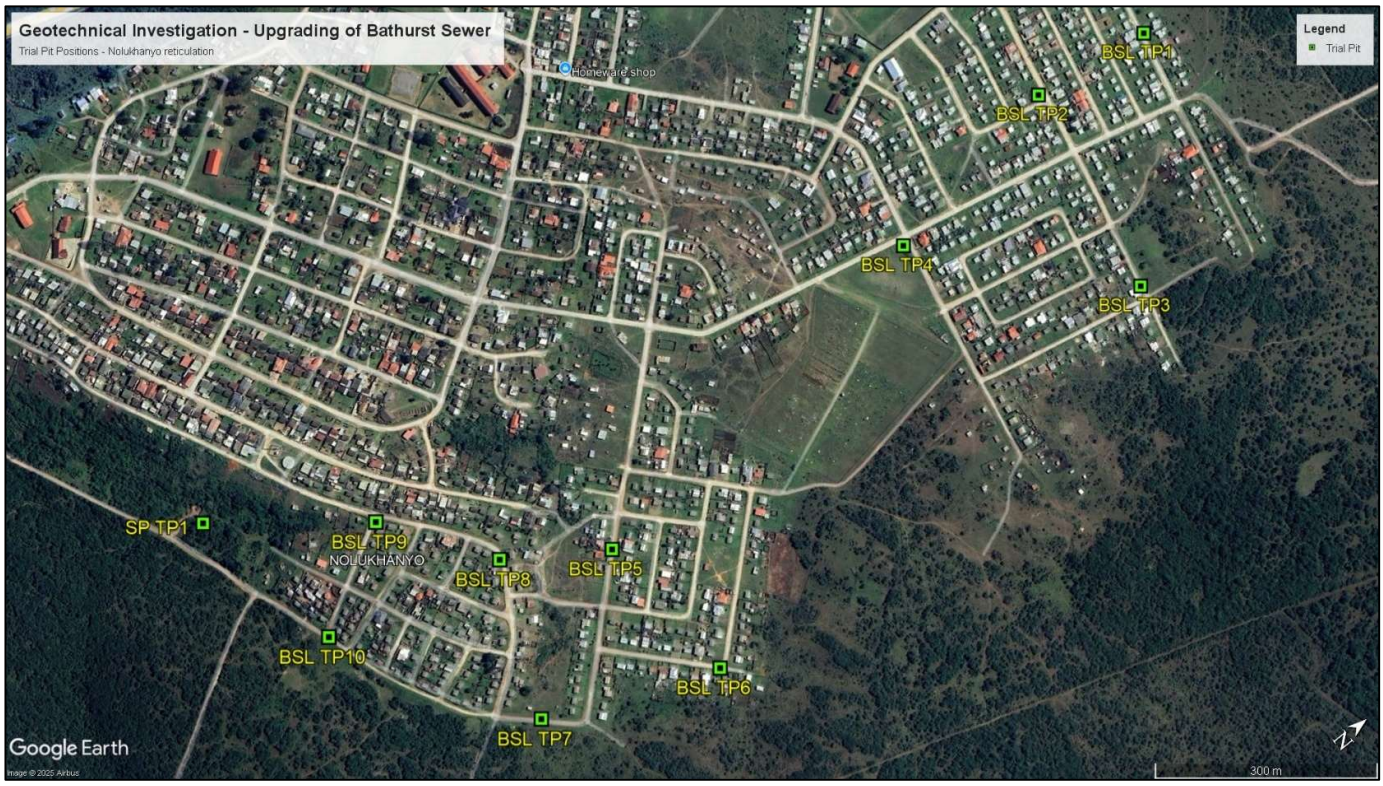


Figure 4: Layout of trial pits – sewer reticulation areas.

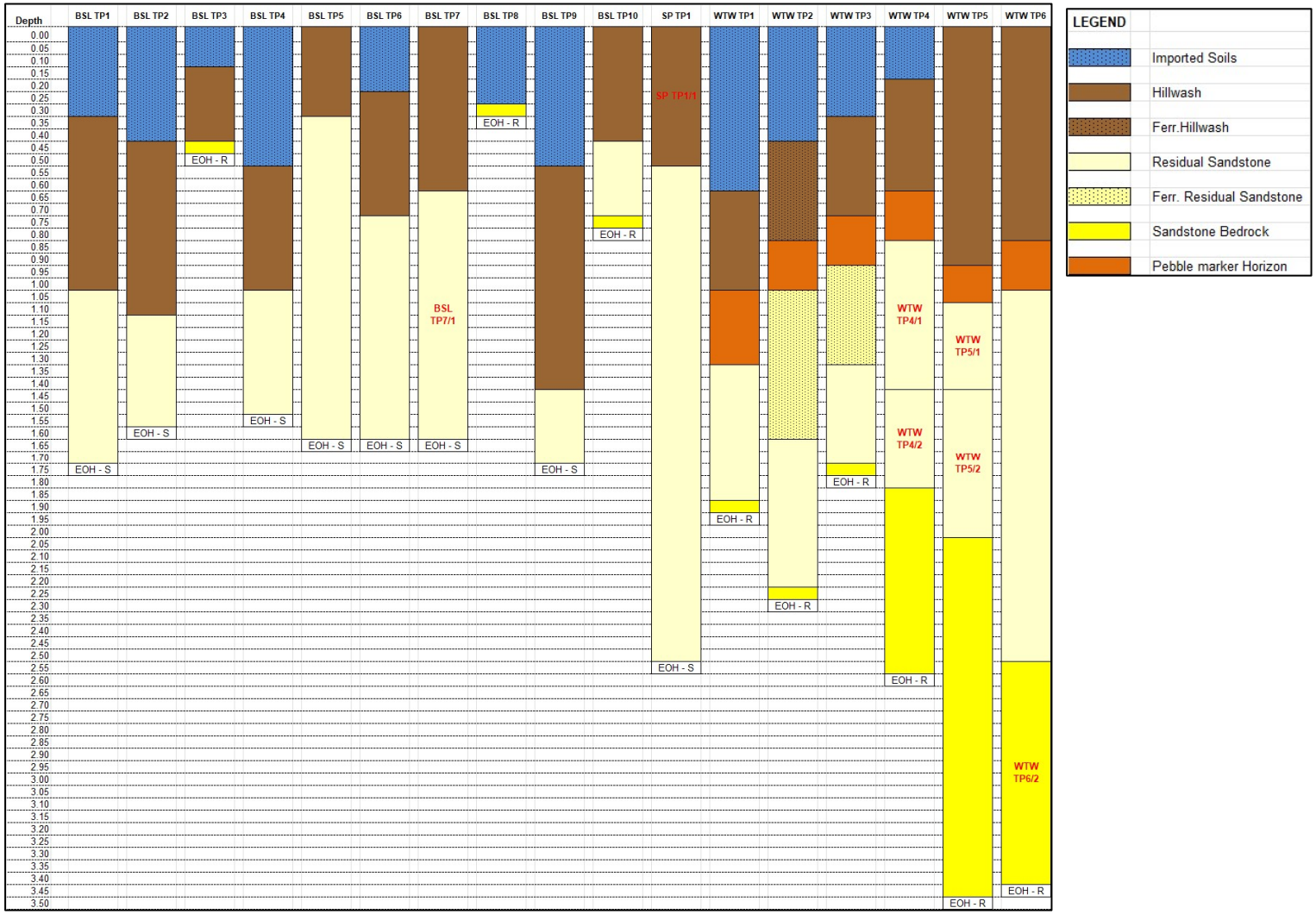


Figure 5: Generalised soil conditions.

2.2 DYNAMIC CONE PENETROMETER TESTING

Dynamic Cone Penetrometer tests - (DCP tests) - were conducted during the site investigation adjacent to the trial pits up to a depth of 1.0 mbgl or refusal and at the bottom of selected trial pits. Detailed summarised DCP test data is attached in Appendix B for reference, and includes the following derived correlations regarding the penetration of the cone in mm/blow, based on current site soil moisture conditions:

- Cumulative penetration depth
- Unconfined Compressive Strength (kPa)
- CBR% according to Kleyn, 1984
- E (MPa) according to Packard, 1973
- E (MPa) according to De Beer 1991
- E according to Jianzhou et al. 1999
- ρ (mm)
- k (kN/m3) as Resilient Modulus

Please note the derived correlations were based on expected imposed traffic stress of approximately 250 kPa (normal traffic) and the thickness of the pavement as 180 mm. These parameters will have to be changed according to your design to obtain revised correlated values.

The DCP testing does not give an accurate estimation on the expected excavation conditions and in-situ bearing capacity of the soil materials, as only the UCS of the material is determined. The testing is however useful to get a basic estimation of existing in-situ soil conditions at current soil moisture contents.

2.3 SOIL CLASSIFICATION

Selected samples were taken of the materials encountered in the trial pit profiling along the pipeline sections as required by the client. Based on the laboratory analysis results the samples were classified according to the revised ASTM Standard on the Unified Classification System. The soil classifications are summarised in the Table below:

Table 1: ASTM Standard USCS Classification Summary Table

SAMPLE INFORMATION			GRADING ANALYSES				ATTERBERG LIMITS			LS	COMPACTIBILITY FACTOR	Moisture Content %	A.S.T.M. STANDARD USCS Classification	GRP Backfill Classification
Number	Depth (m - m)	Origin	Gravel %	Sand %	Silt %	Clay %	LL %	PI	PI'	%				
WTW TP 4/1	0.60 - 1.40	Residual Sandstone	5	28	50	17	40	19	16.0	9.0	0.17	20.6	CL	SC3
WTW TP 5/2	1.40 - 2.00	Residual Sandstone	26	39	18	17	26	9	5.5	4.0	0.30	12.2	SC	SC3
BSL TP 7/1	0.60 - 1.60	Residual Sandstone	1	51	23	25	33	16	15.4	8.5	0.20	18.2	SC	SC3

2.4 GROUND WATER CONDITIONS

No groundwater seepage was encountered in any of the excavated trial pits in both the WWTW and sewer reticulation areas.

Pedogenic soil material in the form of ferricrete was encountered in 2 of the trial pits in the WWTW area within the residual soil materials. The pebble marker horizon identified in all 6 trial pits in the WWTW is also slightly ferruginised.

Pedogenic materials indicates poor subsurface drainage conditions and that seasonal perched groundwater conditions are likely to occur. It is recommended that precautionary measures be implemented to protect against rising dampness. Good site drainage conditions must be ensured.

The seasonal occurrence of perched groundwater conditions is classified as **Possible** over the pipeline sections and **Likely** over the WWTW area.

2.5 EXCAVATABILITY OF IN SITU MATERIALS

It was possible to excavate trial pits to a depth between 0.30 and 3.45 mbgl (mean 1.80 mbgl) after which excavation refused in 9 of the trial pits on moderately hard rock sandstone / siltstone bedrock, and excavation was stopped in the remaining8 trial pits as the maximum specified / required excavation depth was achieved.

Detailed excavatibility conditions and classifications are summarised in the tables below.

Table 2: Excavatibility conditions – General

TEST PIT No:	CO-ORDINATES		Test Pit Final Depth	Depth to Bedrock	E.O.H Comment (Refused/Stopped)	Bedrock (Yes/No?)	Seepage (mbgl)	Material encountered						
	LAT (S)	LON (E)						Imported	Hillwash	Ferr Hillwash	PMH	Res Sandsone	Ferr Res Sandstone	Sandstone Bedrock
WTW TP1	-33.475480	26.845250	1.90	1.85	Refused	No	No	0.00 - 0.60	0.60 - 1.00	-	1.00 -0 1.30	1.30 - 1.85	-	1.85+
WTW TP2	-33.475620	26.845440	2.25	2.20	Refused	Yes	No	0.00 - 0.40	-	0.40 - 0.80	0.80 - 01.00	01.60 - 02.20	01.00 - 01.60	2.20+
WTW TP3	-33.475790	26.845600	1.75	1.70	Refused	Yes	No	0.00 - 0.30	0.30 - 0.70	-	0.70 - 0.90	01.30 -01.70	0.90 - 01.30	1.70+
WTW TP4	-33.476040	26.845860	2.55	1.80	Refused	Yes	No	0.00 - 0.15	0.15 - 0.60	-	0.60 - 0.80	0.80 - 01.80	-	01.80 - 02.55+
WTW TP5	-33.476270	26.845700	3.45	2.00	Refused	Yes	No	-	0.00 - 0.90	-	0.90 - 01.05	01.05 - 02.00	-	02.00 - 03.45+
WTW TP6	-33.476600	26.845480	3.40	2.50	Refused	Yes	No	-	0.00 - 0.80	-	0.80 - 01.00	01.00 - 02.50	-	02.50 - 03.40+
SP TP1	-33.494080	26.836800	2.50		Stopped	No	No	-	0.00 - 0.50	-	-	0.50 - 02.50+	-	-
BSL TP1	-33.481820	26.839880	1.70		Stopped	No	No	0.00 - 0.30	0.30 - 01.00	-	-	01.00 - 01.70+	-	-
BSL TP2	-33.483290	26.839600	1.55		Stopped	No	No	0.00 - 0.40	0.40 - 01.10	-	-	01.10 - 01.55+	-	-
BSL TP3	-33.483810	26.842640	0.45	0.40	Refused	Yes	No	0.00 - 0.10	0.10 - 0.40	-	-	-	-	0.40+
BSL TP4	-33.485700	26.840030	1.50		Stopped	No	No	0.00 - 0.50	0.50 - 01.00	-	-	01.00 - 01.50+	-	-
BSL TP5	-33.490630	26.840700	1.60		Stopped	No	No	-	0.00 - 0.30	-	-	0.30 - 01.60+	-	-
BSL TP6	-33.490530	26.842920	1.60		Stopped	No	No	0.00 - 0.20	0.20 - 0.70	-	-	0.70 - 01.60+	-	-
BSL TP7	-33.492460	26.841860	1.60		Stopped	No	No	-	0.00 - 0.60	-	-	0.60 - 01.60+	-	-
BSL TP8	-33.491660	26.839810	0.30	0.25	Refused	Yes	No	0.00 - 0.25	-	-	-	-	-	0.25+
BSL TP9	-33.492460	26.838340	1.70		Stopped	No	No	0.00 - 0.50	0.50 - 01.40	-	-	01.40 - 01.70+	-	-
BSL TP10	-33.493690	26.839140	0.75	0.70	Refused	Yes	No	0.00 - 0.40	-	-	-	0.40 - 0.70	-	0.70+

Table 3: Excavatibility conditions – Excavation classes

TEST PIT No:	ERF COORDINATE		Test Pit Final Depth	Depth to Bedrock	E.O.H Comment(Refused /Stopped)	Bedrock(Yes /No?)	Seepage(mbgl)	Pedogenic Soils	Sidewall stability	Excavation Classification (SANS 1200 DB)	
	LAT (S)	LON (E)							Good (1), Med (2), Poor (3)	Surface - 1,00	1,00-2,00
WTW TP1	-33.47548	26.84525	1.90	1.85	Refused	No	No	Yes	2	Soft Excavation Class	Soft to Intermediate Excavation Class
WTW TP2	-33.47562	26.84544	2.25	2.20	Refused	Yes	No	Yes	2	Soft Excavation Class	Soft to Intermediate Excavation Class
WTW TP3	-33.47579	26.8456	1.75	1.70	Refused	Yes	No	Yes	2	Soft Excavation Class	Intermediate Excavation Class
WTW TP4	-33.47604	26.84586	2.55	1.80	Refused	Yes	No	Yes	2	Soft Excavation Class	Soft to Intermediate Excavation Class
WTW TP5	-33.47627	26.8457	3.45	2.00	Refused	Yes	No	Yes	2	Soft Excavation Class	Soft to Intermediate Excavation Class
WTW TP6	-33.4766	26.84548	3.40	2.50	Refused	Yes	No	Yes	2	Soft Excavation Class	Soft to Intermediate Excavation Class
SP TP1	-33.49408	26.8368	2.50	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP1	-33.48182	26.83988	1.70	0.00	Stopped	No	No	No	1	Soft Excavation Class	Intermediate Excavation Class
BSL TP2	-33.48329	26.8396	1.55	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP3	-33.48381	26.84264	0.45	0.40	Refused	Yes	No	No	1	Soft to Intermediate Excavation Class	Soft to Intermediate Excavation Class
BSL TP4	-33.4857	26.84003	1.50	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP5	-33.49063	26.8407	1.60	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP6	-33.49053	26.84292	1.60	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP7	-33.49246	26.84186	1.60	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP8	-33.49166	26.83981	0.30	0.25	Refused	Yes	No	No	1	Soft to Intermediate Excavation Class	Soft to Intermediate Excavation Class
BSL TP9	-33.49246	26.83834	1.70	0.00	Stopped	No	No	No	1	Soft Excavation Class	Soft to Intermediate Excavation Class
BSL TP10	-33.49369	26.83914	0.75	0.70	Refused	Yes	No	No	1	Soft to Intermediate Excavation Class	Soft to Intermediate Excavation Class

2.6 MATERIAL UTILISATION

The results of the laboratory analyses conducted on the material samples were evaluated regarding its suitability as bedding material according to the GRP Backfill Soil Type Classification (SC1 to SC4), as well as the SANS 1200 LB-1983 specifications (Selected Granular Material (SGM) and Selected Fill Material (SFM)). Client specified grading analysis ranges was also provided as part of the RFQ for material evaluation.

GRP Backfill Soil Type Classification:

- SC1: Crushed rock with < 15 % sand, maximum 25% passing the 9.5 mm sieve and maximum 5 % fines.
- SC2: Clean, coarse-grained soils: SW, SP, GW, GP or any soil beginning with one of these symbols with 12 % or less fines.
- SC3: Clean, coarse-grained soils with fines: GM, GC, SM, SC or any soil beginning with one of these symbols with 12 % or more fines. Sandy or gravely fine-grained soils: CL, ML, (or CL-ML, CL/ML, ML/CL) with 30 % or more retained on a no. 200 sieve.
- SC4: Fine grained soils: CL, ML, (or CL-ML, CL/ML, ML/CL) with 30 % or less retained on a no. 200 sieve.

SANS 1200 LB-1983 specifications:

- SGM required to be non-cohesive, free-draining and singularly graded, (90 % 19>mm>0.6), with a compatibility factor of < 0.4.
- SFM is required to have a P.I. of < 6 and be free from lumps exceeding 30 mm and vegetation

The classification of the materials is summarised in the Tables below for reference.

The in-situ material utilisation classification is summarised as follow:

- GRP Backfill Soil Type Classification Assessment:
    - None of the encountered materials classify as SC1 or SC2.
    - The residual sandstone material encountered at the WWTW and in the pipeline areas classify as SC3.

- None of the tested materials classify as SC4 according to GRP Classification.

- Selected Granular Material Assessment:
  - The materials are not suitable for use as Selected Granular Material without screening.
  - If the material can be screened to remove fractions smaller than 0.6 mm and larger than 19 mm, the suitability of the material increases to a maximum of 23% of the material within the suitable range, with most materials still 0% suitable.
  - Cohesive materials will remain unsuitable even with screening.

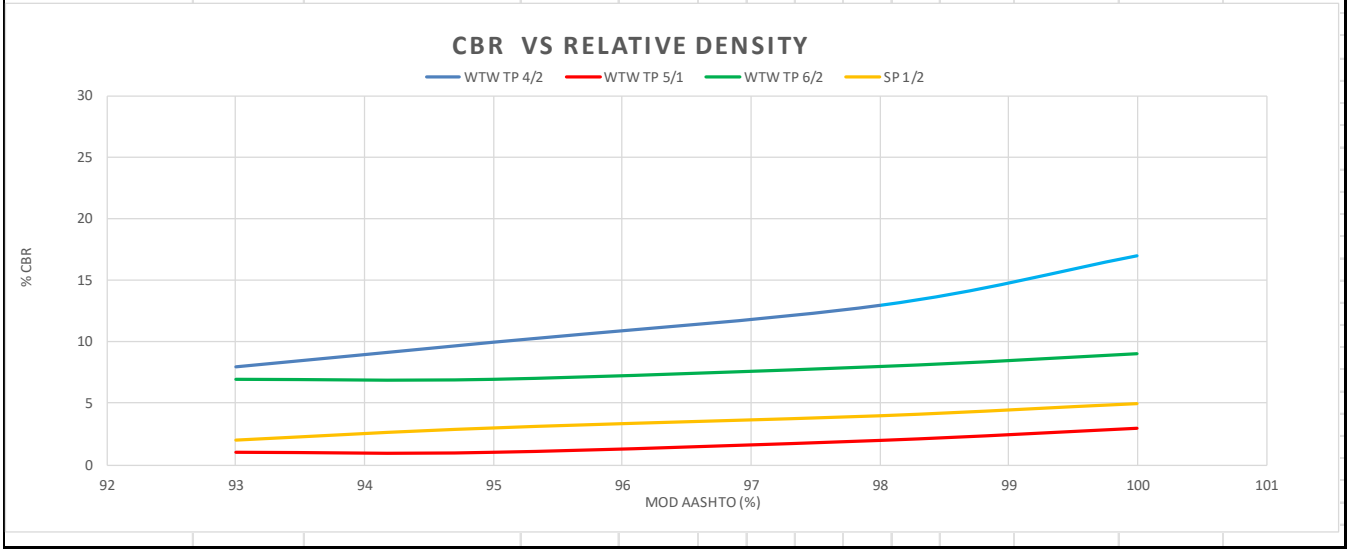
- Selected Fill Material Assessment:
  - None of the materials are suitable SFM when unscreened and unwashed.
  - Screening of the material will not improve the material.
  - Screening and washing of the material will increase suitability for use as SFM only in selected materials, such as residual sandstone WTW TP5/2.

- Material utilisation for Construction:
  - The residual sandstone material has a maximum dry density between 1681 and 1946 kg/m^3 with an optimum moisture content of 9.7 to 18.2 %.
  - The CBR of the material is between 1-6 at 90% MOD AASHTO and increase to a maximum of 3-17 at 100% MOD AASHTO.
  - The residual sandstone material classify as A-2-4 to A-6 according to AASHTO subgrade ratings.
  - The residual sandstone material classifies at best as G10 according to TRH14.
  - The weathered sandstone bedrock material classifies as G10 according to TRH14 and has a A-2-6 subgrade rating according to AASHTO.

The materials are generally not suitable for any use during construction. Potential application can be discussed.

Table 4: Materials compaction characteristics

Sample Number	Depth		MOD. AASHTO		CBR at % MOD.AASHTO					Swell	HRB	COLTO	TRH14 Class
			MDD Kg/m^3	OMC %	100	98	95	93	90		AASHTO		
WTW TP 4/2	1.40 - 1.80	Residual Sandstone	1946	9.7	17	13	10	8	6	1.5	A-2-6	G9	**G10**
WTW TP 5/1	1.05 - 1.40	Residual Sandstone	1681	18.2	3	2	1	1	1	2	A-6	-	-
WTW TP 6/2	2.50 - 3.40	Sandstone Bedrock	1978	10.2	9	8	7	7	6	1.4	A-2-6	-	**G10**
SP 1/2	1.20 - 2.50	Residual Sandstone	1777	11.5	5	4	3	2	1	0.8	A-2-4	-	**-**



Standard Proctor Density tests were conducted on 3 samples, with 2 samples from the materials at the WWTW and one sample taken at the deep sump to be excavated in the settlement. The results indicate maximum dry density of 1838 kg/m3 at 7.4 % OPC and 1785 kg/m3 at 8.6 % OPC respectively. Based on these results the material is potentially suitable Pervious embankment material. Further detailed testing is required for accurate classification.

Table 5: Materials Classification – Bedding (Selected Granular & Fill Assessment)

SAMPLE INFORMATION			GRADING ANALYSES				ATTERBERG LIMITS			LS	COMPACTIBILITY FACTOR	MATERIALS CLASSIFICATION																
														SELECTED GRANULAR MATERIAL (SGM) ASSESSMENT									SELECTED FILL MATERIAL (SFM) ASSESSMENT					
Number	Depth (m - m)	Origin	Gravel %	Sand %	Silt %	Clay %	LL %	PI	PI'	%		A.S.T.M.	GRP Backfill Classification	EVALUATION: ASTM cohesion	EVALUATION: Logs cohesion	EVALUATION: 0.6mm %grading pass	EVALUATION: 19mm %grading pass	EVALUATION: Grading %suitable	EVALUATION: Compactibility factor	EVALUATION: Freely draining	SUITABILITY: SGM with no screening	SUITABIITY: SGM % with screening (0.6 ≤ mm ≤ 19)	EVALUATION: PI ≤ 6	EVALUATION: PI' ≤ 6	EVALUATION: Gravel > 30mm	SUITABILITY: SFM unscreened and unwashed	SUITABILITY: SFM % with screening only	SUITABILITY: SFM % with screening and washing
WTW TP 4/1	0.60 - 1.40	Residual Sandstone	5	28	50	17	40	19	16.0	9.0	0.17	CL	SC3	Cohesive	Cohesive	85	100	**15**	Suitable	No	**Not Suitable**	**Not Suitable**	Not Suitable	Not Suitable	%Suitable	**Not Suitable**	**Not Suitable**	**Not Suitable**
WTW TP 5/2	1.40 - 2.00	Residual Sandstone	26	39	18	17	26	9	5.5	4.0	0.30	SC	SC3	Granular	Cohesive	62	85	**23**	Suitable	Yes	**Not Suitable**	**23 %Suitable**	Not Suitable	Suitable	Suitable	**Not Suitable**	**Not Suitable**	**Suitable**
BSL TP 7/1	0.60 - 1.60	Residual Sandstone	1	51	23	25	33	16	15.4	8.5	0.20	SC	SC3	Cohesive	Cohesive	96	100	**4**	Suitable	Yes	**Not Suitable**	**Not Suitable**	Not Suitable	Not Suitable	95 %Suitable	**Not Suitable**	**Not Suitable**	**Not Suitable**

2.7 CORROSIVITY OF SOILS

The corrosivity of the in-situ soils was determined by selective sampling of the materials and analysis of the soil pH and conductivity at an accredited laboratory. The measured soil conductivity in mS/m (milli-Siemens per meter) was converted Soil Resistivity values in Ohm/m.

Based on the results of pH testing the materials are neutral to slightly alkaline. Based on the conductivity and resistivity of the materials they classify as corrosive to extremely corrosive. Cathodic protection is definitely required based on the measured soil corrosivity.

Table 6: Corrosivity of soils and Cathodic Protection

SAMPLE INFORMATION			SOIL CHEMISTRY				SOIL CORROSIVITY		CALCULATED PERMEABILITY		
Number	Depth (m - m)	Origin	pH	Conductivity (mS/m)	Soil Resistivity (Ohm/m)	Moisture Content %	Soil pH Class & Soil Corrosiveness (Conductivity)	Cathodic Protection Classification & Remarks (Resistivity)	(cm/sec)	m/day	Permeability defined
WTW TP 4/1	0.60 - 1.40	Residual Sandstone	6.70	28.2	34.5	20.6	Neutral / Corrosive	Very Corrosive / Definitely required	2E-06	0.0015	Very Slightly Permeable
WTW TP 5/2	1.40 - 2.00	Residual Sandstone	8.20	15.9	62.8	12.2	Slightly Alkaline / Corrosive	Mildly Corrosive / Sometimes required	4E-07	0.0003	Very Slightly Permeable
BSL TP 7/1	0.60 - 1.60	Residual Sandstone	7.70	79.4	12.6	18.2	Slightly Alkaline / Very Corrosive	Extremely Corrosive / Definitely required	4E-07	0.0003	Very Slightly Permeable

2.8 SOIL PERMEABILITY

The soil permeability was calculated from the grading distribution using Hazen's permeability equation. Results indicate in general very slightly permeable to slightly permeable soil conditions as the norm across the project area, but with some materials being practically impermeable and less material being moderately permeable at best. The calculated soil permeability of material is summarised below.

Table 7: Soil Permeability

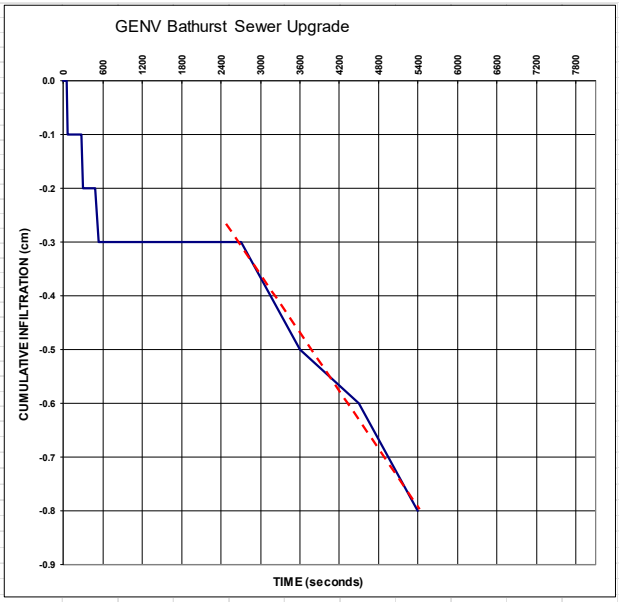
SAMPLE INFORMATION			GRADING ANALYSES				ATTERBERG LIMITS			LS	CALCULATED PERMEABILITY		
Number	Depth (m - m)	Origin	Gravel %	Sand %	Silt %	Clay %	LL %	PI	PI'	%	(cm/sec)	m/day	Permeability defined
WTW TP 4/1	0.60 - 1.40	Residual Sandstone	5	28	50	17	40	19	16.0	9.0	2E-06	0.0015	Very Slightly Permeable
WTW TP 5/2	1.40 - 2.00	Residual Sandstone	26	39	18	17	26	9	5.5	4.0	4E-07	0.0003	Very Slightly Permeable
BSL TP 7/1	0.60 - 1.60	Residual Sandstone	1	51	23	25	33	16	15.4	8.5	4E-07	0.0003	Very Slightly Permeable

In-situ permeability testing was conducted at the proposed WwTW site. Tests were done using the Double Ring Infiltrometer test with 2 tests of 90min duration conducted. The tests are done to determine the saturated vertical infiltration of the materials. Tests were conducted at 0.90 and 1.50 mbgl. The following results were obtained, with detailed data indicated in the figures below:

- Residual Sandstone (Test 1): Measured permeability of 1.4E-04 cm/s (0.120 m/day)
- Residual Sandstone (Test 2): Measured permeability of 1.5E-04 cm/s (0.128 m/day)

Inner Ring Dia.:		cm
Ring Height:		cm
Test No.:	TEST 1	
Position:	0.90 mbgl	
Material:	Res. Sandstone	

Time (sec)	Cum. Infilt	
0	0.0	
15	0.0	
30	0.0	
45	0.0	
60	-0.1	1 min
90	-0.1	
120	-0.1	2 min
150	-0.1	
180	-0.1	3 min
210	-0.1	
240	-0.1	4 min
270	-0.1	
300	-0.2	5 min
360	-0.2	6 min
420	-0.2	7 min
480	-0.2	8 min
540	-0.3	9 min
600	-0.3	10 min
900	-0.3	15 min
1200	-0.3	20 min
1500	-0.3	25 min
1800	-0.3	30 min
2700	-0.3	45 min
3600	-0.5	1 HOUR
4500	-0.6	1 hr 15 min
5400	-0.8	1 hr 30 min
6300		1 hr 45 min
7200		2 HOURS
8100		2 hr 15 min
9000		2 hr 30 min
9900		2 hr 45 min
10800		3 HOURS



h_1 =	0.3	initial height (cm)
h_2 =	0.8	final height (cm)
Δt =	3600	time difference (sec)
k_m =	1.4E-04 cm.s^{-1}	

Figure 6: Double Ring Infiltrometer Test Data – Test 1

Inner Ring Dia.:		cm
Ring Height:		cm
Test No.:	TEST 2	
Position:	1.50 mbgl	
Material:	Res. Sandstone	

Time (sec)	Cum. Infilt	
0	0.0	
15	0.0	
30	0.0	
45	0.0	
60	0.0	1 min
90	0.0	
120	-0.1	2 min
150	-0.1	
180	-0.1	3 min
210	-0.1	
240	-0.1	4 min
270	-0.2	
300	-0.2	5 min
360	-0.2	6 min
420	-0.2	7 min
480	-0.2	8 min
540	-0.2	9 min
600	-0.2	10 min
900	-0.3	15 min
1200	-0.3	20 min
1500	-0.4	25 min
1800	-0.4	30 min
2700	-0.4	45 min
3600	-0.5	1 HOUR
4500	-0.7	1 hr 15 min
5400	-0.8	1 hr 30 min
6300		1 hr 45 min
7200		2 HOURS
8100		2 hr 15 min
9000		2 hr 30 min
9900		2 hr 45 min
10800		3 HOURS

h_1 =	0.4	initial height (cm)
h_2 =	0.8	final height (cm)
t_t =	2700	time difference (sec)

k_m =	1.5E-04	$cm.s^{-1}$

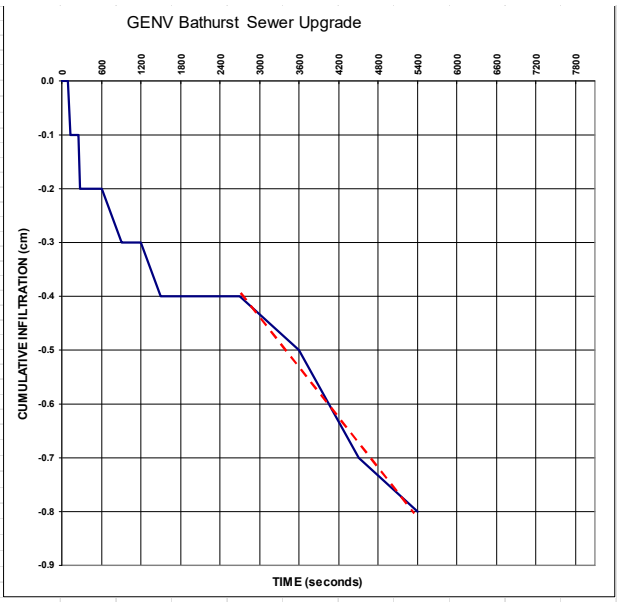


Figure 7: Double Ring Infiltrometer Test Data – Test 2

2.9 ADVERSE SOIL CONDITIONS

The sampled soil material from the trial pits exhibit the following adverse soil conditions as summarised in the table below:

Table 8: Adverse geotechnical soil conditions

SAMPLE INFORMATION			GRADING ANALYSES				ATTERBERG LIMITS			LS	POTENTIALLY ADVERSE GEOTECHNICAL CHARACTERISTICS				
Number	Depth (m - m)	Origin	Gravel %	Sand %	Silt %	Clay %	LL %	PI	PI'	%	Expansiveness	Collapse / Compressibility	Soil pH Class & Soil Corrosiveness (Conductivity)	Cathodic Protection Classification & Remarks (Resistivity)	Dispersivity / Erodibility
WTW TP 4/1	0.60 - 1.40	Residual Sandstone	5	28	50	17	40	19	16.0	9.0	Medium	Low Risk	Neutral / Corrosive	Very Corrosive / Definitely required	High Risk
WTW TP 5/2	1.40 - 2.00	Residual Sandstone	26	39	18	17	26	9	5.5	4.0	Low	Medium Risk	Slightly Alkaline / Corrosive	Mildly Corrosive / Sometimes required	High Risk
BSL TP 7/1	0.60 - 1.60	Residual Sandstone	1	51	23	25	33	16	15.4	8.5	Medium	Low Risk	Slightly Alkaline / Very Corrosive	Extremely Corrosive / Definitely required	High Risk

Based on in-situ observations and processed laboratory data, the following adverse soil characteristics can be expected.:

- Residual Sandstone material is potentially moderately expansive.
- The material is slightly to moderately compressible / collapsible.
- The material is generally corrosive to extremely corrosive.
- The material his expected to be highly erodible and potentially dispersive.

3 SUMMARY AND CONCLUSIONS

- AGES Omega (PTY) Ltd was appointed by Newground Projects to conduct a detailed engineering geological investigation in support of the proposed upgrading to Bathurst Sewer, with the aim of identifying the in-situ soil and rock conditions that can be expected with the excavation of the new upgrades at the waste water treatment works, sewer reticulation and construction potential of in-situ soil materials.
- According to the 1:50 000 geology map 3326 GRAHAMSTOWN, the project area is covered by calcareous sandstone to sandy limestone of the Nanaga Formation and underlain by shale and quartzite of the Weltevrede Formation. No prominent geological structures intersect the project area.
- A total of 17 trial pits were excavated at the WWTW (6 trial pits) and along the pipeline service lines (11 trial pits) at positions indicated and discussed with the client utilising a JCB 3DX TLB-type excavator obtained from Messrs. Yanga Construction. Profiling of the trial pits were conducted according to the Guidelines for Soil and Rock Profiling in South Africa under the guidance of a competent person. Detailed trial pit profiles and photos are attached in Appendix A for reference.
- Dynamic Cone Penetrometer tests - (DCP tests) - were conducted during the site investigation adjacent to the test pits up to a depth of 1.0 mbgl or refusal. Where necessary additional DCP tests were conducted at the bottom of test pits. Detailed summarised DCP test data is attached in Appendix B for reference.
- No groundwater seepage was encountered in any of the trial pits. Pedogenic soil material in the form of ferricrete was encountered in 2 of the trial pits in the WWTW area within the residual soil materials. The pebble marker horizon identified in all 6 trial pits in the WWTW is also slightly ferruginised.
- Excavatibility conditions are discussed in detail in chapter 2.5 of the report.
- Selected samples were submitted to accredited laboratories in East London for detail analysis. Processed results are discussed in detail in Chapter 2 of the report, with laboratory certificates attached in Appendix C for reference. The material is generally not suitable for use during construction. Proctor density of the material is within the suitable range for Pervious embankment material. Further testing is required.
- In-situ permeability testing was conducted at the proposed WwTW site. Tests were done using the Double Ring Infiltrometer test with 2 tests of 90min duration conducted. The tests were done to determine the saturated vertical infiltration rate of the materials. Tests were conducted at 0.90 and 1.50 mbgl. Results are discussed in Chapter 2.8.

- Adverse geotechnical properties of the encountered soil materials are discussed in Chapter 2.9 of the report. The materials are considered slightly to moderately expansive and moderately compressible / collapsible. The materials are corrosive to extremely corrosive and potentially highly erodible.
- Based on the results of this investigation and processed and evaluated laboratory analysis data, it is recommended that construction monitoring and materials testing be conducted to ensure that any conditions that are encountered that are not discussed in this investigation can be identified and recommendations made prior to and during construction.

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APPENDIX A

Detailed Test Pit Profile Logs and Photos

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**WTW TP1**
CLIENT:	Newground	LATITUDE:	-31.88248	LOGGED BY:	Malwande Busakwe
CONTRACTOR:	Yanga Construction	LONGITUDE:	29.87030	DATE EXCAVATED:	31 July 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	824 mamsl	DATE PROFILED:	31 July 2025

Depth	Lithology	Description	Sampling
0 – 600		Moist to very moist, dark khaki brown, in profile dark khaki brown, firm, micro-shattered. sandy clay with frequent gravel and cobbles. IMPORTED SOIL.	
600 – 1000		Very moist, dusky brown, in profile dark brown, firm, intact, sandy clay. Roots. HILLWASH.	
1000 – 1300		Very moist, dark orange brown, in profile firm, intact, clayey sand with scattered ferricrete nodules and also scattered sub-rounded gravel and cobbles. Roots. PEBBLE MARKER HORIZON.	
1300 – 1800		Very moist, yellowish khaki brown, in profile yellowish khaki brown, firm, micro-shattered, clayey sand with scattered gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	
1800		Khaki brown speckled orange, slighly weathered, coarse grained, thickly jointed, moderately hard to very hard rock. SANDSTONE BEDROCK.	
1901		Excavation refused on hard rock SANDSTONE BEDROCK.	

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Notes: No g/w seepage
Good sidewall stability
No sample taken

WTW TP1

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**WTW TP2**
CLIENT:	Newground	**LATITUDE:**	-31.47562	**LOGGED BY:**	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	**LONGITUDE:**	26.84544	**DATE EXCAVATED:**	31 July 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	**ELEVATION:**	824 mamsl	**DATE PROFILED:**	31 July 2025

Depth	Lithology	Description	Sampling
0–400		Moist to very moist, dark khaki brown, in profile dark khaki brown, firm, micro-shattered, sandy clay with frequent ferricrete nodules and also, gravel and cobbles. IMPORTED SOIL.	
400–800		Very moist, dusky brown, in profile dusky brown, firm, intact, sandy clay. with scattered ferricrete nodules. Roots. FERRUGINISED HILLWASH.	
800–1000		Very moist, dark orange brown, in profile firm, intact, clayey sand with scattered ferricrete nodules and also scattered sub-rounded gravel and cobbles. Roots. PEBBLE MARKER HORIZON.	
1000–1600		Very moist, orange brown, in profile orange brown, firm, intact, sandy clay with scattered ferricrete nodules and also gravel, cobbles and boulders. Roots. FERRUGINISED RESIDUAL SANDSTONE.	
1600–2200		Very moist, yellowish khaki brown, in profile yellowish khaki brown, firm, micro-shattered, clayey sand with scattered gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	
2200	EOH	Khaki brown speckled orange, slightly weathered, coarse grained, thickly jointed, moderately hard to very hard rock. SANDSTONE BEDROCK.	
2200–3000		Excavation refused on hard rock SANDSTONE BEDROCK.	

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Notes: No g/w seepage
Good sidewall stability
No sample taken

WTW TP2

PROJECT:	Bathurst Sewer Upgrade			TEST PIT NO.:	WTW TP3
CLIENT:	Newground	LATITUDE:	-31.47579	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84560	DATE EXCAVATED:	31 July 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	31 July 2025

Depth	Description	Sampling
0 – 100	Moist to very moist, dark khaki brown, in profile dark khaki brown, firm, micro-shattered. sandy clay with scattered gravel and cobbles. IMPORTED SOIL.	
100 – 700	Very moist, dusky brown, in profile dusky brown, firm, intact, sandy clay. Roots. HILLWASH.	
700 – 900	Very moist, dark orange brown, in profile firm, intact, clayey sand with scattered ferricrete nodules and also scattered sub-rounded gravel and cobbles. Roots. PEBBLE MARKER HORIZON.	
900 – 1300	Very moist, orange brown, in profile orange brown, firm, intact, sandy clay with scattered ferricrete nodules and also gravel, cobbles and boulders. Roots. FERRUGINISED RESIDUAL SANDSTONE.	
1300 – 1700	Very moist, yellowish khaki brown, in profile yellowish khaki brown, firm, micro-shattered, clayey sand with scattered gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	
1700	Khaki brown speckled orange, slightly weathered, coarse grained, thickly jointed, moderately hard to very hard rock. SANDSTONE BEDROCK.	
1800 – 3000	Excavation refused on hard rock SANDSTONE BEDROCK.	

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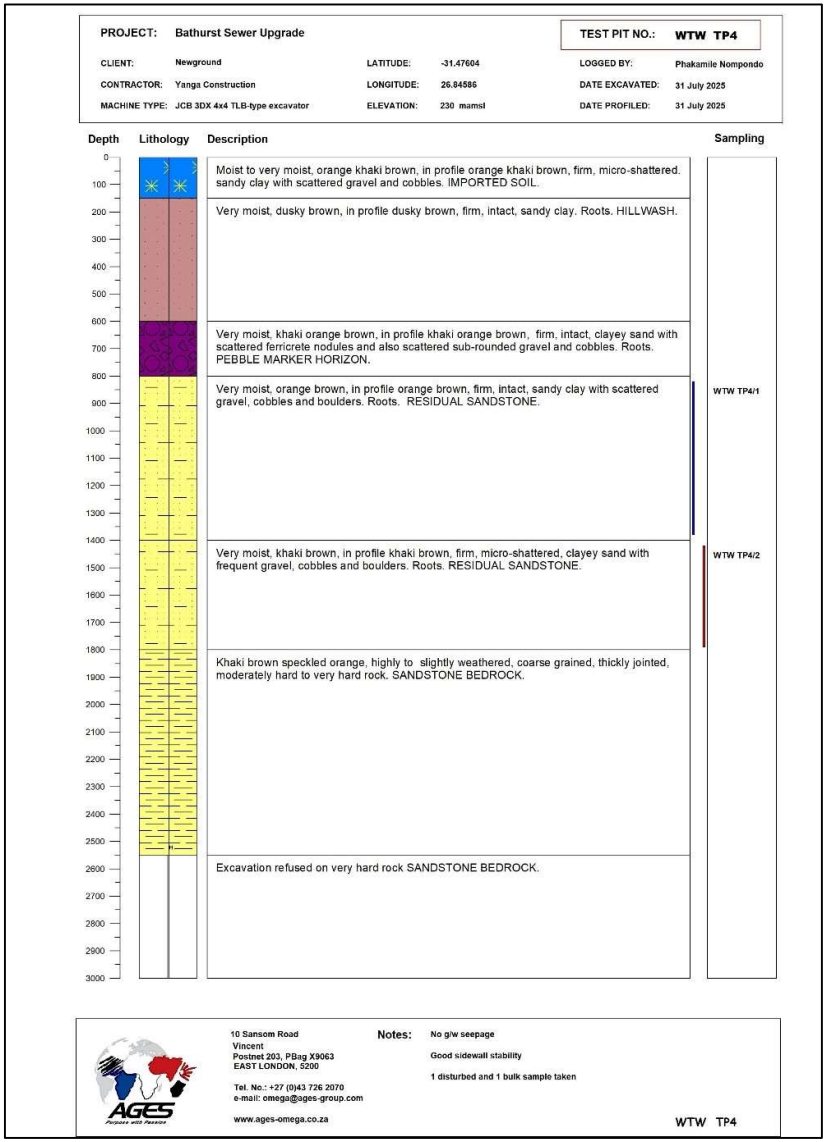
Notes: No g/w seepage
Good sidewall stability
No sample taken

WTW TP3



PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**WTW TP4**
CLIENT:	Newground	LATITUDE:	-31.47604	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84586	DATE EXCAVATED:	31 July 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	31 July 2025

Depth	Description	Sampling
0–100	Moist to very moist, orange khaki brown, in profile orange khaki brown, firm, micro-shattered. sandy clay with scattered gravel and cobbles. IMPORTED SOIL.	
100–600	Very moist, dusky brown, in profile dusky brown, firm, intact, sandy clay. Roots. HILLWASH.	
600–800	Very moist, khaki orange brown, in profile khaki orange brown, firm, intact, clayey sand with scattered ferricrete nodules and also scattered sub-rounded gravel and cobbles. Roots. PEBBLE MARKER HORIZON.	
800–1400	Very moist, orange brown, in profile orange brown, firm, intact, sandy clay with scattered gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	WTW TP4/1
1400–1800	Very moist, khaki brown, in profile khaki brown, firm, micro-shattered, clayey sand with frequent gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	WTW TP4/2
1800–2600	Khaki brown speckled orange, highly to slightly weathered, coarse grained, thickly jointed, moderately hard to very hard rock. SANDSTONE BEDROCK.	
2600–3000	Excavation refused on very hard rock SANDSTONE BEDROCK.	

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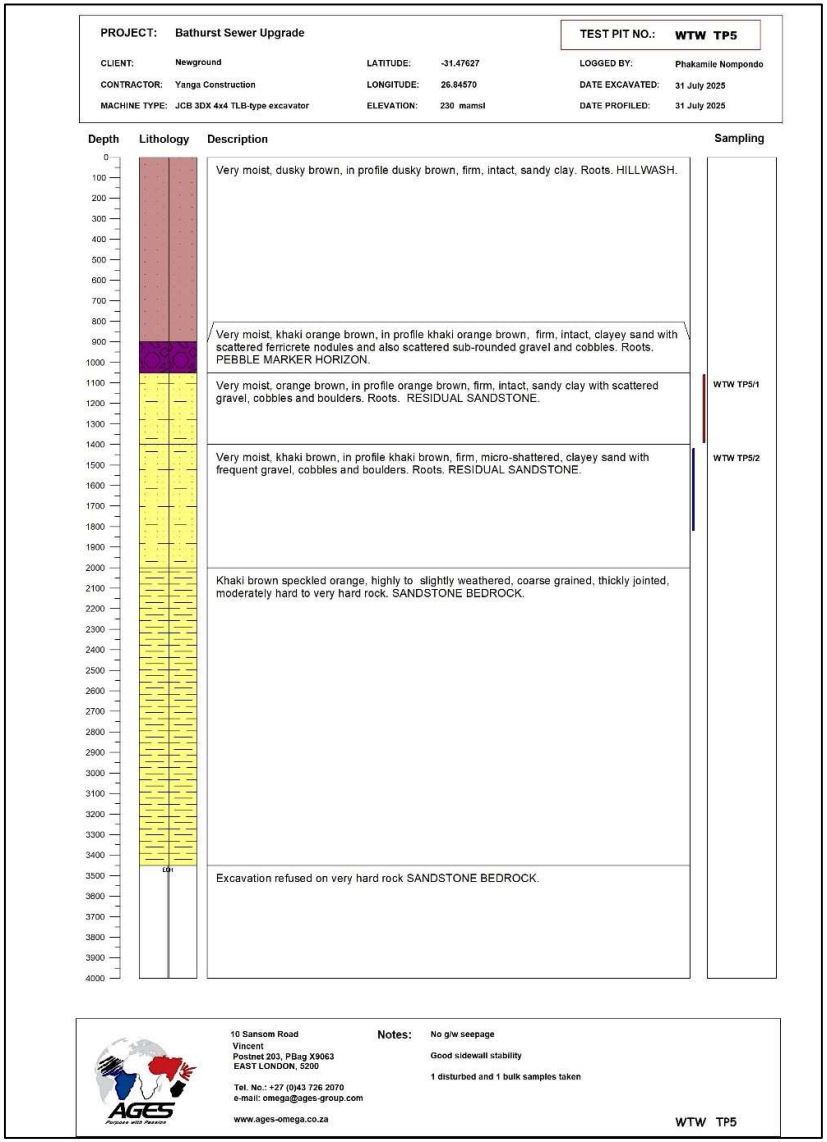
Notes:
No g/w seepage
Good sidewall stability
1 disturbed and 1 bulk sample taken

WTW TP4


PROJECT: Bathurst Sewer Upgrade
TEST PIT NO.: WTW TP5
CLIENT: Newground
LATITUDE: -31.47627
LOGGED BY: Phakamile Nompondo
CONTRACTOR: Yanga Construction
LONGITUDE: 26.84570
DATE EXCAVATED: 31 July 2025
MACHINE TYPE: JCB 3DX 4x4 TLB-type excavator
ELEVATION: 230 mamsl
DATE PROFILED: 31 July 2025
Depth
Lithology
Description
Sampling
Very moist, dusky brown, in profile dusky brown, firm, intact, sandy clay. Roots. HILLWASH.
Very moist, khaki orange brown, in profile khaki orange brown, firm, intact, clayey sand with scattered ferricrete nodules and also scattered sub-rounded gravel and cobbles. Roots. PEBBLE MARKER HORIZON.
Very moist, orange brown, in profile orange brown, firm, intact, sandy clay with scattered gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.
WTW TP5/1
Very moist, khaki brown, in profile khaki brown, firm, micro-shattered, clayey sand with frequent gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.
WTW TP5/2
Khaki brown speckled orange, highly to slightly weathered, coarse grained, thickly jointed, moderately hard to very hard rock. SANDSTONE BEDROCK.
Excavation refused on very hard rock SANDSTONE BEDROCK.
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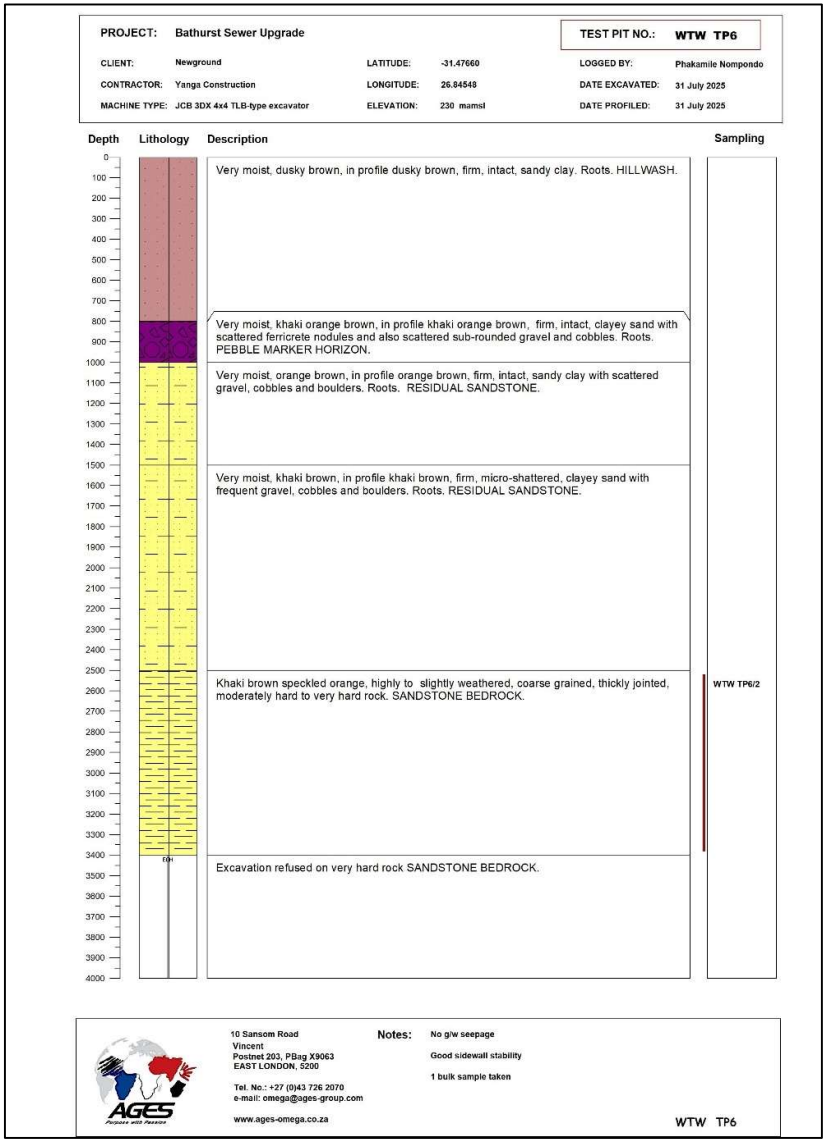
Notes:
No g/w seepage
Good sidewall stability
1 disturbed and 1 bulk samples taken
WTW TP5

WTW
TP5



PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**WTW TP6**
CLIENT:	Newground	LATITUDE:	-31.47660	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84548	DATE EXCAVATED:	31 July 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	31 July 2025

Depth	Description	Sampling
0–800	Very moist, dusky brown, in profile dusky brown, firm, intact, sandy clay. Roots. HILLWASH.	
800–1000	Very moist, khaki orange brown, in profile khaki orange brown, firm, intact, clayey sand with scattered ferricrete nodules and also scattered sub-rounded gravel and cobbles. Roots. PEBBLE MARKER HORIZON.	
1000–2500	Very moist, orange brown, in profile orange brown, firm, intact, sandy clay with scattered gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	
	Very moist, khaki brown, in profile khaki brown, firm, micro-shattered, clayey sand with frequent gravel, cobbles and boulders. Roots. RESIDUAL SANDSTONE.	
2500–3400	Khaki brown speckled orange, highly to slightly weathered, coarse grained, thickly jointed, moderately hard to very hard rock. SANDSTONE BEDROCK.	WTW TP6/2
EOH	Excavation refused on very hard rock SANDSTONE BEDROCK.	

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Notes: No g/w seepage
Good sidewall stability
1 bulk sample taken

WTW TP6

PROJECT:	Bathurst Sewer Upgrade			TEST PIT NO.:	SP TP1
CLIENT:	Newground	LATITUDE:	-33.49408	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.83680	DATE EXCAVATED:	31 July 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	31 July 2025

Depth	Lithology	Description	Sampling
0–500		Very moist, dark brown, in profile dark brown, firm, intact, clayey sand with a scattered gravel. Roots. HILLWASH.	SP TP1/1
500–1200		Moist to very moist, light orange brown, in profile light orange brown, firm, micro-shattered, sandy clay with scattered gravel. Roots. RESIDUAL SANDSTONE.	
1200–2500		Very moist, orange khaki brown, in profile orange brown, firm, intact, clayey sand with scattered to frequent gravel, cobbles and ocassional boulders. Roots. RESIDUAL SANDSTONE.	
2500	EOH	Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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Notes:
No g/w seepage
Good sidewall stability
1 disturbed and 1 bulk sample taken

SP TP1

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP1**
CLIENT:	Newground	LATITUDE:	-33.48182	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.83988	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–100		Moist to very moist, dark khaki brown, in profile dark khaki brown, firm, intact, sandy clay with frequent gravel and cobbles. Roots. IMPORTED SOILS.	
100–1000		Very moist, dark brown, in profile dark brown, firm, intact, clayey sand. Roots. HILLWASH.	
1000–1700		Very moist, orange khaki brown, in profile orange khaki brown, firm, micro-shattered, sandy clay with frequent gravel, cobbles and occasional boulders. RESIDUAL SANDSTONE.	
1700	EOH	Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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Notes:
No g/w seepage
Good sidewall stability
No sample taken

BSL TP1

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP2**
CLIENT:	Newground	LATITUDE:	-33.48329	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.83960	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–400		Moist to very moist, khaki brown, in profile khaki brown, soft, intact, clayey sand. Roots. IMPORTED SOILS.	
400–1100		very moist, dusky brown, in profile dusky brown, soft, intact, clayey sand. Roots. HILLWASH.	
1100–1500		Very moist, orange khaki brown, in profile orange brown, firm, intact, clayey sand with scattered to frequent gravel, cobbles and ocassional boulders. Roots. RESIDUAL SANDSTONE.	
1500	EOH	Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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Notes:
No g/w seepage
Good sidewall stability
No sample taken

BSL TP2

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP3**
CLIENT:	Newground	LATITUDE:	-33.48381	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84264	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–100		Moist to very moist, khaki brown, in profile khaki brown, firm, micro-shattered, clayey sand with frequent gravel and cobbles. Roots. IMPORTED SOILS.	
100–400		Very moist, dusky brown, in profile dusky brown, soft, intact, sandy clay with scattered gravel and cobbles. Roots. HILLWASH.	
400	EOH	Greyish brown speckled orange, slightly weathered, coarse grained, thickly jointed, moderately hard rock to hard rock. SANDSTONE BEDROCK.	
500		Excavation refused on hard rock SANDSTONE BEDROCK.	

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Notes:
No g/w seepage
Good sidewall stability
No sample taken

BSL TP3

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP4**
CLIENT:	Newground	LATITUDE:	-33.48570	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84003	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–500		Moist to very moist, dark khaki brown, in profile dark khaki brown, soft to firm, intact, clayey sand with frequent gravel and cobbles. Roots. IMPORTED SOILS.	
500–1000		Very moist, dark brown, in profile dark brown, firm, micro-shattered, sandy clay. Roots. HILLWASH.	
1000–1500		Moist, dark orange brown, in profile dark orange brown, firm to stiff, micro-shattered, sandy clay. RESIDUAL SANDSTONE.	
1500	EOH	Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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Notes:
- No g/w seepage
- Good sidewall stability
- No sample taken

BSL TP4

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP5**
CLIENT:	Newground	LATITUDE:	-33.49063	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84070	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–300		Very moist, khaki brown, in profile khaki brown, soft, intact, micro-shattered, silty sand. Roots. HILLWASH.	
300–1100		Very moist, dark orange brown, in profile dark orange brown, firm, intact, sandy clay. Roots. RESIDUAL SANDSTONE.	
1100–1600		Moist, orange brown, in profile orange brown, firm, intact, clayey sand. RESIDUAL SANDSTONE.	
1600–3000		Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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Notes:
No g/w seepage
Good sidewall stability
No sample taken

BSL TP5

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP6**
CLIENT:	Newground	LATITUDE:	-33.49063	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84292	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–100		Moist to very moist, khaki brown, in profile khaki brown, soft, intact, silty sand with scattered gravel and cobbles. Roots. IMPORTED SOIL.	
100–700		Very moist, dark brown, in profile dark brown, firm, intact, sandy clay. Roots. HILLWASH.	
700–1600		Moist, yellowish orange brown, in profile yellowish orange brown, firm, micro-shattered, clayey sand with frequent gravel and cobbles. RESIDUAL SANDSTONE.	
1600–3000		Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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Notes:
- No g/w seepage
- Good sidewall stability
- No sample taken

BSL TP6

PROJECT:	Bathurst Sewer Upgrade			TEST PIT NO.:	BSL TP7
CLIENT:	Newground	LATITUDE:	-33.49246	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.84186	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–600		Very moist, dark brown, in profile dark brown, firm, intact, sandy clay. Roots. HILLWASH.	
600–1600		Moist, yellowish orange brown, in profile yellowish orange brown, firm, micro-shattered, sandy clay with scattered to frequent gravel and cobbles. RESIDUAL SANDSTONE.	BSL TP7/1
1600–3000		Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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EAST LONDON, 5200

Tel. No.: +27 (0)43 726 2070
e-mail: omega@ages-group.com

www.ages-omega.co.za

Notes:
No g/w seepage
Good sidewall stability
1 disturbed sample taken

BSL TP7

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP8**
CLIENT:	Newground	LATITUDE:	-33.49166	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.83981	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–300		Very moist, dusky brown, in profile dusky brown, firm, micro-shattered, sandy clay with scattered to frequent gravel and cobbles. Roots. IMPORTED SOILS.	
300		Creamish brown speckled orange, slightly weathered, coarse grained, thickly jointed, hard rock to very hard rock. SANDSTONE BEDROCK.	
300	EOH	Excavation refused on very hard rock SANDSTONE BEDROCK.	

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Notes: No g/w seepage
Good sidewall stability
No sample taken

BSL TP8

PROJECT:	**Bathurst Sewer Upgrade**			**TEST PIT NO.:**	**BSL TP9**
CLIENT:	Newground	LATITUDE:	-33.49246	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.83834	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–500		Moist to very moist, khaki brown, in profile khaki brown, soft to firm, intact, silty sand with frequent gravel and cobbles. Roots. IMPORTED SOILS.	
500–1400		Very moist, dark brown, in profile dark brown, soft to firm, intact, clayey sand. Roots. HILLWASH.	
1400–1700		Very moist, orange brown, in profile orange brown, soft to firm, intact, sandy clay. RESIDUAL SANDSTONE.	
1700	EOH	Excavation was stopped on RESIDUAL SANDSTONE with a firm consistency.	

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EAST LONDON, 5200

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e-mail: omega@ages-group.com

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Notes:
No g/w seepage
Good sidewall stability
No sample taken

BSL TP9

PROJECT:	Bathurst Sewer Upgrade			**TEST PIT NO.:**	**BSL TP10**
CLIENT:	Newground	LATITUDE:	-33.49369	LOGGED BY:	Phakamile Nompondo
CONTRACTOR:	Yanga Construction	LONGITUDE:	26.83914	DATE EXCAVATED:	02 August 2025
MACHINE TYPE:	JCB 3DX 4x4 TLB-type excavator	ELEVATION:	230 mamsl	DATE PROFILED:	02 August 2025

Depth	Lithology	Description	Sampling
0–100		Very moist, orange brown, in profile orange brown, firm, micro-shattered, sandy clay with scattered gravel and cobbles. Roots. HILLWASH.	
400–500		Very moist, khaki brown, in profile khaki brown, firm, intact, silty sand with frequent gravel and cobbles. RESIDUAL SANDSTONE.	
700	EOH	Khaki brown speckled orange, sligtly weathered, very coarse grained, thickly jointed, hard rock to very hard rock. SANDSTONE BEDROCK.	
800		Excavation refused on very hard rock SANDSTONE BEDROCK.	

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Tel. No.: +27 (0)43 726 2070
e-mail: omega@ages-group.com

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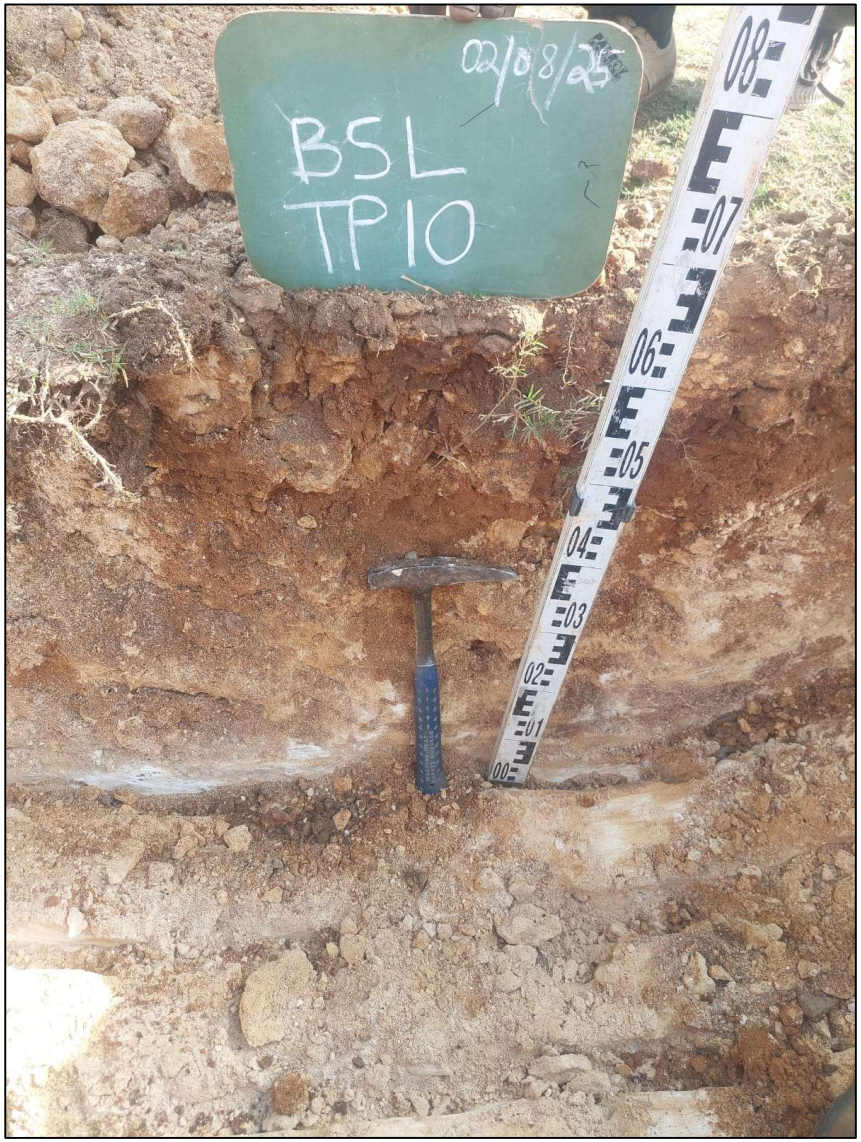
Notes: No g/w seepage
Good sidewall stability
No sample taken

BSL TP10



APPENDIX B

Dynamic Cone Penetrometer Data

ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	WTW TP1									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	9	0	0.0							
5	136	-127	25.4	85	7	22	36	96	0.0005	532
10	191	-182	11.0	212	20	42	87	133	0.0003	737
15	337	-328	29.2	73	6	20	31	91	0.0005	504
20	500	-491	32.6	65	5	18	28	87	0.0005	482
25	624	-615	24.8	88	7	22	37	97	0.0005	537
30	677	-668	10.6	221	20	43	91	135	0.0003	748
35	707	-698	6.0	411	42	67	167	168	0.0003	934
40	759	-750	10.4	226	21	44	93	136	0.0003	753
45	804	-795	9.0	264	25	49	108	143	0.0003	797
50	857	-848	10.6	221	20	43	91	135	0.0003	748
55	900	-891	8.6	278	27	51	114	146	0.0003	811
60	942	-933	8.4	285	27	51	116	147	0.0003	819
65	980	-971	7.6	318	31	56	130	153	0.0003	851
70	1000	991	4.0	640	70	91	256	197	0.0002	1094
75	1010	-1001	2.0	1362	170	156	535	258	0.0002	1433
80										
85	Stopped									
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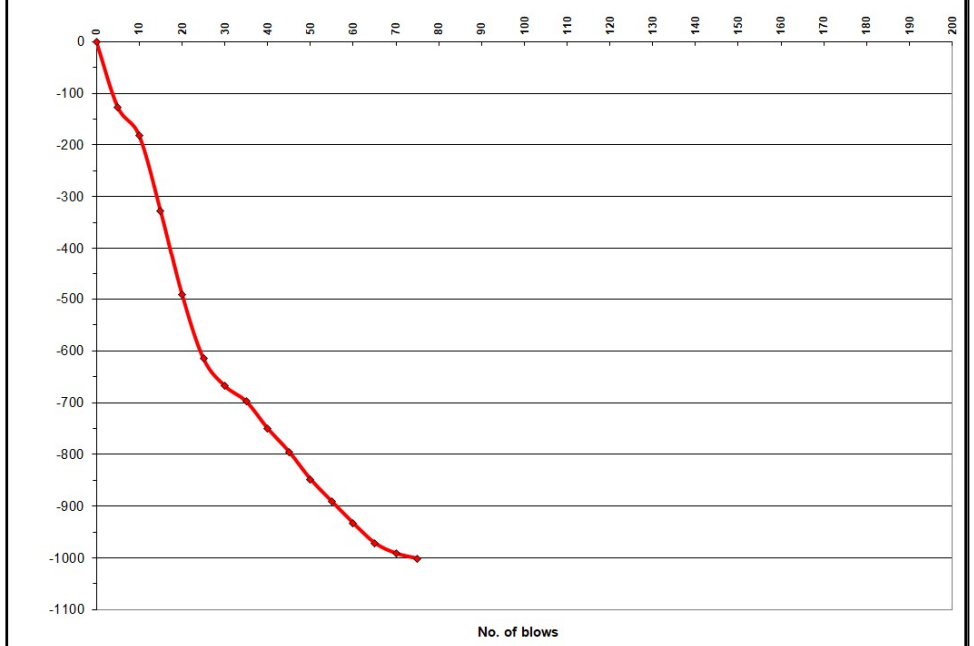
GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	WTW TP2									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	11	0	0.0							
5	227	-216	43.2	48	3	15	20	78	0.0006	432
10	356	-345	25.8	84	7	22	35	95	0.0005	529
15	409	-398	10.6	221	20	43	91	135	0.0003	748
20	434	-423	5.0	502	53	77	202	180	0.0002	1002
25	483	-472	9.8	241	23	46	99	139	0.0003	771
30	527	-516	8.8	271	26	50	111	145	0.0003	804
35	586	-575	11.8	197	18	40	81	129	0.0003	717
40	656	-645	14.0	163	14	35	68	121	0.0004	671
45	777	-766	24.2	90	7	23	38	98	0.0005	542
50	829	-818	10.4	226	21	44	93	136	0.0003	753
55	896	-885	13.4	171	15	36	71	123	0.0004	682
60	929	-918	6.6	371	37	62	150	162	0.0003	900
65	957	-946	5.6	443	46	70	179	173	0.0003	959
70	978	967	4.2	607	66	88	243	193	0.0002	1073
75	1007	-996	5.8	427	44	69	173	170	0.0003	946
80										
85	Stopped									
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95										
100										
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ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	WTW TP3									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	8	0	0.0							
5	277	-269	53.8	38	3	12	16	71	0.0006	397
10	358	-350	16.2	139	12	31	58	114	0.0004	634
15	413	-405	11.0	212	20	42	87	133	0.0003	737
20	479	-471	13.2	174	15	36	72	124	0.0004	686
25	528	-520	9.8	241	23	46	99	139	0.0003	771
30	569	-561	8.2	293	28	52	120	149	0.0003	827
35	618	-610	9.8	241	23	46	99	139	0.0003	771
40	698	-690	16.0	141	12	31	59	115	0.0004	637
45	778	-770	16.0	141	12	31	59	115	0.0004	637
50	849	-841	14.2	161	14	34	67	120	0.0004	667
55	899	-891	10.0	236	22	45	97	138	0.0003	765
60	912	-904	2.6	1023	122	127	405	233	0.0002	1294
65	938	-930	5.2	481	51	75	194	178	0.0003	987
70	975	967	7.4	327	32	57	133	155	0.0003	860
75	1002	-994	5.4	461	48	72	186	175	0.0003	973
80	1010	-1002	1.6	1737	206	176	677	281	0.0002	1563
85										
90	Stopped									
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ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	WTW TP4									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	10	0	0.0							
5	247	-237	47.4	43	3	14	19	75	0.0006	417
10	400	-390	30.6	70	5	19	30	89	0.0005	495
15	500	-490	20.0	111	9	26	46	105	0.0004	584
20	527	-517	5.4	461	48	72	186	175	0.0003	973
25	558	-548	6.2	397	40	65	161	166	0.0003	922
30	560	-550	0.4	7873	442	279	2952	483	0.0001	2684
35										
40	Stopped									
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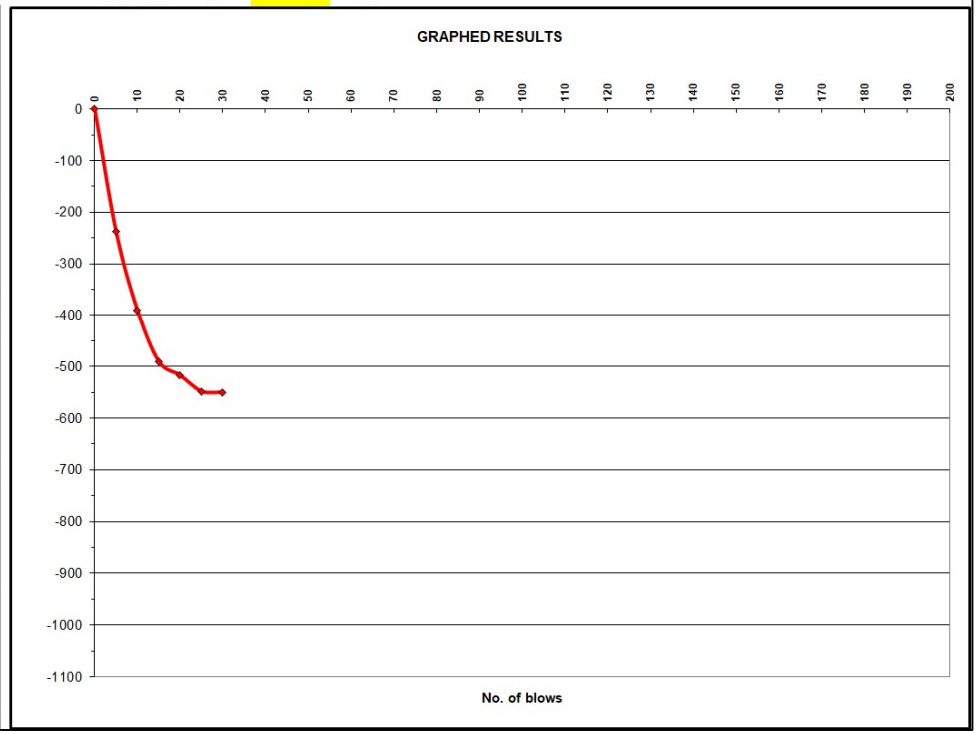

ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	WTW TP5									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	11	0	0.0							
5	202	-191	38.2	55	4	16	23	82	0.0006	454
10	288	-277	17.2	131	11	30	54	111	0.0004	619
15	348	-337	12.0	193	17	39	80	128	0.0004	712
20	413	-402	13.0	177	16	37	73	124	0.0004	691
25	489	-478	15.2	149	13	33	62	117	0.0004	650
30	569	-558	16.0	141	12	31	59	115	0.0004	637
35	644	-633	15.0	152	13	33	63	118	0.0004	653
40	718	-707	14.8	154	13	33	64	118	0.0004	657
45	759	-748	8.2	293	28	52	120	149	0.0003	827
50	786	-775	5.4	461	48	72	186	175	0.0003	973
55	824	-813	7.6	318	31	56	130	153	0.0003	851
60	859	-848	7.0	348	35	59	141	158	0.0003	879
65	900	-889	8.2	293	28	52	120	149	0.0003	827
70	948	937	9.6	246	23	46	101	140	0.0003	777
75	987	-976	7.8	309	30	55	126	152	0.0003	843
80	1010	-999	4.6	550	59	82	221	186	0.0002	1036
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90	Stopped									
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ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	WTW TP6									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	No DCP Data									
5	Shallow Bedrock									
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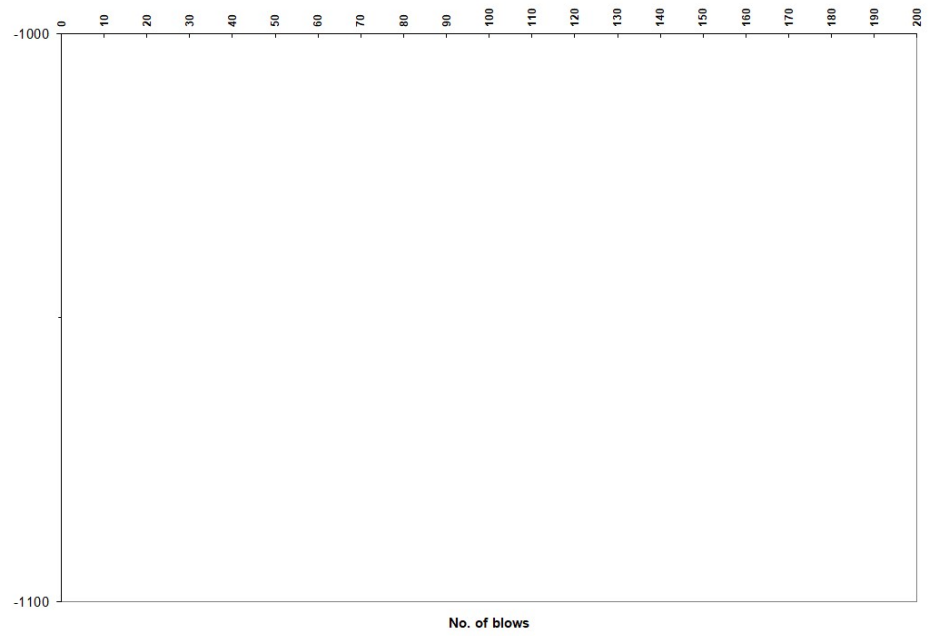
GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	SP TP1									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	97	0	0.0							
5	386	-289	57.8	35	2	12	15	69	0.0006	386
10	742	-645	71.2	28	2	10	12	64	0.0007	356
15	821	-724	15.8	143	12	32	60	115	0.0004	640
20	904	-807	16.6	136	12	30	57	113	0.0004	628
25	976	-879	14.4	158	14	34	66	119	0.0004	664
30	1010	-913	6.8	359	36	61	146	160	0.0003	889
35										
40	Stopped									
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ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	SP TP2									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	8	0	0.0							
5	357	-349	69.8	28	2	10	12	65	0.0007	359
10	549	-541	38.4	54	4	16	23	81	0.0006	453
15	884	-876	67.0	30	2	10	13	66	0.0007	364
20	915	-907	6.2	397	40	65	161	166	0.0003	922
25	1010	-1002	19.0	117	10	27	49	107	0.0004	596
30										
35	Stopped									
40										
45	1568	-1568	313.6	6	0	3	2	36	0.0013	200
50	1673	-1673	21.0	105	9	25	44	103	0.0004	573
55	1813	-1813	28.0	77	6	20	32	92	0.0005	512
60	2031	-2031	43.6	47	3	14	20	78	0.0006	431
65	2112	-2112	16.2	139	12	31	58	114	0.0004	634
70	2254	2254	28.4	76	6	20	32	92	0.0005	509
75	2255	-2255	0.2	16760	500	301	6161	633	0.0001	3518
80										
85	Refused									
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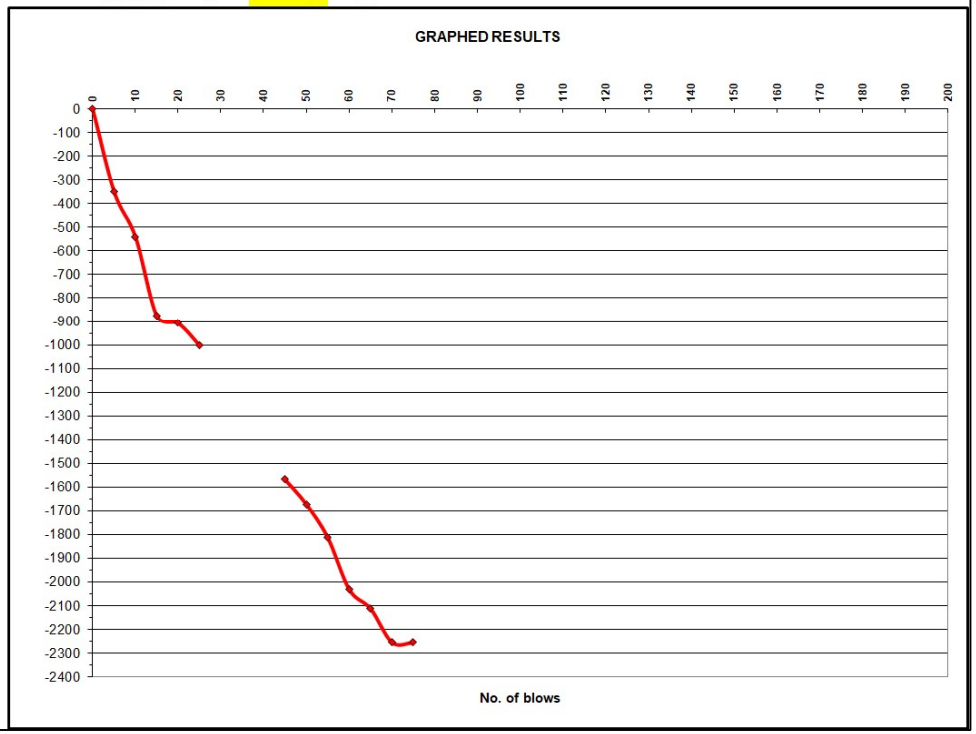

ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	SP TP3									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	11	0	0.0							
5	97	-86	17.2	131	11	30	54	111	0.0004	619
10	168	-157	14.2	161	14	34	67	120	0.0004	667
15	200	-189	6.4	383	39	64	155	164	0.0003	910
20	244	-233	8.8	271	26	50	111	145	0.0003	804
25	287	-276	8.6	278	27	51	114	146	0.0003	811
30	307	-296	4.0	640	70	91	256	197	0.0002	1094
35	308	-297	0.2	16760	500	301	6161	633	0.0001	3518
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45	Refused									
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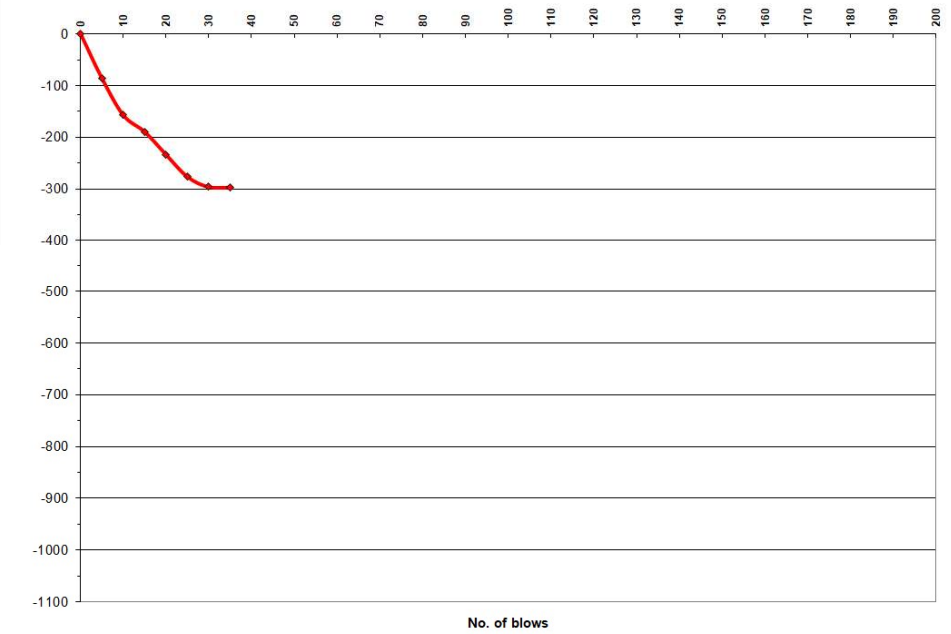
GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP1									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	11	0	0.0							
5	128	-117	23.4	93	7	23	39	99	0.0005	549
10	227	-216	19.8	112	9	27	47	105	0.0004	586
15	359	-348	26.4	82	6	21	35	94	0.0005	524
20	458	-447	19.8	112	9	27	47	105	0.0004	586
25	537	-526	15.8	143	12	32	60	115	0.0004	640
30	609	-598	14.4	158	14	34	66	119	0.0004	664
35	718	-707	21.8	101	8	25	42	102	0.0004	564
40	874	-863	31.2	68	5	19	29	88	0.0005	491
45	1010	-999	27.2	79	6	21	33	93	0.0005	518
50										
55	Stopped									
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										
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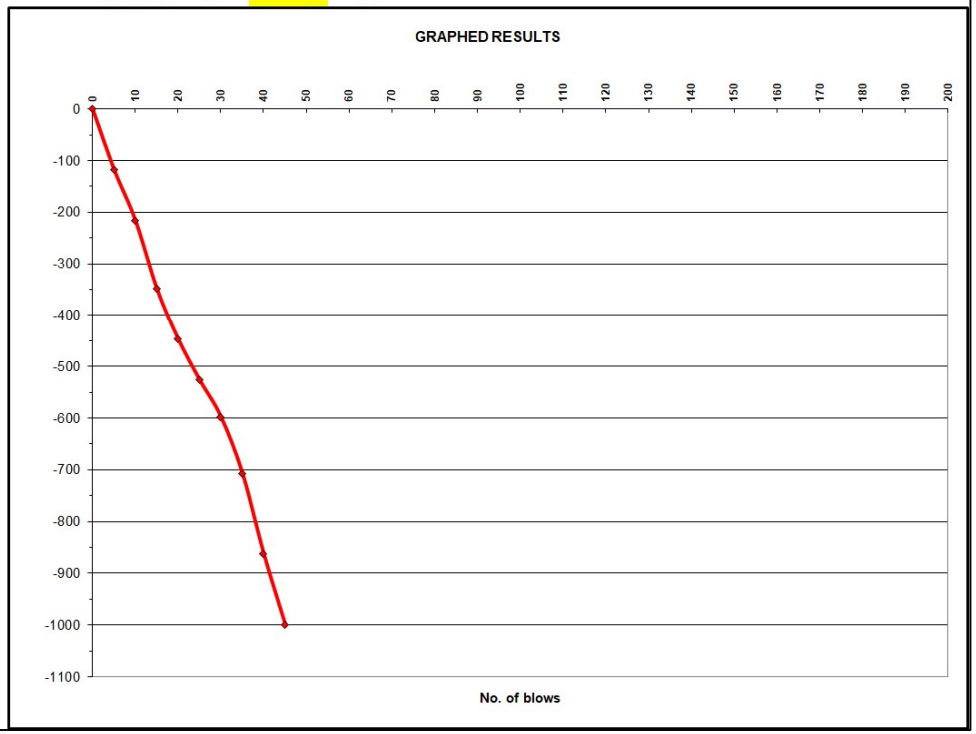
200										



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

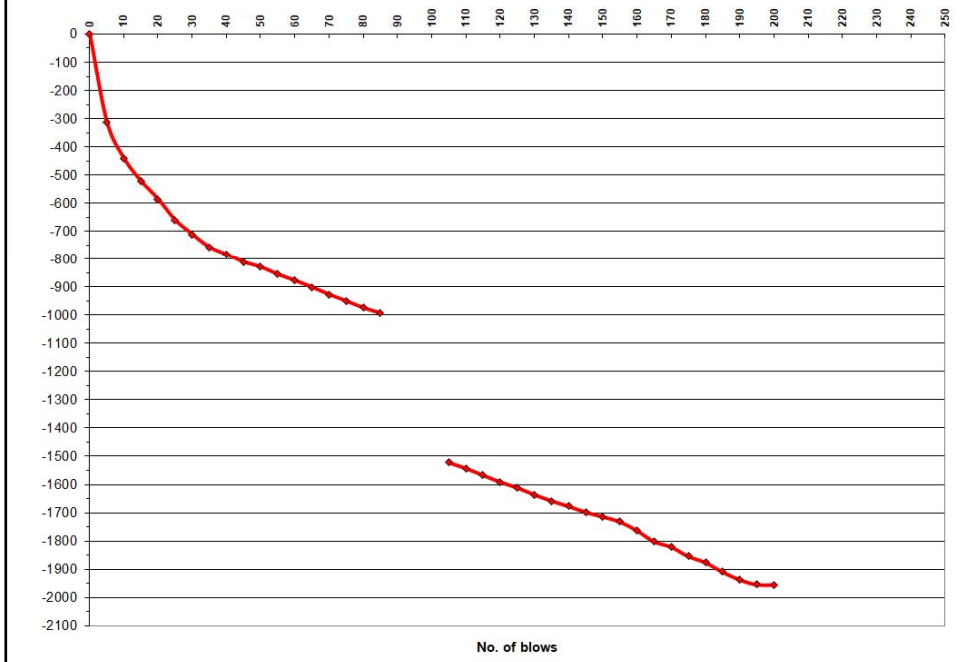
Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP4									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	17	0	0.0							
5	329	-312	62.4	32	2	11	14	67	0.0007	375
10	458	-441	25.8	84	7	22	35	95	0.0005	529
15	539	-522	16.2	139	12	31	58	114	0.0004	634
20	603	-586	12.8	180	16	37	74	125	0.0004	695
25	677	-660	14.8	154	13	33	64	118	0.0004	657
30	728	-711	10.2	231	21	44	95	137	0.0003	759
35	774	-757	9.2	258	24	48	106	142	0.0003	790
40	800	-783	5.2	481	51	75	194	178	0.0003	987
45	828	-811	5.6	443	46	70	179	173	0.0003	959
50	846	-829	3.6	718	81	99	286	205	0.0002	1139
55	872	-855	5.2	481	51	75	194	178	0.0003	987
60	894	-877	4.4	577	62	85	231	190	0.0002	1054
65	918	-901	4.8	525	56	79	211	183	0.0002	1018
70	944	-927	5.2	481	51	75	194	178	0.0003	987
75	967	950	4.6	550	59	82	221	186	0.0002	1036
80	991	-974	4.8	525	56	79	211	183	0.0002	1018
85	1010	-993	3.8	677	75	95	270	201	0.0002	1116
90										
95	Stopped									
100										
105	1522	-1522	304.4	6	0	3	3	36	0.0012	202
110	1543	-1543	4.2	607	66	88	243	193	0.0002	1073
115	1567	-1567	4.8	525	56	79	211	183	0.0002	1018
120	1591	-1591	4.8	525	56	79	211	183	0.0002	1018
125	1611	-1611	4.0	640	70	91	256	197	0.0002	1094
130	1636	-1636	5.0	502	53	77	202	180	0.0002	1002
135	1658	-1658	4.4	577	62	85	231	190	0.0002	1054
140	1677	-1677	3.8	677	75	95	270	201	0.0002	1116
145	1698	-1698	4.2	607	66	88	243	193	0.0002	1073
150	1714	-1714	3.2	816	94	109	325	215	0.0002	1193
155	1732	-1732	3.6	718	81	99	286	205	0.0002	1139
160	1763	-1763	6.2	397	40	65	161	166	0.0003	922
165	1802	-1802	7.8	309	30	55	126	152	0.0003	843
170	1821	-1821	3.8	677	75	95	270	201	0.0002	1116
175	1854	-1854	6.6	371	37	62	150	162	0.0003	900
180	1876	-1876	4.4	577	62	85	231	190	0.0002	1054
185	1909	-1909	6.6	371	37	62	150	162	0.0003	900
190	1937	-1937	5.6	443	46	70	179	173	0.0003	959
195	1954	-1954	3.4	764	87	104	304	210	0.0002	1165
200	1955	-1955	0.2	16760	500	301	6161	633	0.0001	3518
205										
210	Refused									

GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

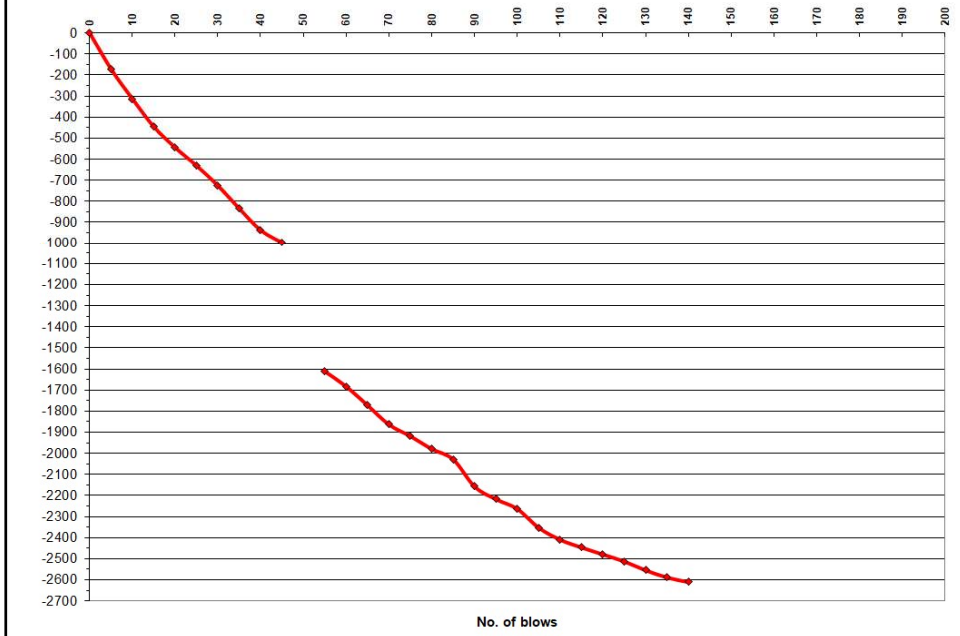
Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP5									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	13	0	0.0							
5	184	-171	34.2	62	5	17	26	85	0.0005	474
10	326	-313	28.4	76	6	20	32	92	0.0005	509
15	458	-445	26.4	82	6	21	35	94	0.0005	524
20	557	-544	19.8	112	9	27	47	105	0.0004	586
25	643	-630	17.2	131	11	30	54	111	0.0004	619
30	738	-725	19.0	117	10	27	49	107	0.0004	596
35	847	-834	21.8	101	8	25	42	102	0.0004	564
40	950	-937	20.6	107	9	26	45	104	0.0004	577
45	1009	-996	11.8	197	18	40	81	129	0.0003	717
50										
55	1611	-1611	322.2	5	0	3	2	36	0.0013	197
60	1683	-1683	14.4	158	14	34	66	119	0.0004	664
65	1772	-1772	17.8	126	11	29	52	110	0.0004	611
70	1863	1863	18.2	123	10	28	51	109	0.0004	606
75	1918	-1918	11.0	212	20	42	87	133	0.0003	737
80	1979	-1979	12.2	190	17	39	78	127	0.0004	708
85	2028	-2028	9.8	241	23	46	99	139	0.0003	771
90	2157	-2157	25.8	84	7	22	35	95	0.0005	529
95	2217	-2217	12.0	193	17	39	80	128	0.0004	712
100	2263	-2263	9.2	258	24	48	106	142	0.0003	790
105	2352	-2352	17.8	126	11	29	52	110	0.0004	611
110	2409	-2409	11.4	204	19	41	84	131	0.0003	727
115	2446	-2446	7.4	327	32	57	133	155	0.0003	860
120	2479	-2479	6.6	371	37	62	150	162	0.0003	900
125	2512	-2512	6.6	371	37	62	150	162	0.0003	900
130	2554	-2554	8.4	285	27	51	116	147	0.0003	819
135	2588	-2588	6.8	359	36	61	146	160	0.0003	889
140	2610	-2610	4.4	577	62	85	231	190	0.0002	1054
145										
150										
155										
160										
165										
170										
175										
180										
185										
190										
195										
200										

GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

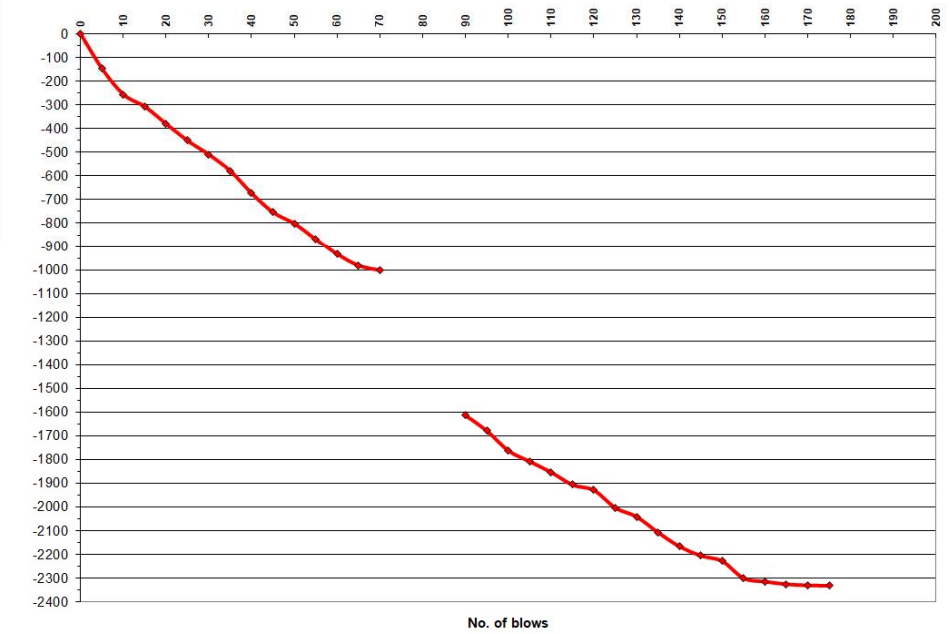
Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP6									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	8	0	0.0							
5	154	-146	29.2	73	6	20	31	91	0.0005	504
10	263	-255	21.8	101	8	25	42	102	0.0004	564
15	314	-306	10.2	231	21	44	95	137	0.0003	759
20	387	-379	14.6	156	14	34	65	119	0.0004	660
25	458	-450	14.2	161	14	34	67	120	0.0004	667
30	517	-509	11.8	197	18	40	81	129	0.0003	717
35	586	-578	13.8	166	15	35	69	121	0.0004	675
40	681	-673	19.0	117	10	27	49	107	0.0004	596
45	761	-753	16.0	141	12	31	59	115	0.0004	637
50	809	-801	9.6	246	23	46	101	140	0.0003	777
55	876	-868	13.4	171	15	36	71	123	0.0004	682
60	941	-933	13.0	177	16	37	73	124	0.0004	691
65	989	-981	9.6	246	23	46	101	140	0.0003	777
70	1009	1001	4.0	640	70	91	256	197	0.0002	1094
75										
80	Stopped									
85										
90	1614	-1614	322.8	5	0	3	2	36	0.0013	197
95	1679	-1679	13.0	177	16	37	73	124	0.0004	691
100	1762	-1762	16.6	136	12	30	57	113	0.0004	628
105	1808	-1808	9.2	258	24	48	106	142	0.0003	790
110	1853	-1853	9.0	264	25	49	108	143	0.0003	797
115	1906	-1906	10.6	221	20	43	91	135	0.0003	748
120	1929	-1929	4.6	550	59	82	221	186	0.0002	1036
125	2003	-2003	14.8	154	13	33	64	118	0.0004	657
130	2041	-2041	7.6	318	31	56	130	153	0.0003	851
135	2107	-2107	13.2	174	15	36	72	124	0.0004	686
140	2166	-2166	11.8	197	18	40	81	129	0.0003	717
145	2205	-2205	7.8	309	30	55	126	152	0.0003	843
150	2228	-2228	4.6	550	59	82	221	186	0.0002	1036
155	2300	-2300	14.4	158	14	34	66	119	0.0004	664
160	2314	-2314	2.8	944	111	120	374	226	0.0002	1257
165	2325	-2325	2.2	1228	151	145	483	249	0.0002	1381
170	2330	-2330	1.0	2900	300	221	1116	338	0.0001	1878
175	2332	-2332	0.4	7873	442	279	2952	483	0.0001	2684
180										
185	Refused									
190										
195										
200										

GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP7									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	22	0	0.0							
5	134	-112	22.4	98	8	24	41	101	0.0004	559
10	258	-236	24.8	88	7	22	37	97	0.0005	537
15	358	-336	20.0	111	9	26	46	105	0.0004	584
20	448	-426	18.0	124	10	29	52	109	0.0004	608
25	618	-596	34.0	62	5	17	26	85	0.0005	475
30	721	-699	20.6	107	9	26	45	104	0.0004	577
35	791	-769	14.0	163	14	35	68	121	0.0004	671
40	863	-841	14.4	158	14	34	66	119	0.0004	664
45	919	-897	11.2	208	19	41	86	132	0.0003	732
50	973	-951	10.8	217	20	42	89	134	0.0003	742
55	1010	-988	7.4	327	32	57	133	155	0.0003	860
60										
65	Stopped									
70										
75	1618	-1618	323.6	5	0	3	2	35	0.0013	197
80	1677	-1677	11.8	197	18	40	81	129	0.0003	717
85	1762	-1762	17.0	132	11	30	55	112	0.0004	622
90	1789	-1789	5.4	461	48	72	186	175	0.0003	973
95	1826	-1826	7.4	327	32	57	133	155	0.0003	860
100	1843	-1843	3.4	764	87	104	304	210	0.0002	1165
105	1871	-1871	5.6	443	46	70	179	173	0.0003	959
110	1907	-1907	7.2	337	33	58	137	157	0.0003	870
115	1921	-1921	2.8	944	111	120	374	226	0.0002	1257
120	1962	-1962	8.2	293	28	52	120	149	0.0003	827
125	2009	-2009	9.4	252	24	47	103	141	0.0003	784
130	2013	-2013	0.8	3699	342	239	1414	369	0.0001	2049
135										
140	Refused									
145										
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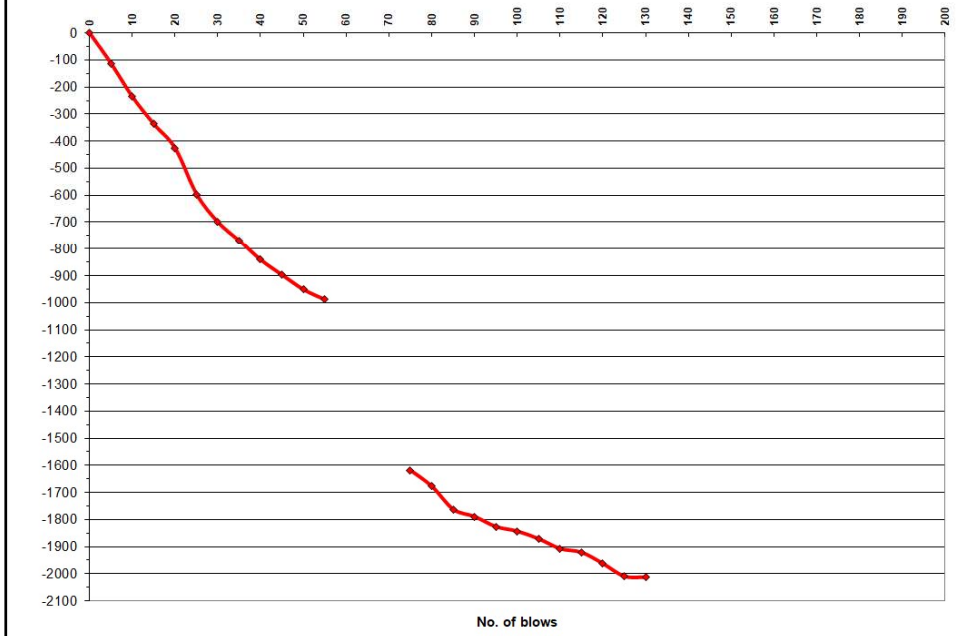
GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP8									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	No DCP Data									
5	Shallow Bedrock									
10										
15										
20										
25										
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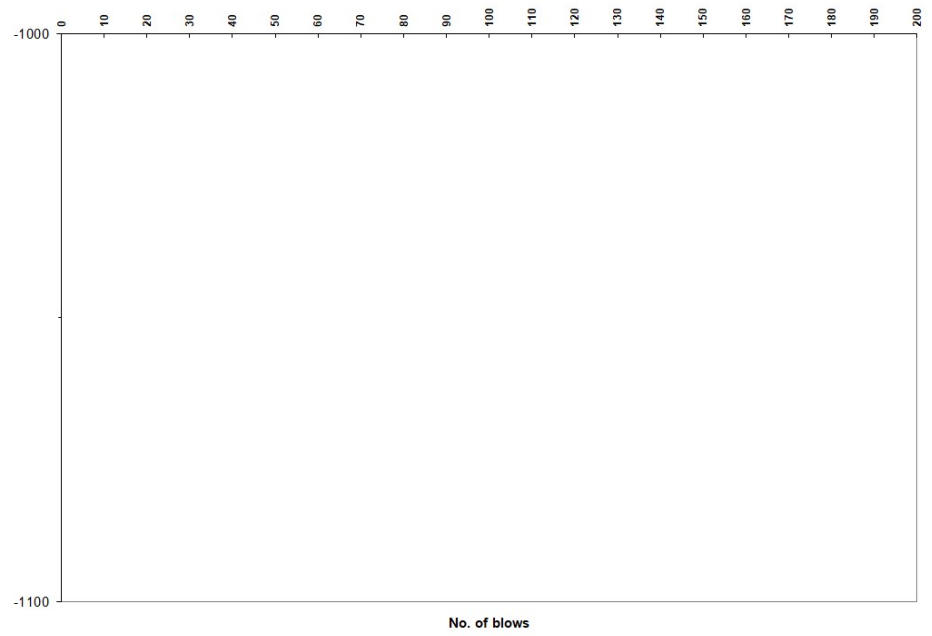
200										

GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP9									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	11	0	0.0							
5	266	-255	51.0	40	3	13	17	73	0.0006	405
10	394	-383	25.6	85	7	22	36	95	0.0005	530
15	500	-489	21.2	104	8	25	44	103	0.0004	571
20	600	-589	20.0	111	9	26	46	105	0.0004	584
25	684	-673	16.8	134	11	30	56	112	0.0004	625
30	767	-756	16.6	136	12	30	57	113	0.0004	628
35	980	-969	42.6	49	3	15	21	78	0.0006	435
40	1010	-999	6.0	411	42	67	167	168	0.0003	934
45										
50	Stopped									
55										
60	1721	-1721	344.2	5	0	3	2	35	0.0013	192
65	1787	-1787	13.2	174	15	36	72	124	0.0004	686
70	1869	1869	16.4	137	12	31	57	114	0.0004	631
75	2027	-2027	31.6	67	5	18	29	88	0.0005	488
80	2100	-2100	14.6	156	14	34	65	119	0.0004	660
85	2162	-2162	12.4	186	17	38	77	127	0.0004	703
90	2240	-2240	15.6	145	13	32	60	116	0.0004	643
95	2311	-2311	14.2	161	14	34	67	120	0.0004	667
100	2372	-2372	12.2	190	17	39	78	127	0.0004	708
105	2511	-2511	27.8	77	6	20	33	92	0.0005	513
110	2512	-2512	0.2	16760	500	301	6161	633	0.0001	3518
115										
120	Refused									
125										
130										
135										
140										
145										
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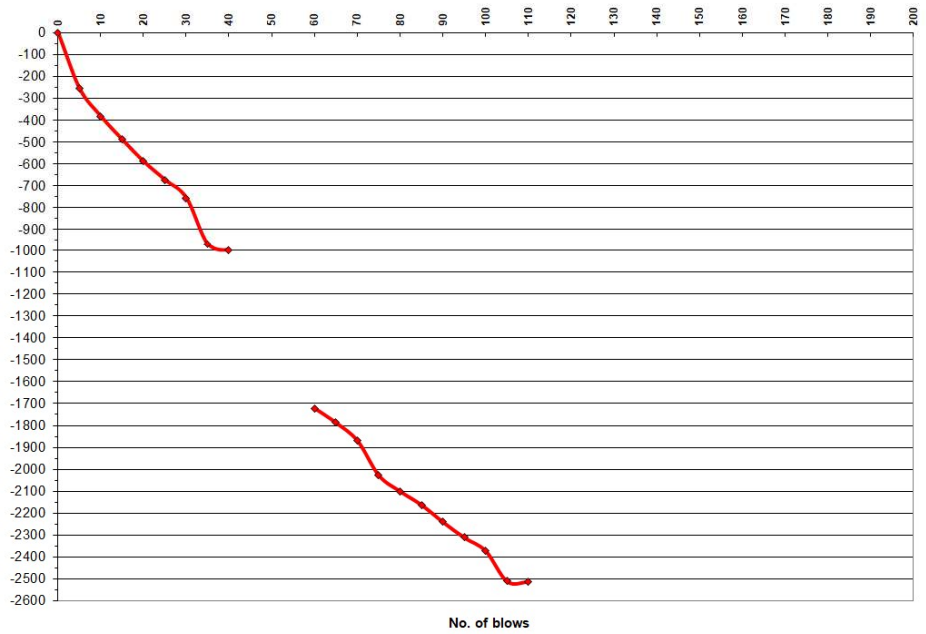
GRAPHED RESULTS



ANALYSES OF DYNAMIC CONE PENETRATION TEST RESULTS

PROJECT: GTEC - Bathurst Sewer Upgrade

DEPTH: Surface

Traffic Stress σ'_v 250 kPa

Thickness D 180 mm

CONDUCTED ON: 31 July 2025

NO. OF BLOWS	BSL TP10									
	Values (mm)	Cumulative penetration (mm)	mm/blow	UCS (kPa)	CBR% (Kleyn, 1984)	E (MPa) (Packard, 1973)	E (De Beer, 1991) MPa	E (Jianzhou et al., 1999)	ρ (mm)	k (kN/m3)
0	11	0	0.0							
5	69	-58	11.6	201	18	40	83	130	0.0003	722
10	105	-94	7.2	337	33	58	137	157	0.0003	870
15	133	-122	5.6	443	46	70	179	173	0.0003	959
20	154	-143	4.2	607	66	88	243	193	0.0002	1073
25	200	-189	9.2	258	24	48	106	142	0.0003	790
30	201	-190	0.2	16760	500	301	6161	633	0.0001	3518
35										
40	Refused									
45										
50										
55										
60										
65										
70										
75										
80										
85										
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195										
200										

APPENDIX C

Laboratory Analysis Certificates

Labco Southern Africa (Pty) Ltd
Email: infoel@labco.co.za ■ www.labco.co.za
Email: justin@labco.co.za ■ Phone: +27 (0)43 050 0903
East London Branch – Unit 5 Evergreen Park, C/o B Road & Main Road, Beacon Bay
sanas Testing Laboratory T0787

MATERIALS TEST REPORT

Client	:	Ages Omega (Pty) Ltd	**Client Reference**	:	E24-070
Address	:	10 Sansom Road	**Order No.**	:	E24-070
	:	Vincent	**Report Status**	:	Complete
	:	East London	**Date Received**	:	12.08.2025
	:	-	**Date Tested**	:	27.08.2025 - 03.09.2025
Attention	:	Malwande Busakwe	**Date Reported**	:	03.09.2025
E-mail	:	mbusakwe@ages-group.com	**Page**	:	1 of 5
Project	:	GTEC E24-070			
Job Card	:	E3417 Report 1 of 2 \44382			6
Sampling Procedure(s):		SAMPLES COLLECTED BUT NOT SAMPLED			

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Test Method(s)
California Bearing Ratio	SANS 3001-GR40
Maximum Dry Density & Optimum Moisture Content	SANS 3001- GR30
Sieve Analysis	SANS 3001- GR1
Atterberg Limits	SANS 3001 - GR10
Hydrometer Analysis	SANS 3001 - GR3

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

Any information contained in this test report pertain only to the areas and/or samples tested. Documents may only be reproduced or published in their full context.

While every care is taken to ensure that all tests are carried out in accordance with recognised standards, neither Labco Southern Africa (Pty) Ltd nor its employees shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequences thereof.

All interpretations, Interpolations, Opinions and/or Classifications contained in this report falls outside our scope of accreditation.

The following parameters, where applicable, were excluded from the classification procedure: Chemical modifications, Additional fines, Fractured Faces, Soluble Salts, pH, Conductivity, Coarse Sand Ratio, Durability (COLTO: G4-G9).

The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

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Any information gained by the laboratory prior, during or after the test process will be treated as confidential and will not be reproduced or disclosed to any person or organisation, unless required to do so by law.

Where the sample has been supplied by the customer the results apply to the sample as received.

**All results are authorized by technical signatories.

viat

Justin Tarr
Technical Signatory.

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Client	: Ages Omega (Pty) Ltd	Date Received	: 12.08.2025
Project	: GTEC E24 - 070	Date Reported	: 05/09/2025
Job Card No:	E3417	Page No.	: 2 of 1

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		E3417/1 ◆	E3417/2 ■
Field Number		-	-
Client Reference		WTW TP 4/2	WTW TP 5/1
Depth (m)		1.40 - 1.80	1.05 - 1.40
Position		WTW TP 4/2	WTW TP 5/1
Coordinates	X		
	Y		
Description		Residual Sandstone	Residual Sandstone
Additional information			
Calcrete/Crushed			
Stabilizing Agent			

Sieve Analysis (Wet preparation)

Percentage Passing	100 mm		
	75 mm	100	
	63 mm	94	
	50 mm	92	
	37.5 mm	90	
	28 mm	88	
	20 mm	84	100
	14 mm	78	97
	5 mm	64	93
	2 mm	56	91
	1 mm	56	91
	0.425 mm	51	88
	0.075 mm	33	59
Grading Modulus		1.61	0.62

Soil Mortar Analysis

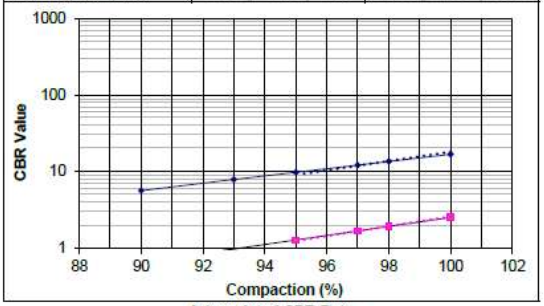
Coarse Sand	9	3
Coarse Fine Sand	7	6
Medium Fine Sand	10	11
Fine Fine Sand	15	15
Silt and Clay	59	64

Atterberg Limits	<0.425mm	<0.425mm
Liquid Limit (%)	30	36
Plasticity Index (%)	14	17
Linear Shrinkage (%)	7.0	9.0

Laboratory No.		E3417/1 ◆	E3417/2 ■
Maximum Dry Density & Optimum Moisture Content			
MDD	kg/m^3	1946	1681
OMC	%	9.7	18.2

California Bearing Ratio

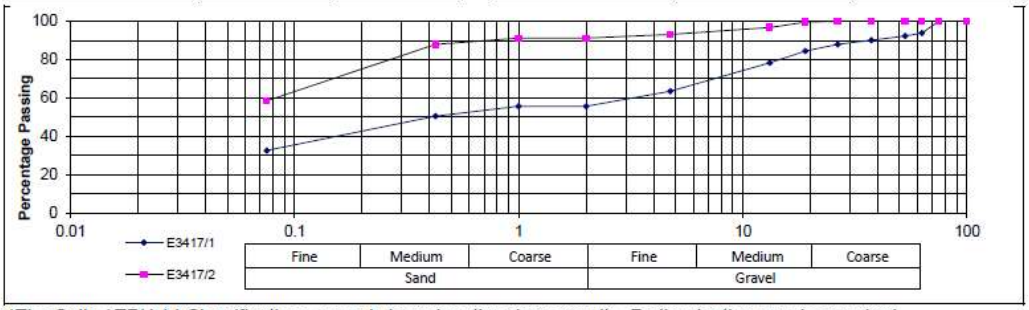
Compaction Data							
Moisture	%	9.8			16.2		
Dry Density	kg/m^3	1945	1850	1736	1681	1599	1515
Compaction	%	100.0	95.1	89.3	100.0	95.1	90.1
Penetration Data							
CBR at	2.50 mm	18	9	5	3	1	1
	5.00 mm	15	11	6	2	1	1
	7.50 mm	12	9	5	2	1	1
Swell @ 96hrs (%)		1.1	1.3	1.5	0.7	1.5	2.0
Final Moisture (%)		13.0	14.2	15.5	20.5	22.3	25.3



Interpolated CBR Data

CBR @ 100% Mod. AASHTO		17	3
@ 98%		13	2
@ 97%		12	2
@ 95%		10	1
@ 93%		8	1
@ 90%		6	1
@ SANS3001 Midpoint		13	2

Classifications		
HRB (AASHTO)	A-2-6(1)	A-6(7)
COLTO*	G9	
TRH14*	G10	



*The Colto / TRH 14 Classifications are only based on the above results. Further testing may be required

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Client	: Ages Omega (Pty) Ltd	Date Received :	12.08.2025
Project	: GTEC E24 - 070	Date Reported :	05/09/2025
Job Card No:	E3417	Page No. :	3 of 1

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		E3417/3 ◆	E3417/4 ■
Field Number		-	-
Client Reference		WTW TP 6/2	SP 1/2
Depth (m)		2.50 - 3.40	1.20 - 2.50
Position		WTW TP 6/2	SP 1/2
Coordinates	X		
	Y		
Description		Sandstone Bedrock	Residual Sandstone
Additional information			Sewer Pump
Calcrete/Crushed			
Stabilizing Agent			

Sieve Analysis (Wet preparation)

Percentage Passing			
	100 mm		
	75 mm	100	
	63 mm	95	
	50 mm	90	
	37.5 mm	80	
	28 mm	74	
	20 mm	60	
	14 mm	52	
	5 mm	38	
	2 mm	33	
	1 mm	33	100
	0.425 mm	30	99
	0.075 mm	19	25
Grading Modulus		2.19	0.76

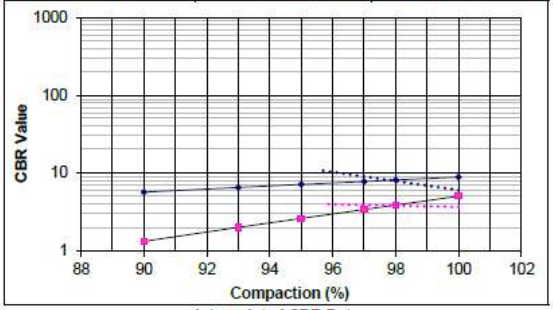
Soil Mortar Analysis

Coarse Sand	10	0
Coarse Fine Sand	7	17
Medium Fine Sand	10	50
Fine Fine Sand	15	7
Silt and Clay	58	25
Atterberg Limits	**<0.425mm**	**<0.425mm**
Liquid Limit (%)	28	25
Plasticity Index (%)	11	7
Linear Shrinkage (%)	5.5	3.5

Laboratory No.		E3417/3 ◆	E3417/4 ■
Maximum Dry Density & Optimum Moisture Content			
MDD	kg/m³	1978	1777
OMC	%	10.2	11.5

California Bearing Ratio

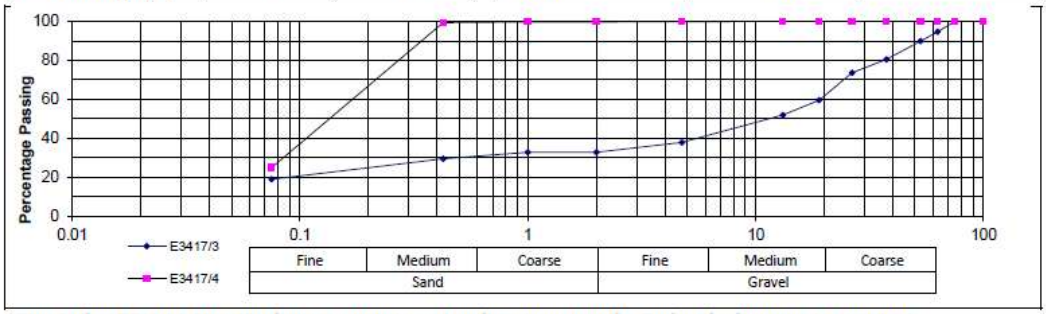
Compaction Data							
Moisture	%	10.2			11.7		
Dry Density	kg/m³	1976	1891	1782	1778	1704	1606
Compaction	%	100.0	95.7	90.1	100.0	95.8	90.3
Penetration Data							
CBR at	2.50 mm	6	11	6	4	4	1
	5.00 mm	8	11	6	5	4	2
	7.50 mm	9	13	5	5	4	2
Swell @ 96hrs (%)		0.7	1.0	1.4	0.3	0.5	0.8
Final Moisture (%)		14.3	16.4	18.3	16.4	18.3	20.8



Interpolated CBR Data

CBR		Mod. AASHTO		
@	100%		9	5
@	98%		8	4
@	97%		8	3
@	95%		7	3
@	93%		7	2
@	90%		6	1
@	SANS3001 Midpoint		8	4

Classifications		
HRB (AASHTO)	A-2-6(0)	A-2-4(0)
COLTO*		
TRH14*	G10	



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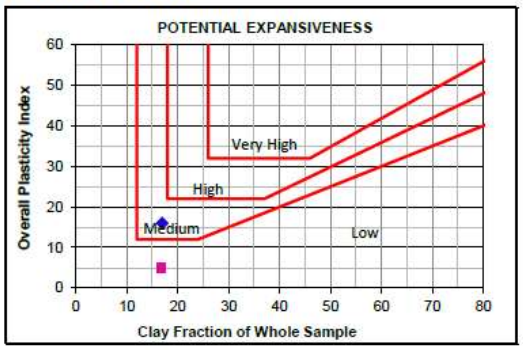
Client:	Ages Omega (Pty) Ltd	Date Received:	12.08.2025
Project:	GTEC E24 - 070	Date Reported:	05/09/2025
Job Card No:	E3417	Page No.:	4 of 6

FOUNDATION INDICATOR

Laboratory Number		E3417/5 ◆	E3417/6 ■
Field Number		-	-
Client Reference		WTW TP 4/1	WTW TP 5/2
Depth (m)		0.60 - 1.40	1.40 - 2.00
Position		WTW TP 4/1	WTW TP 5/2
Coordinates	X		
	Y		
Visual Description		Residual Sandstone	Residual Sandstone
Classification Description		Clay of low plasticity \ Silt-Clay Materials	Clayey sand \ Silt-Clay Materials
Stabilizing Agent			

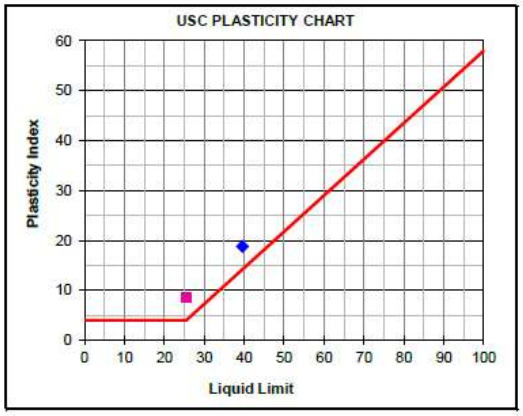


Moisture Content & Relative Density

Moisture Content (%)	20.6	12.2
Relative Density (S.G.)		

Sieve Analysis (Wet Prep)

Percentage Passing	100 mm		
	75 mm		
	63 mm		
	50 mm		100
	37.5 mm		98
	28 mm		94
	20 mm		85
	14 mm	100	83
	5 mm	95	74
	2 mm	89	67
	0.425 mm	84	61
	0.250 mm	78	55
	0.150 mm	73	46
	0.075 mm	67	35
Grading Modulus		0.60	1.37

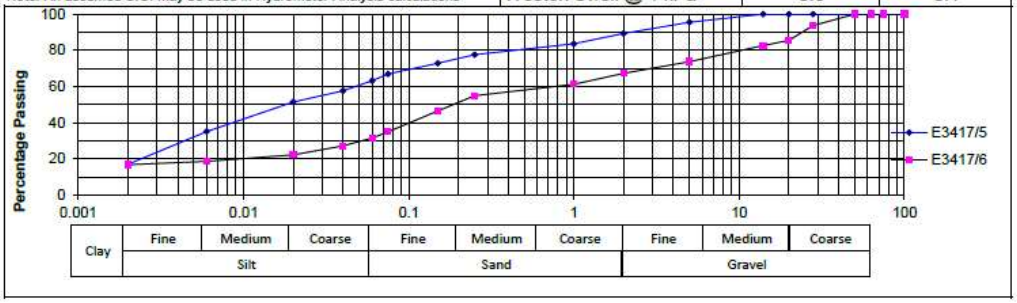


Hydrometer Analysis

		-2.00 mm	-2.00 mm
Percentage Passing	0.060 mm	63	32
	0.040 mm	58	27
	0.020 mm	51	22
	0.006 mm	35	19
	0.002 mm	17	17
Gravel	%	11	33
Sand	%	26	36
Silt	%	46	15
Clay	%	17	17

Note: An assumed S.G. may be used in Hydrometer Analysis calculations

Laboratory Number		E3417/5 ◆	E3417/6 ■
Atterberg Limits			
Liquid Limit	%	40	26
Plasticity Index	%	19	9
Linear Shrinkage	%	9.0	4.0
Overall PI	%	16	5
Classifications			
HRB (AASHTO)		A-6(11)	A-2-4(0)
Unified (ASTM D2487)		CL	SC
Weston Swell @ 1 kPa		0.8	0.1



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Client:	Ages Omega (Pty) Ltd	Date Received:	12.08.2025
Project:	GTEC E24 - 070	Date Reported:	05/09/2025
Job Card No:	E3417	Page No.:	5 of 6

FOUNDATION INDICATOR

Laboratory Number		E3417/7 ◆	■
Field Number		-	
Client Reference		BSL TP 7/1	
Depth (m)		0.60 - 1.60	
Position		BSL TP 7/1	
Coordinates	X		
	Y		
Visual Description		Residual Sandstone	
Classification Description		Clayey sand \ Silt-Clay Materials	
Stabilizing Agent			

Moisture Content & Relative Density

Moisture Content (%)	18.2	
Relative Density (S.G.)		

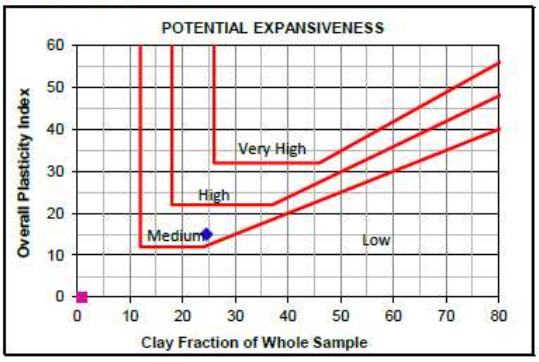
Sieve Analysis (Wet Prep)

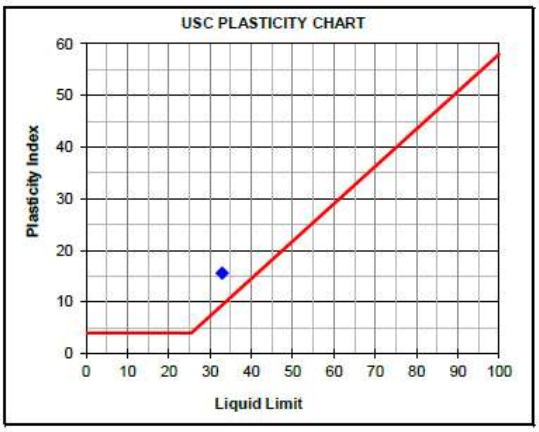
Percentage Passing	100 mm		
	75 mm		
	63 mm		
	50 mm		
	37.5 mm		
	28 mm		
	20 mm		
	14 mm	100	
	5 mm	99	
	2 mm	98	
	0.425 mm	96	
	0.250 mm	84	
	0.150 mm	57	
	0.075 mm	48	
Grading Modulus		0.58	

Hydrometer Analysis -2.00 mm -2.00 mm

Percentage Passing	0.060 mm	45	
	0.040 mm	43	
	0.020 mm	41	
	0.006 mm	33	
	0.002 mm	25	
Gravel	%	2	
Sand	%	52	
Silt	%	21	
Clay	%	25	

Note: An assumed S.G. may be used in Hydrometer Analysis calculations





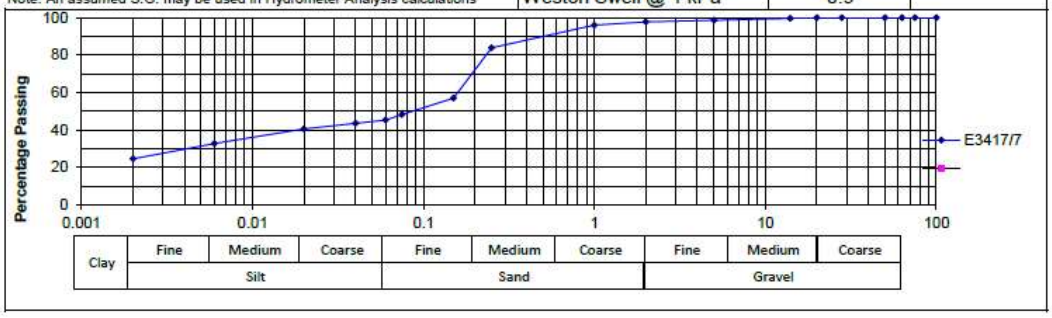
Laboratory Number		E3417/7 ◆	■

Atterberg Limits

Liquid Limit	%	33	
Plasticity Index	%	16	
Linear Shrinkage	%	8.5	
Overall PI	%	15	0

Classifications

HRB (AASHTO)	A-6(4)	
Unified (ASTM D2487)	SC	
Weston Swell @ 1 kPa	0.9	



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MATERIALS TEST REPORT

Client	:	Ages Omega (Pty) Ltd	**Client Reference**	:	E24-070
Address	:	10 Sansom Road	**Order No.**	:	E24-070
	:	Vincent	**Report Status**	:	Complete
	:	East London	**Date Received**	:	12.08.2025
	:	-	**Date Tested**	:	27.08.2025 - 03.09.2025
Attention	:	Malwande Busakwe	**Date Reported**	:	03.09.2025
E-mail	:	mbusakwe@ages-group.com	**Page**	:	1 of 5
Project	:	GTEC E24-070			
Job Card	:	E3417 Report 2 of 2 *l44382*			
Sampling Procedure(s):		SAMPLES COLLECTED BUT NOT SAMPLED			

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Test Method(s)
*Compactibility Factor	SANS 0120
*Proctor MDD	

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

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The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

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Any information gained by the laboratory prior, during or after the test process will be treated as confidential and will not be reproduced or disclosed to any person or organisation, unless required to do so by law.

Where the sample has been supplied by the customer the results apply to the sample as received.

**All results are authorized by technical signatories.

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Justin Tarr
Technical Signatory.

Company Registration No:, 2008/003519/07
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Directors: ■ GP Eichbauer (Managing) ■H Greffrath ■ P Byron
Branches ■ Cape Town - 9 Lood Street Brackenfell Industria, Cape Town (021) 905-0515 ■ East London - Unit 5 Evergreen Park, Beacon Bay (043) 050 0903 ■Water & Environmental Laboratory - 202 Circular Drive, Lorraine (041) 450 2590 ■ Technical Excellence Academy - Meke Street, Struandale (041) 450 4831

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CIVIL ENGINEERING MATERIALS TESTING SERVICES (PTY) Ltd

CUSTOMER : Ages Omega (Pty) Ltd
10 Sansom Road
Vincent
East London

ATTENTION : Mr Frikkie De Jager

SAMPLING METHOD : Collected but not sampled

PROJECT : GTEC E24 - 070

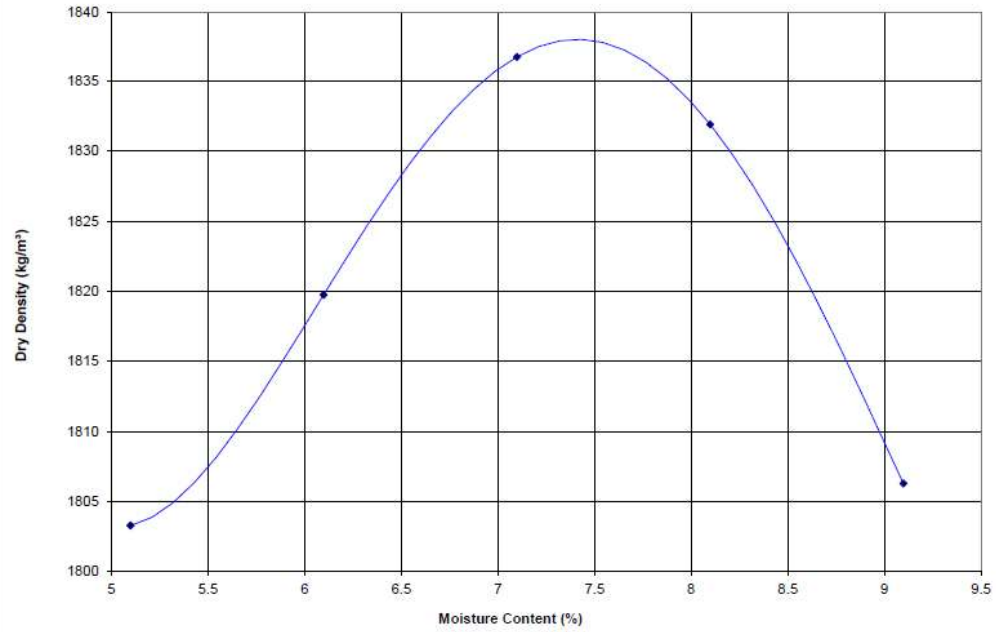
PROJECT Nr : GTEC E24 - 070
REPORT DATE : 03.09.2025
REF/ O/No. : E24 - 070
DATE RECEIVED: 12.08.2025
DATE TESTED: 27.08.2025

Laboratory Number : E3417/1 Field Reference No.: N/A
Position in field: WTW TP 4/2 Depth (m) : 1.40 - 1.80

Material Description: Residual Sandstone

MOISTURE / DENSITY RELATIONSHIP - ASTM D698

Moisture Content; (%)	7.1	8.1	6.1	9.1	5.1	Maximum Dry Density	1838 kg/m^3
Dry Density (kg/m^3)	1837	1832	1820	1806	1803	Optimum Moisture Content	7.4 %



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CIVIL ENGINEERING MATERIALS TESTING SERVICES (PTY) Ltd

CUSTOMER : Ages Omega (Pty) Ltd
10 Sansom Road
Vincent
East London
ATTENTION : Mr Frikkie De Jager
SAMPLING METHOD : Collected but not sampled

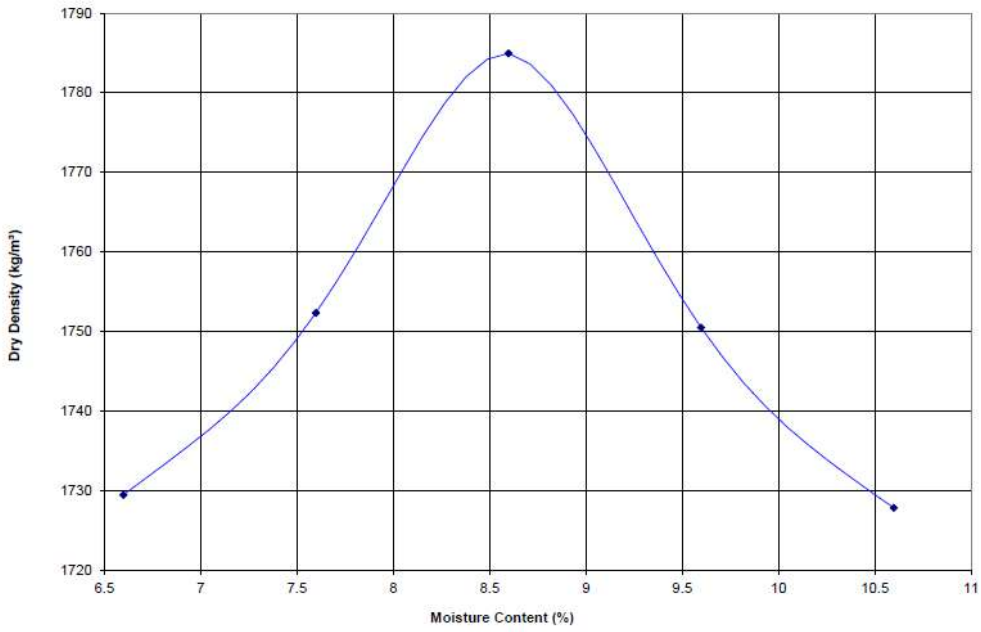
PROJECT : GTEC E24 - 070
PROJECT Nr : GTEC E24 - 070
REPORT DATE : 03.09.2025
REF/ O/No. : E24 - 070
DATE RECEIVED: 12.08.2025
DATE TESTED: 27.08.2025

Laboratory Number : E3417/2 Field Reference No.: N/A
Position in field: WTW TP 5/1 Depth (m) : 1.05 - 1.40

Material Description: Residual Sandstone

MOISTURE / DENSITY RELATIONSHIP - ASTM D698

Moisture Content; (%)	7.6	8.6	9.6	6.6	10.6	Maximum Dry Density	1785 kg/m^3
Dry Density (kg/m^3)	1752	1785	1750	1729	1728	Optimum Moisture Content	8.6 %



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Web: www.labco.co.za

CIVIL ENGINEERING MATERIALS TESTING SERVICES (PTY) Ltd

CUSTOMER : Ages Omega (Pty) Ltd
10 Sansom Road
Vincent
East London

ATTENTION : Mr Frikkie De Jager

SAMPLING METHOD : Collected but not sampled

PROJECT : GTEC E24 - 070

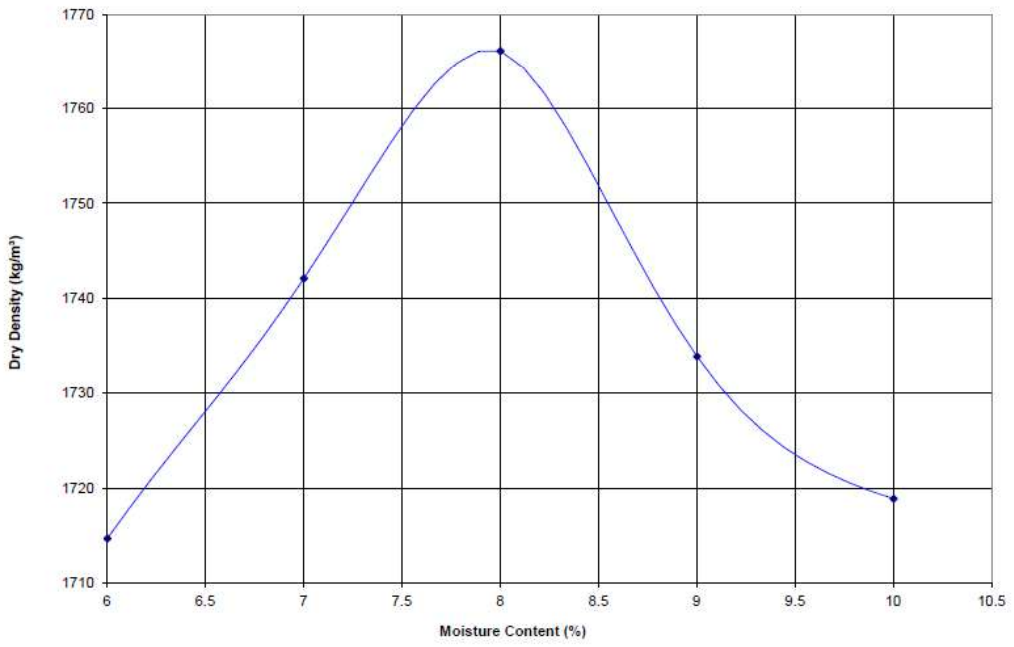
PROJECT Nr : GTEC E24 - 070
REPORT DATE : 03.09.2025
REF/ O/No. : E24 - 070
DATE RECEIVED: 12.08.2025
DATE TESTED: 27.08.2025

Laboratory Number : E3417/4 Field Reference No.: N/A
Position in field: SP 1/2 Sewer Pump Depth (m) : 1.20 - 2.50

Material Description: Residual Sandstone

MOISTURE / DENSITY RELATIONSHIP - ASTM D698

Moisture Content; (%)	7.0	8.0	9.0	10.0	6.0	Maximum Dry Density	1766 kg/m^3
Dry Density (kg/m^3)	1742	1766	1734	1719	1715	Optimum Moisture Content	8.0 %



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Job Card No: E3417 Page No. : 5 of 6

AGGREGATE TEST REPORT

Laboratory Number		E3417/5	E3417/6	E3417/7			
Field Number		-	-	-			
Client Reference		WTW TP 4/1	WTW TP 5/2	BSL TP 7/1			
Depth (m)		0.60 - 1.40	1.40 - 2.00	0.60 - 1.60			
Position		WTW TP 4/1	WTW TP 5/2	BSL TP 7/1			
Description		Residual Sandstone	Residual Sandstone	Residual Sandstone			
Organic Impurities	TMH1 - B6* Ref.						
pH Value	TMH1 - A20						
Compactibility Factor	SANS 0120 LB-1983	0.17	0.30	0.20			
Conductivity	TMH1 - A21T ($S.m^{-1}$)						

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T0391

CERTIFICATE OF ANALYSES

Date received:	**2025-09-09**			**Date completed:**	**2025/09/12**
Project number:	**1000**	**Report number:**	**147748_1**	**Order number:**	**23477**
				Project:	**E3417**
Client name:	**Labco Southern Africa (Pty) Ltd**			**Contact person:**	**Nicolette Coldrey**
Address:	**PO Box 10114, Linton Grange, Port Elizabeth, 6015**			**Email:**	**nicolette@labco.co.za**
Telephone:	**+27 (0)41 364 1290**			**Cell:**	**---**

Analyses	**Method Identification**	**Sample Identification:**		
		E3417/5 WTW TP 4/1 RESIDUAL SANDSTONE 0.60-1.40	**E3417/6 WTW TP 5/2 RESIDUAL SANDSTONE 1.40-2.00**	**E3417/7 BSL TP 7/1 RESIDUAL SANDSTONE 0.60-1.60**
Sample Number		**25-20683**	**25-20684**	**25-20685**
Paste pH 1:2	WLAB077	6.7	8.2	7.7
Paste Electrical Conductivity in mS/m at 25°C*	---	28.2	15.9	79.4

Please note:

- **The blank is subtracted from all leach results, except pH and Electrical Conductivity.**
- *** = Not SANAS Accredited**
- **Tests marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this Laboratory.**
- **[o] = Analyses performed by an Outsourced Laboratory**

S. Laubscher
Technical Signatory

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C4.5 Survey

+16000 Y
+3705500 X
+13500 Y
+3705500 X
+16000 Y
+3706500 X
+13500 Y
+3706500 X
+16000 Y
+3707500 X
+13500 Y
+3707500 X

NOTES

SYMBOLOGY SCALE 1/1000

UNLESS OTHERWISE STATED
CADASTRAL BOUNDARIES ARE UNVERIFIED
AND ARE PROVIDED AS A GUIDE ONLY

IF REQUIRED, ALL CADASTRAL BOUNDARIES
ARE TO BE CONFIRMED BY A PROFESSIONAL
LAND SURVEYOR UNDER SEPARATE APPOINTMENT

LEGEND

- BM — BENCH MARK
- BH — BOREHOLE
- CM — CABLE MARKER
- CC — CABLE CHAMBER
- CP / SI — CATCH PIT / STORMWATER INLET
- FH — FIRE HYDRANT
- F — FLAG POLE
- FL — FLOOR LEVEL
- GATE
- IL — INVERT LEVEL
- LAMP POST
- MH — MANHOLE
- RODDING EYE
- SIGN POST
- S — STEEL POLE
- TAP — TAP
- V — VALVE
- WM — WATER METER
- W — WATER PIPELINE MARKER
- W — WOODEN POLE
- POWER LINE
- SG CADASTRAL
- STAY WIRE
- TELKOM
- BUSH
- FENCE
- MARSH
- PERMANENT BUILDING
- ROCK
- TEMPORARY BUILDING
- TREE

N

BENCH MARKS
(WGS 84 Lo = 27)

BM

12mm PEG IN CONCRETE

Name	Y Co-ord	X Co-ord	Height
BM1	14328.26	3705537.22	225.004
BM2	14400.66	3705651.02	227.492
BM3	14228.94	3705668.98	229.464
BM4	15084.13	3706156.66	234.840
BM5	14775.39	3706222.15	236.470
BM6	14604.39	3706426.09	240.507
BM7	14813.91	3706380.35	239.874
BM8	15085.38	3706332.91	237.321
BM9	15270.34	3706422.64	237.598
BM10	15460.80	3706574.48	238.454
BM11	15277.95	3706796.57	240.132
BM12	15079.64	3706614.63	240.941
BM13	14881.80	3706607.91	242.516
BM14	14665.06	3706570.11	248.557
BM15	14907.23	3706775.65	247.332
BM16	14999.21	3706964.32	260.534
BM17	14868.64	3707088.25	259.385
BM18	14751.67	3706982.95	253.142
BM19	14593.94	3707153.48	262.379
BM20	14718.39	3707276.32	265.007
BM21	14738.69	3707408.93	274.954
BM22	14949.09	3707511.51	277.972
BM23	14897.95	3707289.04	272.765
BM24	15026.86	3707375.65	276.531
BM25	15275.13	3707494.42	282.850
BM26	15599.71	3707639.37	262.205
BM27	15010.40	3707303.06	272.235
BM28	15180.32	3707408.86	284.592
BM29	15432.68	3707515.38	274.967
BM30	15670.76	3707616.06	253.931
BM31	15639.81	3707436.50	253.970

Surveyed by: M. Musekiwa, A. Duna & S. Ntuli

Date: Sep - Oct 2024 & Sep 2025

Scale 1:3000 @ A0

Prepared by:

NPM Geomatics

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Title

SURVEY FOR THE UPGRADE OF THE BATHURST SEWER RETICULATION SYSTEM

9400 Bathurst Sewer Survey Rev1.dr4

Drawing No